

## Journal of Safety Research – rok 2011, ročník 42

### Číslo 2 (April 2011)



**Tom Kontogiannis. *A systems perspective of managing error recovery and tactical re-planning of operating teams in safety critical domains.* Pages 73-85.**

**Introduction:** Research in human error has provided useful tools for designing procedures, training, and intelligent interfaces that trap errors at an early stage. However, this “error prevention” policy may not be entirely successful because human errors will inevitably occur. This requires that the error management process (e.g., detection, diagnosis and correction) must also be supported. Research has focused almost exclusively on error detection; little is known about error recovery, especially in the context of safety critical systems. The aim of this paper is to develop a research framework that integrates error recovery strategies employed by experienced practitioners in handling their own errors. **Method and Results:** A control theoretic model of human performance was used to integrate error recovery strategies assembled from reviews of the literature, analyses of near misses from aviation and command & control domains, and observations of abnormal situations training at air traffic control facilities. The method of system dynamics has been used to analyze and compare error recovery strategies in terms of patterns of interaction, system affordances, and types of recovery plans. System dynamics offer a promising basis for studying the nature of error recovery management in the context of team interactions and system characteristics. **Impact on industry:** The proposed taxonomy of error recovery strategies can help human factors and safety experts to develop resilient system designs and training solutions for managing human errors in unforeseen situations; it may also help incident investigators to explore why people's actions and assessments were not corrected at the time. **Research Highlights:** ► State transition diagrams are used to explain error detection and recovery. ► The Extended Control Model (ECOM) integrates several strategies for error recovery. ► A taxonomy of recovery strategies is modeled in terms of system dynamics. ► Proposals are made for resilient system design, training and incident investigation Please use these.

- **Keywords:** Error recovery; Error management; Re-planning; System dynamics; Safety critical systems; Complexity; Coupling

**Madhav V. Chitturi, Andrew W. Ooms, Andrea R. Bill, David A. Noyce. *Injury outcomes and costs for cross-median and median barrier crashes.* Pages 87-92.**

**Introduction:** The objective of this research was to quantify the injury outcomes and develop reliable and comprehensive injury costs for cross-median crashes (CMC) and median barrier crashes (MBC). **Method:** A three-step methodology was developed to quantify the crash costs for each crash severity and type. All CMC and MBC between 2001 and 2007 in Wisconsin were identified and used in this analysis. The Wisconsin CODES database provided comprehensive injury costs based on the injury types and severities suffered by participants in study crashes. **Results:** As expected, multi-vehicle CMC result in more total injuries and more severe injuries than single-vehicle CMC. Injury costs for the same injury level on KABCO scale are different for different crash types. Injury costs for concrete MBC are 33% to 50% less than those of multi-vehicle CMC, while the injury costs of concrete MBC for lower severities (B and C) are similar to those of single-vehicle CMC for the same severities; but for incapacitating injuries the costs are 30% less. As expected, concrete MBC result in lower severities than CMC. The costs, by crash severity, vary significantly between different crash types. Concrete median barrier injury crashes are roughly 20% of multi-vehicle CMC costs and 50% of single-vehicle CMC costs. **Conclusions:** Results indicate that using one set of crash costs for all crash types biases any evaluation. Therefore, it is recommended that crash-type-specific costs be used in applications such as development of median barrier warrant where specific types of crashes are considered (CMC and MBC). **Impact on industry:** Using crash specific costs can lead to a more realistic benefit-cost analysis and enable better decision-making. **Research highlights:** ► Developed methodology to quantify crash costs for each crash type and severity. ► Concrete median barrier crashes result in lower severities than cross-median crashes. ► Costs by crash severity vary significantly between cross-median and median barrier crashes. ► Using one set of crash costs for all crash types biases any evaluation.

- **Keywords:** Crash cost; Injury outcome; Median barrier crash; Cross median crash

**Wei-Shin Huang, Ching-Huei Lai. *Survival risk factors for fatal injured car and motorcycle drivers in single alcohol-related and alcohol-unrelated vehicle crashes.* Pages 93-99.**

**Introduction:** A high percentage of drivers who die as a result of a single vehicle crash are under the influence of alcohol. We aimed to better understand the prevalence of these fatalities and the ratio of death to injuries based on various risk factors. We focused on alcohol-related and -unrelated single-vehicle crashes to investigate the influence of such risk factors on the time until death for car and motorcycle drivers. **Methods:** We combined data from national police reports and a vital registration database in Taiwan. Survival analysis using Cox regression models was used to identify the risk factors of time until death. **Results:** Overall, nearly 60% of car driver fatalities and 40% of motorcycle driver fatalities involved the consumption of alcohol. Survival analysis of single-vehicle crashes suggested that the traffic island separation between a car moving at a higher speed and motorcycle traffic resulted in a higher risk of death over time for motorcycle drivers who consumed alcohol. The factors attributed to a higher risk of death over time for motorcycle drivers were older age, crashing into trees, night-time driving, driving on curved roads, and driving on local roads. Driving without restraints and driving on roads with higher speed limits attributed to a higher risk of death over time for car drivers. **Conclusions:** The factors that influence the risk of death over time in a motor-vehicle accident involving alcohol depended on different elements, which should each be considered when attempting to reduce this risk. **Impact on Industry:** More efforts should be made to investigate the various risk factors in areas with large motorcycle populations. **Research Highlights:** ► Nearly 60% of killed car drivers and 40% of killed motorcycle drivers were under the influence of alcohol. ► The traffic island separation between a car moving at higher speed and motorcycle traffic resulted in a higher risk of death over time for motorcycle drivers who consumed alcohol. ► Higher risk of death over time for motorcycle drivers were older age, unrestrained,

crashing into trees, night-time driving, driving on curved roads, driving roads with higher speed limits and on local roads.

- **Keywords:** Alcohol; Crash risks; Motorcycles; Survival analysis

**Despina Stavrinou, Katherine W. Byington, David C. Schwebel. *Distracted walking : cell phones increase injury risk for college pedestrians. Pages 101-107.***

**Introduction:** Distraction on cell phones jeopardizes motor-vehicle driver safety, but few studies examine distracted walking. At particular risk are college students, who walk frequently in and near traffic, have increased pedestrian injury rates compared to other age groups, and frequently use cell phones. **Method:** Using an interactive and immersive virtual environment, two experiments studied the effect of cell phone conversation on distraction of college student pedestrians. In the first, we examined whether pedestrians would display riskier behavior when distracted by a naturalistic cell phone conversation than when undistracted. We also considered whether individual difference factors would moderate the effect of the distraction. In a second experiment, we examined the impact of three forms of distraction on pedestrian safety: (a) engaging in a cell phone conversation, (b) engaging in a cognitively challenging spatial task by phone, and (c) engaging in a cognitively challenging mental arithmetic task by phone. **Results:** Results revealed that cell phone conversations distracted college pedestrians considerably across all pedestrian safety variables measured, with just one exception. Attention to traffic was not affected by the naturalistic phone conversation in Experiment 1, but was altered by the cognitively-demanding content of some types of conversation in Experiment 2. The content of the conversation did not play a major role in distraction across other variables; both mundane and cognitively complex conversations distracted participants. Moreover, no significant associations between individual difference factors and susceptibility to distraction emerged. **Impact on Industry:** Results may inform researchers, policy makers, and pedestrians themselves. Educational campaigns might discourage telephone conversations in pedestrian environments. **Research Highlights:** ► This study examined cell phone distraction in college student pedestrians. ► Cell phones distracted pedestrians across most pedestrian safety variables measured. ► Both mundane and cognitively complex conversations distracted participants. ► No associations emerged between individual factors and distraction susceptibility. ► Results may inform researchers, policy makers, and pedestrians themselves.

- **Keywords:** Pedestrian; Motor vehicle injury; Traffic; Cell phones; Distraction

**Rebecca Brookland, Dorothy Begg. *Adolescent, and their parents, attitudes towards graduated driver licensing and subsequent risky driving and crashes in young adulthood. Pages 109-115.***

**Problem:** Although Graduated Driver Licensing Systems (GDLS) have helped reduce young driver crash rates, they remain significantly over-represented in crash statistics. To be effective GDLS rely heavily on support for the legislation by those directly involved; parents to enforce the restrictions and adolescents to comply. There is some evidence that practices regarding GDLS restrictions influence adolescent driving outcomes in the early stage of licensure. However there has been no examination undertaken on the influence of parent and adolescent attitudes toward GDLS on adolescents' driving behavior and crash experiences as they move into their young adult years. The aim of this research was to examine these relationships. **Method:** This investigation was based on a longitudinal study of a birth cohort, and uses data collected when the cohort members were aged 15, 18, and 21 years. At age 15 both adolescent and their parent attitudes toward GDLS were measured. At age 18 adolescent GDLS attitudes were measured again. The association between these measures and self-reported risky driving behavior and crash involvement at age 21 were examined. **Results:** Negative attitudes

toward the learner supervisor restriction for males, and negative attitudes toward a GDLS for females were strongly associated with risky driving and crash involvement as young adults. **Impact on industry:** Targeting interventions to improve adolescents and parents understanding of the reasons for graduated licensing and the specific restrictions may improve attitudes and views and thereby contribute to a reduction in risky driving behaviors and crash risk among young adults. **Research Highlights:** ► Parents and adolescents need to support GDLS for them to be effective. ► Negative attitudes towards GDLS were associated with risky driving and crashes. ► Interventions should target improving the understanding of the reasons for GDLS.

- **Keywords:** Young drivers; Parent; Graduated driver licensing; Risky driving; Crashes

**Frank Gross, Eric T. Donnell. *Case-control and cross-sectional methods for estimating crash modification factors : comparisons from roadway lighting and lane and shoulder width safety effect studies. Pages 117-129.***

**Problem:** While observational before-after studies are considered the industry standard for developing crash modification factors (CMFs), there are practical limitations that may preclude their use in highway safety analysis. There is a need to explore alternative methods for estimating CMFs. **Method:** This paper employs case-control and cross-sectional analyses to estimate CMFs for fixed roadway lighting and the allocation of lane and shoulder widths. **Results:** Based on the case-control method, the CMF for intersection lighting is 0.886, while the cross-sectional study indicates a CMF of 0.881. The CMFs developed for lane and shoulder widths are also similar when comparing the two methods. **Conclusions:** This paper suggests that case-control and cross-sectional studies produce consistent results if care is taken in the study design and model development. **Impact on industry:** Case-control and cross-sectional studies may provide a viable alternative to estimate CMFs when a before-after study is impractical due to data restrictions. **Research highlights:** ► Observational before-after studies are the industry standard for developing CMFs. ► Practical limitations sometimes preclude the use of before-after studies. ► Cross-sectional and case-control studies are alternatives for estimating CMFs. ► Case-control studies account for many sources of variation in cross-sectional data. ► Cross-sectional analyses can produce results similar to the case-control method.

- **Keywords:** Road safety; Case-control; Cross-sectional; Crash modification factor; Countermeasure evaluation

**Jay J. Doucet, Linda Hill, Pat Stout, Vishal Bansal, Jeanne Lee, Dale Fortlage, Bruce Potenza, Pritha Workman, Raul Coimbra. *The unrecognized danger of a new transportation mechanism of injury : pedicabs. Pages 131-135.***

**Objective:** Pedicabs are a new and controversial transportation innovation for tourists in congested areas in several U.S. cities. Scant literature on this trauma mechanism exists. The purpose of this study is to identify the incidence, demographics, morbidity, mortality, and potential for injury prevention of pedicab incidents amongst major trauma admissions at an urban, academic Level I Trauma Center. **Patients & Methods:** Researchers conducted a retrospective review of the Trauma Registry from 2000 to 2009. All patients identified as being injured in a pedicab incident were reviewed. Demographics, diagnoses, toxicology, treatments, and injury severity scale (ISS) were collected. Outcomes included mortality, ICU, and hospital length of stay (LOS), discharge disposition, and hospital charges. A photographic survey of 50 local pedicabs was examined for the presence and use of safety equipment. **Results:** During the period of

January 2000 to July 2009 there were 15 major trauma victims from identified pedicab incidents. Falling from the pedicab was the mechanism of injury in 14 of 15 cases. There were two fatalities in victims following severe traumatic brain injury. Traumatic brain injury, skull fracture, or loss of consciousness was seen in 11/15 victims. Ethanol ingestion was detected in blood tests of 10 of the 14 adult victims. Median charges of hospitalization due to a pedicab related injury was US\$29,956 ± 77,482. A photographic survey of 50 local pedicabs reveals very limited use of safety belts by passengers despite existing city ordinances. **Conclusions:** Major trauma victims of pedicab incidents in the United States suffer significant injuries and death. Most cases occurred in passengers falling from the pedicab at night after alcohol ingestion. There is an opportunity for implementation of strategies toward improved injury prevention with this new form of transport. **Research Highlights:** ► Pedicab use and incidents have become more frequent in San Diego. ► Major trauma victims of pedicab incidents in San Diego suffer significant injuries and death. ► Most injuries and one fatality occurred from intoxicated passengers falling at night. ► There is an opportunity for strategies towards improved injury prevention with pedicabs.

- **Keywords:** Bicycle; Cycle; Rickshaw; Pedicab; Injury; Trauma; Traumatic brain injury; Injury prevention; Alcohol

**Adam E. Barry, Steven M. Howell, Maurice Dennis. *Evaluating impaired drivers confidence and intention to "(Please) drink responsibly". Pages 137-142.***

**Introduction:** Currently, alcohol industry-sponsored advertisements subsume traditional designated driver and don't drink and drive messages within responsible drinking campaigns. Yet, to date, there remains a dearth of literature specifically examining the attitudinal beliefs impaired drivers attach to the responsible drinking message. **Objective:** This investigation sought to examine the responsible drinking attitudes and beliefs of impaired drivers, specifically examining their confidence and intention to drink responsibly the next time they consumed alcohol. **Methods:** A random sample of 729 students attending a large, public Texas university completed a web-based administration of the *Characteristic of Responsible Drinking Survey* (CHORDS). **Results:** Participants in this sample who had driven while impaired by alcohol exhibited significantly less confidence in refraining from drinking and driving and reported significantly lower intentions to designate a driver, take a taxi, or use a safe-ride program the next time they consumed alcohol. Additionally, they also reported less confidence, and lower intentions, to ensure their blood alcohol concentrations remained below the legal limit (0.08%) the next time they consumed alcohol. **Conclusions:** Drivers who had driven while impaired significantly differed in their confidence and intention to drink responsibly the next time they consumed alcohol. Logistic regression results indicate that by increasing one's confidence in responsible drinking, and increasing their intention to drink responsibly, the likelihood of impaired driving can be decreased. **Impact on industry:** Results from this investigation demonstrate one's responsible drinking attitudinal beliefs accounts for a significant amount of the variance associated with one's alcohol-related behaviors. Thus, further research should examine and establish how individuals conceptualize and practice responsible drinking. **Research Highlights:** ► Those who had driven impaired reported less confidence in drinking responsibly. ► Those who had driven impaired reported lower intentions to drink responsibly. ► Impaired drivers had less intent to designate a driver the next time they drank. ► Impaired drivers had lower intentions for BAC to stay below 0.08% when drinking.

- **Keywords:** Alcohol; Responsible Drinking; Designated Driver; Impaired Driving

**A.E. af Wåhlberg. *The accident-exposure association: Self-reported versus recorded collisions. Pages 143-146.***

**Problem:** It has been claimed that exposure to risk of road traffic accidents (usually conceptualized as mileage) is curvilinearly associated with crashes (i.e., the increase in number of crashes decreases with increased mileage). However, this effect has been criticized as mainly an artifact of self-reported data. **Method:** To test the proposition that self-reported accidents create part of the curvilinearity in data by under-reporting by high-accident drivers, self-reported and recorded collisions were plotted against hours of driving for bus drivers. **Results:** It was found that the recorded data differed from self-reported information at the high end of exposure, and had a more linear association with the exposure measure as compared to the self-reported data, thus supporting the hypothesis. **Discussion:** Part of the previously reported curvilinearity between accidents and exposure is apparently due to biased methods. Also, the interpretation of curvilinearity as an effect of exposure upon accidents was criticized as unfounded, as the causality may just as well go the other way. **Impact on industry:** The question of how exposure associates with crash involvement is far from resolved, and everyone who uses an exposure metric (mileage, time, induced) should be careful to investigate the exact properties of their variable before using it. **Research highlights:** ► Less curvilinearity between road traffic accidents and exposure when objectively recorded crashes are used, as compared to self-reported ones. ► Self-reported mileage is not only unreliable, but can create biased results. ► No evidence that yearly mileage influences crash risk per mile.

- **Keywords:** Accident; Exposure; Low mileage bias; Methodology