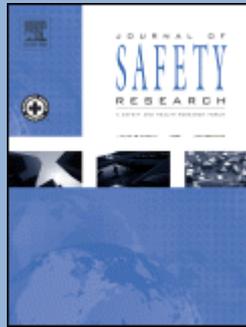


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Nicole S.N. Yiu, N.N. Sze, Daniel W.M. Chan. *Implementation of safety management systems in Hong Kong construction industry – A safety practitioner's perspective.* Pages 1-9.

Introduction: In the 1980s, the safety management system (SMS) was introduced in the construction industry to mitigate against workplaces hazards, reduce the risk of injuries, and minimize property damage. Also, the Factories and Industrial Undertakings (Safety Management) Regulation was introduced on 24 November 1999 in Hong Kong to empower the mandatory implementation of a SMS in certain industries including building construction. Therefore, it is essential to evaluate the effectiveness of the SMS in improving construction safety and identify the factors that influence its implementation in Hong Kong. **Method:** A review of the current state-of-the-practice helped to establish the critical success factors (CSFs), benefits, and difficulties of implementing the SMS in the construction industry, while structured interviews were used to establish the key factors of the SMS implementation. **Results:** Results of the state-of-the-practice review and structured interviews indicated that visible senior commitment, in terms of manpower and cost allocation, and competency of safety manager as key drivers for the SMS implementation. More so, reduced accident rates and accident costs, improved organization framework, and increased safety audit ratings were identified as core benefits of implementing the SMS. Meanwhile, factors such as insufficient resources, tight working schedule, and high labor turnover rate were the key challenges to the effective SMS implementation in Hong Kong. **Practical applications:** The findings of the study were consistent and indicative of the future development of safety management practice and the sustainable safety improvement of Hong Kong construction industry in the long run.

- **Keywords:** Safety management system; Construction industry; Safety practitioner; Safety commitment; Safety audit

Angela H. Eichelberger, Anne T. McCartt, Jessica B. Cicchino. *Fatally injured pedestrians and bicyclists in the United States with high blood alcohol concentrations.* Pages 1-9.

Introduction: Little research has focused on the problem of alcohol impairment among pedestrians and bicyclists in the United States. The aim of the current study was to investigate the prevalence, trends, and characteristics of alcohol-impaired fatally injured pedestrians and bicyclists. **Method:** Data from the Fatality Analysis Reporting System (FARS) were analyzed for fatally injured passenger vehicle drivers, pedestrians, and bicyclists 16 and older during 1982–2014. Logistic regression models examined whether personal, roadway, and crash characteristics were associated with high blood alcohol concentrations (BACs) among fatally injured pedestrians and bicyclists. **Results:** From 1982 to 2014, the percentage of fatally injured pedestrians with high BACs ($\geq 0.08\text{g/dL}$) declined from 45% to 35%, and the percentage of fatally injured bicyclists with high BACs declined from 28% to 21%. By comparison, the percentage of fatally injured passenger vehicle drivers with high BACs declined from 51% in 1982 to 32% in 2014. The largest reductions in alcohol impairment among fatally injured pedestrians and bicyclists were found among ages 16–20. During 2010–2014, fatally injured pedestrians and bicyclists ages 40–49 had the highest odds of having a high BAC, compared with other age groups. **Conclusions:** A substantial proportion of fatally injured pedestrians and bicyclists have high BACs, and this proportion has declined less dramatically than for fatally injured passenger vehicle drivers during the past three decades. Most countermeasures used to address alcohol-impaired driving may have only limited effectiveness in reducing fatalities among alcohol-impaired pedestrians and bicyclists. **Practical applications:** Efforts should increase public awareness of the risk of walking or bicycling when impaired. Results suggest the primary target audience for educational campaigns directed at pedestrians and bicyclists is middle-age males. Further research should evaluate the effectiveness of potential countermeasures, such as lowering speeds or improving lighting in urban areas.

- **Keywords:** Pedestrians; Bicyclists; Fatalities; Alcohol; Motor vehicle crashes

Athanasios Theofilatos, Apostolos Ziakopoulos, Eleonora Papadimitriou, George Yannis. *How many crashes are caused by driver interaction with passengers? A meta-analysis approach.* Pages 11-20.

Introduction: Conversation and other interactions with passengers while driving induce a level of distraction to the person driving. **Method:** This paper conducts a qualitative literature review on the effect of passenger interaction on road safety and then extends it by using meta-analysis techniques. **Results:** The literature review indicates that the distraction due to passengers is a very frequent risk factor, with detrimental effects to various driving behavior and safety measures (e.g., slower reaction times to events, increased severity of injuries in crashes), associated with non-negligible proportions of crashes. Particular issues concern the effect of passenger age (children, teenagers) on which the literature is inconclusive. Existing studies vary considerably in terms of study methods and outcome measures. Nevertheless, a meta-analysis could be carried out regarding the proportion of crashes caused by this distraction factor. The selection of studies for the meta-analysis was based on a rigorous method including specific study selection criteria. The findings of the random-effects meta-analyses that were carried out showed that driver interaction with passengers causes a non-negligible proportion of road crashes, namely 3.55% of crashes regardless of the age of the passengers and 3.85% when child and teen passengers are excluded. Both meta-estimates were statistically significant, revealing the need for further research, especially considering the role of passenger age. **Practical applications:** Stakeholders could make good estimates on future crash numbers and causes and take action in order to counter the effects of passenger interaction.

- **Keywords:** Interaction; Conversation; Passengers; Driver distraction; Meta-analysis

Wei Hu, Qiao Dong, Chunjiao Dong, Jun Yang, Baoshan Huang. *Access to trauma centers for road crashes in the United States. Pages 21-27.*

Introduction: Existing research indicates that around 90% of all U.S. residents have access to at least one level I or II trauma center within 60min. However, a limitation of these estimates lies in that they are based on where people live and not where people are injured, which may overestimate the access to trauma centers for seriously injured patients in fatal crashes. **Method:** In this study, the Fatality Analysis Reporting System (FARS) data between 2013 and 2014 were collected and analyzed to quantify the access of injured patients to trauma centers for fatal crashes across states. Two types of distance, linear distance and route distance, were calculated using ArcGIS. The estimated transport time to the nearest level I/II trauma center was also calculated and compared to the recorded on-scene and transport time. **Results and Conclusions:** The Northeast region had the nearest average linear and route distance between fatal crash and trauma center (25.3km and 31.7km, respectively), followed by the Midwest (44.4km and 54.1km), the South (47.3km and 57.0km), and the West (50.9km and 67.5km). The comparison between the estimated and actual transport time revealed that the different states adopted different trauma triage protocols, resulting in different utilization rates of the level I/II trauma center among states. A linear regression analysis demonstrated that the longer the average route distance, the less the seriously injured patients in fatal crashes were taken to level I/II trauma center directly. **Practical applications:** These findings may help to identify the access to trauma centers for road crashes and the variation of delivery ratio to trauma center among the states, therefore a better utilization of trauma centers for road crashes can be achieved for the emergency medical services (EMS) systems.

- **Keywords:** Geographical information systems (GIS); Trauma triage protocols; Linear regression analysis; Trauma center

Nini Xia, Mark A. Griffin, Xueqing Wang, Xing Liu, Dan Wang. *Is there agreement between worker self and supervisor assessment of worker safety performance? An examination in the construction industry. Pages 29-37.*

Introduction: Individual safety performance (behavior) critically influences safety outcomes in high-risk workplaces. Compared to the study of generic work performance on different measurements, few studies have investigated different measurements of safety performance, typically relying on employees' self-reflection of their safety behavior. This research aims to address this limitation by including worker self-reflection and other (i.e., supervisor) assessment of two worker safety performance dimensions, safety compliance and safety participation. **Method:** A sample of 105 workers and 17 supervisors in 17 groups in the Chinese construction industry participated in this study. Comparisons were made between worker compliance and participation in each measurement, and between workers' and supervisors' assessment of workers' compliance and participation. Multilevel modeling was adopted to test the moderating effects on the worker self-reflection and supervisor-assessment relationship by group safety climate and the work experience of supervisors. **Results:** Higher levels of safety compliance than participation were found for self-reflection and supervisor assessment. The discrepancy between the two measurements in each safety performance dimension was significant. The work experience of supervisors attenuated the discrepancy between self- and supervisor-assessment of compliance. Contrary to our expectations, the moderating effect of group safety climate was not supported. **Conclusions:** The discrepancy between worker self- and supervisor-assessment of worker safety performance, thus, suggests the importance of including alternative measurements of

safety performance in addition to self-reflection. Lower levels of participation behavior in both raters suggest more research on the motivators of participatory behavior. **Practical applications:** The discrepancy between different raters can lead to negative reactions of ratees, suggesting that managers should be aware of that difference. Assigning experienced supervisors as raters can be effective at mitigating interrater discrepancy and conflicts in the assessment of compliance behavior.

- **Keywords:** Self-reflection; Supervisor-assessment; Safety compliance; Safety participation; Construction industry

David G. Kidd, Jeremiah Singer, Richard Huey, Laura Kerfoot. *The effect of a gearshift interlock on seat belt use by drivers who do not always use a belt and its acceptance among those who do.* Pages 39-51.

Introduction: Seat belts reduce the risk of fatal injury in a crash, yet in 2015, nearly 10,000 people killed in passenger vehicles were unrestrained. Enhanced seat belt reminders increase belt use, but a gearshift interlock that prevents the vehicle from being placed into gear unless the seat belt is used may prove more effective. **Method:** Thirty-two people with a recent seat belt citation and who admitted to not always using a seat belt as a driver were recruited as part-time belt users and asked to evaluate two new vehicles. Sixteen drove two vehicles with an enhanced reminder for one week each, and 16 drove a vehicle with an enhanced reminder for one week and a vehicle with a gearshift interlock the following week. Sixteen full-time belt users who reported always using a seat belt drove a vehicle with a gearshift interlock for one week to evaluate acceptance. **Results:** Relative to the enhanced reminder, the gearshift interlock significantly increased the likelihood that a part-time belt user used a belt during travel time in a trip by 21%, and increased the rate of belt use by 16%; this effect approached significance. Although every full-time belt user experienced the gearshift interlock, their acceptance of the technology reported in a post-study survey was fairly positive and not significantly different from part-time belt users. Six part-time belt users circumvented the gearshift interlock by sitting on a seat belt, waiting for the system to deactivate, or unbuckling during travel. **Conclusion:** The gearshift interlock increased the likelihood that part-time belt users buckled up and the rate of belt use during travel relative to the enhanced reminder but could be more effective if it prevented circumvention. **Practical applications:** An estimated 718–942 lives could be saved annually if the belt use of unbuckled drivers and front passengers increased 16–21%.

- **Keywords:** Seat belt use; Enhanced reminder; Gearshift interlock; Part-time belt user

Jennifer L. Marcum, Michael Foley, Darrin Adams, Dave Bonauto. *Characteristics of construction firms at risk for future workers' compensation claims using administrative data systems, Washington State.* Pages 53-58.

Introduction: Construction is high-hazard industry, and continually ranks among those with the highest workers' compensation (WC) claim rates in Washington State (WA). However, not all construction firms are at equal risk. We tested the ability to identify those construction firms most at risk for future claims using only administrative WC and unemployment insurance data. **Methods:** We collected information on construction firms with 10–50 average full time equivalent (FTE) employees from the WA unemployment insurance and WC data systems (n=1228). Negative binomial regression was used to test the ability of firm characteristics measured during 2011–2013 to predict time-loss claim rates in the following year, 2014. **Results:** Claim rates in 2014 varied by construction industry groups, ranging from 0.7 (Land Subdivision) to 4.6 (Foundation, Structure, and Building Construction) claims per 100 FTE. Construction firms with higher average WC

premium rates, a history of WC claims, increasing number of quarterly FTE, and lower average wage rates during 2011–2013 were predicted to have higher WC claim rates in 2014. **Conclusions:** We demonstrate the ability to leverage administrative data to identify construction firms predicted to have future WC claims. This study should be repeated to determine if these results are applicable to other high-hazard industries. **Practical Applications:** This study identified characteristics that may be used to further refine targeted outreach and prevention to construction firms at risk.

- **Keywords:** Construction firms; Workers' compensation; Work-related injury

Anne Vingaard Olesen, Rune Elvik, Camilla Sloth Andersen, Harry S. Lahrman. *Does a tow-bar increase the risk of neck injury in rear-end collisions?* Pages 59-65.

Introduction: Does a tow-bar increase the risk of neck injury in the struck car in a rear-end collision? The rear part of a modern car has collision zones that are rendered nonoperational when the car is equipped with a tow-bar. Past crash tests have shown that a car's acceleration was higher in a car equipped with a tow-bar and also that a dummy placed in a car with a tow-bar had higher peak acceleration in the lower neck area. **Method:** This study aimed to investigate the association between the risk of neck injury in drivers and passengers, and the presence of a registered tow-bar on the struck car in a rear-end collision. We performed a merger of police reports, the National Hospital Discharge Registry, and the National Registry of Motor Vehicles in Denmark. We identified 9,370 drivers and passengers of whom 1,519 were diagnosed with neck injury within the first year after the collision. We found a statistically insignificant 5% decrease in the risk of neck injury in the occupants of the struck car when a tow-bar was fitted compared to when it was not fitted (hazard ratio=0.95; 95% confidence level=0.85–1.05; p=0.32). The result was controlled for gender, age, and the seat of the occupant. Several other collision and car characteristics and demographic information on the drivers and passengers were evaluated as confounders but were not statistically significant. **Conclusions:** The present study may serve as valuable input for a meta-analysis on the effect of a tow-bar because negative results are necessary in order to avoid publication bias.

- **Keywords:** Tow-bar; Neck injury; Rear-end collision; Car collision zones; Registry study

Christofer Skurka, Brian L. Quick, Tobias Reynolds-Tylus, Todd Short, Ann L. Bryan. *An evaluation of a college campus emergency preparedness intervention.* Pages 67-72.

Introduction: Given the range of emergencies that beset postsecondary institutions, university administrators must take a multimodal approach to prepare campus stakeholders for safety threats. One such strategy is emergency preparedness communication. **Methods:** In the present investigation, we tested the efficacy of a professionally produced video that uses the federally endorsed slogan, Run-Hide-Fight(r). Undergraduate students participated in a quasi-experiment with a pretest-posttest-delayed posttest control group design. **Results:** Using the theory of planned behavior as our guiding framework, we found that video exposure increased attitudes, perceived norms, perceived behavioral control, intentions, as well as knowledge of recommended behavioral responses. Favorable attitudes and injunctive norms positively predicted intentions at the initial and delayed posttests. Importantly, the video's effects on most of the outcomes endured two weeks after video exposure. **Conclusions:** A brief emergency preparedness video using the Run-Hide-Fight(r) theme can have immediate and lingering effects on psychosocial predictors of appropriate emergency response behaviors. **Practical Applications:** Administrators at higher education institutions should consider showing emergency preparedness messages to increase the likelihood that stakeholders

will take appropriate action in case of a campus threat. In particular, these messages should aim to promote favorable attitudes toward appropriate response behaviors and instill beliefs that appropriate responses ought to be performed.

- **Keywords:** Emergency preparedness; Theory of planned behavior; Campus safety

Emrah Kazan, Mumtaz A. Usmen. *Worker safety and injury severity analysis of earthmoving equipment accidents. Pages 73-81.*

Introduction: Research on construction worker safety associated with construction equipment has mostly focused on accident type rather than injury severity and the embedded factor relationships. Significant variables and their effects on the degree of injury are examined for earthmoving equipment using data from OSHA. Four types of equipment, backhoe, bulldozer, excavator, and scraper are included in the study. Accidents involving on-foot workers and equipment operators are investigated collectively, as well as separately. **Methods:** Cross tabulation analysis was conducted to establish the associations between selected categorical variables, using degree of injury as a dichotomous dependent variable (fatal vs. nonfatal) and a number of independent variables having different values. Odds ratios were calculated to determine how much a certain variable/factor increases the odds of fatality in an accident, and the odds ratios were ranked to determine the relative impact of a given factor. **Results:** It was found that twelve variables were significantly associated with injury severity. Rankings based on odds ratios showed that inadequate safety training (2.54), missing equipment protective system (2.38), being a non-union worker (2.26), being an equipment operator (1.93), and being on or around inadequately maintained equipment (1.58) produced higher odds for fatality. **Conclusion:** A majority of the earthmoving equipment accidents resulted in fatality. Backhoes were the most common equipment involved in accidents and fatalities. Struck-by accidents were the most prevalent and most fatal. Non-OSHA compliant safety training, missing seatbelt, operator not using seatbelt, malfunctioning back-up alarms, and poorly maintained equipment were factors contributing to accidents and fatalities. On-foot workers experienced a higher number of accidents than operators, while fatality odds were higher for the operators. **Practical applications:** Safety professionals should benefit from our findings in planning and delivering training and providing oversight to workers in earthmoving equipment operations.

- **Keywords:** Equipment operators; On-foot workers; IMIS database; Odds ratio; Fatal accidents

Turky H. Almigbal, Abdullah A. Alfaifi, Muath A. Aleid, Baki Billah, Mohammed J. Alramadan, Eman Sheshah, Turki A. AlMogbel, Ghassan A. Aldekhayel, Mohammed Ali Batais. *Safe driving practices and factors associated with motor-vehicle collisions among people with insulin-treated diabetes mellitus: Results from the Diabetes and Driving (DAD) study. Pages 83-88.*

Introduction: The aim of this study was to assess the prevalence of people with insulin-treated diabetes mellitus (ITDM) who have discussed issues related to diabetes and driving with their health care providers (HCPs). We also sought to determine the safe driving practices that are currently employed by this group. Finally, we investigated the factors that might increase the risk of motor-vehicle collisions (MVCs) among this group in Saudi Arabia. **Method:** This cross-sectional study surveyed a representative sample of 429 current male drivers with ITDM using a structured questionnaire in Saudi Arabia. **Results:** Most of the participants (76.5%) never discussed topics regarding diabetes and driving with their HCPs. The majority of the participants (61.8%) reported at least never doing one of the following: (a) carrying a blood glucose testing kit while driving, (b)

testing their blood glucose level before driving or during a journey, or (c) having thought of a specific threshold of blood glucose level that would preclude driving. Three factors were associated with a higher risk of MVCs among participants with ITDM: (a) being on a basal/boluses regimen, (b) never having a discussion regarding diabetes and driving with their HCPs, and (c) having experienced hypoglycemia during driving. **Conclusions:** The majority of people with ITDM had not had a discussion regarding diabetes and driving with their HCPs, which was reflected by a lack of safe driving practices. People with ITDM should be encouraged to take precautions while driving in order to prevent future MVCs. **Practical applications:** This research highlights the importance of investing more effort in educating drivers who have diabetes about safe driving practices by their health care providers. Also, it will attract the attention of policymakers for an urgent need to establish clear policies and procedures for dealing with drivers who have diabetes.

- **Keywords:** Diabetes mellitus; Hypoglycemia; Driving; Motor-vehicle collisions; Licensing agency

Leila Nasri, Milad Baghersad, Richard Gruss, Nico Sung Won Marucchi, Alan S. Abrahams, Johnathon P. Ehsani. *An investigation into online videos as a source of safety hazard reports.* Pages 89-99.

Introduction: Despite the advantages of video-based product reviews relative to text-based reviews in detecting possible safety hazard issues, video-based product reviews have received no attention in prior literature. This study focuses on online video-based product reviews as possible sources to detect safety hazards. **Methods:** We use two common text mining methods – sentiment and smoke words – to detect safety issues mentioned in videos on the world's most popular video sharing platform, YouTube. Results: 15,402 product review videos from YouTube were identified as containing either negative sentiment or smoke words, and were carefully manually viewed to verify whether hazards were indeed mentioned. 496 true safety issues (3.2%) were found. Out of 9,453 videos that contained smoke words, 322 (3.4%) mentioned safety issues, vs. only 174 (2.9%) of the 5,949 videos with negative sentiment words. Only 1% of randomly-selected videos mentioned safety hazards. **Conclusions:** Comparing the number of videos with true safety issues that contain sentiment words vs. smoke words in their title or description, we show that smoke words are a more accurate predictor of safety hazards in video-based product reviews than sentiment words. This research also discovers words that are indicative of true hazards versus false positives in online video-based product reviews. **Practical applications:** The smoke words lists and word sub-groups generated in this paper can be used by manufacturers and consumer product safety organizations to more efficiently identify product safety issues from online videos. This project also provides realistic baselines for resource estimates for future projects that aim to discover safety issues from online videos or reviews.

- **Keywords:** Safety hazard; Online video sharing; Product recall; Text mining; Smoke words

Natalie Spitzer, Maile T. Phillips, Wendy Chow, Thomas W. Mangione. *Factors associated with life jacket use among cabin sailboat and day sailor boaters in the United States.* Pages 101-114.

Introduction: In 2015, drowning accounted for 68% of the 626 recreational boating related deaths in the United States. Although life jackets are estimated to prevent between 50% to 80% of boating deaths, approximately 83% of sailboat-related drowning victims were reported to not be wearing life jackets. Life jacket use among adult boaters has remained consistently low across most boat types and may vary by boater, boating, and environmental conditions. Although many risky environmental and boating factors may be associated with a higher risk of boating death, drowning occurs in all situations and it is useful to understand adult life jacket wearing behaviors in differing boating

situations. **Methods:** This study uses observational survey data from 61318 adult sailors collected during the summer months of 1999 – 2017 from 124 selected study sites across 30 states in the US. Life jacket use was compared for day sailors and cabin sailboats by multiple boating, boater, and environmental conditions using Chi-square tests for equality of proportions. Results of these tests led to a choice of 3 informative and scientifically compelling variables to summarize variation in life jacket use for each sailboat type. Odds ratios were calculated comparing life jacket use from each boating situation to the lowest risk situation as determined by the 3 selected variables. These variables were represented in a tree diagram, detailing the additive impact of each factor. Following these analyses, all boating conditions were categorized to be risky or non-risky and a count variable was created for each observation based on the number of risks present. Cochran-Armitage trend tests were conducted to test for linearity in life jacket use for both boat types. **Results:** The overall life jacket wear rate was higher among adults in day sailor sailboats (51.6%) compared to cabin sailboats (13.8%) and in all measured demographic, boating, and environmental circumstances. Comparing high-risk cabin sailboat conditions of low water temperatures, small boat size, and high wind speed to the lowest-risk situation accounted for a 23.3% range in life jacket wear rate (OR=4.7). Comparing high-risk day sailor sailboat conditions of small boat size, one boater on board, and choppy/rough wave height to the lowest-risk situation accounted for a 39.3% range in life jacket wear rate (OR=5.9). For both boat types, the number of risks present and life jacket wear rate exhibited a statistically significant positive linear relationship at $p < 0.0001$. **Conclusion:** Study results suggest that boaters are aware of the connection between life jacket use and drowning prevention and are more likely to wear life jackets when boating in conditions perceived to be risky. **Practical applications:** Boating safety promotion efforts should recommend adult life jacket use in all boating situations, as seemingly non-risky conditions may still result in drownings.

- **Keywords:** Sailboats; Boating safety; Life jackets; Drowning prevention; Boating risk

Zijian Zheng, Pan Lu, Brenda Lantz. *Commercial truck crash injury severity analysis using gradient boosting data mining model. Pages 115-124.*

Introduction: Truck crashes contribute to a large number of injuries and fatalities. This study seeks to identify the contributing factors affecting truck crash severity using 2010 to 2016 North Dakota and Colorado crash data provided by the Federal Motor Carrier Safety Administration. **Method:** To fulfill a gap of previous studies, broad considerations of company and driver characteristics, such as company size and driver's license class, along with vehicle types and crash characteristics are researched. Gradient boosting, a data mining technique, is applied to comprehensively analyze the relationship between crash severities and a set of heterogeneous risk factors. **Results:** Twenty five variables were tested and 22 of them are identified as significant variables contributing to injury severities, however, top 11 variables account for more than 80% of injury forecasting. The relative variable importance analysis is conducted and furthermore marginal effects of all contributing factors are also illustrated in this research. Several factors such as trucking company attributes (e.g., company size), safety inspection values, trucking company commerce status (e.g., interstate or intrastate), time of day, driver's age, first harmful events, and registration condition are found to be significantly associated with crash injury severity. Even though most of the identified contributing factors are significant for all four levels of crash severity, their relative importance and marginal effect are all different. **Conclusions:** For the first time, trucking company and driver characteristics are proved to have significant impact on truck crash injury severity. Some of the results in this study reinforce previous studies' conclusions. **Practical applications:** Findings in this study can be helpful for transportation agencies to reduce injury severity, and develop efficient strategies to improve safety.

- **Keywords:** Truck crash injury severity; Commercial truck company; Data mining; Gradient boosting

Rebecca Weast. *Temporal factors in motor-vehicle crash deaths: Ten years later.* Pages 125-131.

Objective: To assess trends in traffic fatalities on several temporal scales: year to year, by month, by day of week, and by time of day, to determine why some times correspond with higher rates of crash deaths, and to assess how these trends relate to age, the role of the deceased, and alcohol consumption. **Method:** Traffic fatalities were identified using the Fatality Analysis Reporting System (FARS) for 1998 through 2014 and assessed for their time of occurrence. Three days that, on average, contained particularly high numbers of crash deaths were then assessed in greater detail, considering the age of the deceased, role of the deceased (vehicle occupant, bicyclist, motorcyclist, or pedestrian), and the blood alcohol content of either the driver (for passenger vehicle occupants) or the deceased. **Results:** Annual crash fatality totals were much lower in 2014 than in 1998, but the decrease was not steady; a marked drop in crash deaths occurred after 2007 and continued until 2014. On average the most fatalities per day occurred in July and August (116 per day), followed closely by June, September, and October. During the week, the greatest number of fatalities on average occur on weekend days, and during the day the most fatalities tend to occur between the hours of 3p.m. and 7p.m. Holidays like Independence Day and New Year's Day show elevated crash fatalities, and a greater percentage of these crashes involved alcohol, when compared with adjacent days. **Conclusion:** Certain days and times of year stand out as posing an elevated crash risk, and even with the decrease in average daily fatalities over the past decade, these days and times of year have remained consistent. **Practical application:** These results indicate focused areas for continued efforts to reduce fatal crashes.

- **Keywords:** Crash fatalities; Temporal patterns

Blazej Palat, Patricia Delhomme. *Causal attribution in explanations of near-crash events behind the wheel, and its relationship to comparative judgments.* Pages 133-139.

Introduction: The development of skills essential for avoiding crashes depends, in particular, on how drivers explain the causes of dangerous driving behaviors that resulted in a near crash. Here, we analyze causes attributed to such behaviors by car drivers in a self-report study. We explore the relationships between the dimensions of causal attribution, attribution of responsibility for the near crash, and drivers' comparative judgments. **Method:** For approximately two months, drivers used logbooks to document the near crashes that occurred during their trips. The causes attributed in those reports to driving behaviors resulting in near crashes were then coded by two judges on the basis of several causal dimensions. Drivers also estimated their own and an average driver's skill levels, and their risk of being involved, as a driver, in a crash. **Results:** We distinguished main types of causes of the near crashes reported. Drivers had a tendency to more often attribute external causes to their own behaviors resulting in near crashes than to those of others. The probability of attributing a controllable cause increased with overestimation of one's own skills and decreased with underestimation of one's own risk in comparison to other drivers. The probability of attributing a stable cause increased with underestimation of one's own risk. **Conclusions:** When they explained their own behaviors resulting in near crashes, drivers mentioned different causes than when they explained those of others. Overestimation of one's own skills as compared to other drivers could be beneficial for developing crash-avoiding skills, insofar as it seems to foster attribution of controllable causes. By contrast, underestimation of one's own risk could have the opposite effect. **Practical applications:** Vulnerability to road risks should be stressed in driver's training and risk communication campaigns. However, self-confidence with respect to one's skills should not always be targeted as a safety problem.

- **Keywords:** Psychology; Cognition; Risk perception; Driving; Accident prevention

Sherrie-Anne Kaye, Ioni Lewis, James Freeman. *Comparison of self-report and objective measures of driving behavior and road safety: A systematic review. Pages 141-151.*

Introduction: This research systematically reviewed the existing literature in regards to studies which have used both self-report and objective measures of driving behavior. The objective of the current review was to evaluate disparities or similarities between self-report and objective measures of driving behavior. **Methods:** Searches were undertaken in the following electronic databases, PsycINFO, PubMed, and Scopus, for peer-reviewed full-text articles that (1) focused on road safety, and (2) compared both subjective and objective measures of driving performance or driver safety. A total of 22,728 articles were identified, with 19 articles, comprising 20 studies, included as part of the review. **Results:** The research reported herein suggested that for some behaviors (e.g., driving in stressful situations) there were similarities between self-report and objective measures while for other behaviors (e.g., sleepiness and vigilance states) there were differences between these measurement techniques. In addition, findings from some studies suggested that in-vehicle devices may be a valid measurement tool to assess driving exposure in older drivers. **Conclusions:** Further research is needed to examine the correspondence between self-report and objective measures of driving behavior. In particular, there is a need to increase the number of studies which compare "like with like" as it is difficult to draw comparisons when there are variations in measurement tools used. **Practical applications:** Incorporating a range of objective and self-report measurements tools in research would help to ensure that the methods used offer the most reliable measures of assessing on-road behaviors.

- **Keywords:** Systematic review; Road safety; Self-report driving behavior; Objective measures; driving behavior

Feng Chen, Suren Chen, Xiaoxiang Ma. *Analysis of hourly crash likelihood using unbalanced panel data mixed logit model and real-time driving environmental big data. Pages 153-159.*

Introduction: Driving environment, including road surface conditions and traffic states, often changes over time and influences crash probability considerably. It becomes stretched for traditional crash frequency models developed in large temporal scales to capture the time-varying characteristics of these factors, which may cause substantial loss of critical driving environmental information on crash prediction. **Method:** Crash prediction models with refined temporal data (hourly records) are developed to characterize the time-varying nature of these contributing factors. Unbalanced panel data mixed logit models are developed to analyze hourly crash likelihood of highway segments. The refined temporal driving environmental data, including road surface and traffic condition, obtained from the Road Weather Information System (RWIS), are incorporated into the models. **Results:** Model estimation results indicate that the traffic speed, traffic volume, curvature and chemically wet road surface indicator are better modeled as random parameters. The estimation results of the mixed logit models based on unbalanced panel data show that there are a number of factors related to crash likelihood on I-25. Specifically, weekend indicator, November indicator, low speed limit and long remaining service life of rutting indicator are found to increase crash likelihood, while 5-am indicator and number of merging ramps per lane per mile are found to decrease crash likelihood. **Conclusions:** The study underscores and confirms the unique and significant impacts on crash imposed by the real-time weather, road surface, and traffic conditions. With the unbalanced panel data structure, the rich information from real-time driving environmental big data can be well incorporated.

- **Keywords:** Real-time driving environment; Mixed logit model; Refined temporal scale; Random parameter; Big data

Alexis B. Peterson, Erin K. Sauber-Schatz, Karin A. Mack. *Ability to monitor driving under the influence of marijuana among non-fatal motor-vehicle crashes: An evaluation of the Colorado electronic accident reporting system. Pages 161-167.*

Introduction: As more states legalize medical/recreational marijuana use, it is important to determine if state motor-vehicle surveillance systems can effectively monitor and track driving under the influence (DUI) of marijuana. This study assessed Colorado's Department of Revenue motor-vehicle crash data system, Electronic Accident Reporting System (EARS), to monitor non-fatal crashes involving driving under the influence (DUI) of marijuana. **Methods:** Centers for Disease Control and Prevention guidelines on surveillance system evaluation were used to assess EARS' usefulness, flexibility, timeliness, simplicity, acceptability, and data quality. We assessed system components, interviewed key stakeholders, and analyzed completeness of Colorado statewide 2014 motor-vehicle crash records. **Results:** EARS contains timely and complete data, but does not effectively monitor non-fatal motor-vehicle crashes related to DUI of marijuana. Information on biological sample type collected from drivers and toxicology results were not recorded into EARS; however, EARS is a flexible system that can incorporate new data without increasing surveillance system burden. **Conclusions:** States, including Colorado, could consider standardization of drug testing and mandatory reporting policies for drivers involved in motor-vehicle crashes and proactively address the narrow window of time for sample collection to improve DUI of marijuana surveillance. **Practical applications:** The evaluation of state motor-vehicle crash systems' ability to capture crashes involving drug impaired driving (DUID) is a critical first step for identifying frequency and risk factors for crashes related to DUID.

- **Keywords:** Motor-vehicle crashes; Marijuana; Driving under the influence of drugs; Surveillance; Drugged driving