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Arun Vijayan, Saniyat Islam, Michael Jones, Rajiv Padhye, Lyndon Arnold. *Degradation of fluorescent high-visibility colors used in safety garments for the Australian railway industry*. Pages 1-7.

Introduction: This study investigated the compliance of four fluorescent orange high-visibility garment substrates that are predominantly used in the Australian railway industry. While Special Purpose Orange (SPO), a shade of the Fluorescent orange (Fl-orange) is recommended by most Australian states as the high-visibility background color of a safety garment, there appear to be variations in the background color of clothing used by line-workers and rail contractors. The color of the garment was assessed for compliance with the Australian Standard AS/NZS 1906.2.2010 for high-visibility materials for safety garments. The results were also compared with ANSI Z535.2011 and BS EN ISO 20471.2013 Standards. **Method:** Photometric and colorimetric assessments of the background color of the garment substrates were performed using a spectrophotometer and were evaluated for compliance with the Standards after washing and exposure to UV. **Results:** The spectrophotometry measurements showed that Fl-orange background color for all samples except one complied with the AS/NZS 1906.2 Standard for daytime high-visibility garments after 20 washes but failed to comply after exposure to UV. It was also found that the chromaticity coordinates of the corners of the Fl-orange color space, specified in the AS/NZS 1906.4.2010 Standard are much wider and yellower when compared with the ANSI Z535.1.2011 and BS EN ISO 20471.2013 Standards. The sample that failed to comply with the Australian and American Standards however complied with the ISO Standard. **Practical Applications:** Irrespective of the Standard used, the research has shown the degrading effect of washing and light exposure and raises the questions as to how regularly, and under what conditions high-visibility garments need to be replaced. These findings will provide information for safety garment manufacturers about the characteristics and performance of high-visibility safety garments which make them conspicuous during daytime use. This research recommends that colors for railway workers should be chosen based on the conspicuity, commercial viability, reproducibility and durability rather than simply adopting standards from other industry domains or other countries.

- **Keywords:** High-visibility safety garments; Fluorescent orange; Degradation; Chromaticity; Railway

Joshua Fink, Valerian Kwigizile, Jun-Seok Oh. *Quantifying the impact of adaptive traffic control systems on crash frequency and severity: Evidence from Oakland County, Michigan*. Pages 1-7.

Introduction: Despite seeing widespread usage worldwide, adaptive traffic control systems have experienced relatively little use in the United States. Of the systems used, the Sydney Coordinated Adaptive Traffic System (SCATS) is the most popular in America. Safety benefits of these systems are not as well understood nor as commonly documented. **Method:** This study investigates the safety benefits of adaptive traffic control systems by using the large SCATS-based system in Oakland County, MI known as FAST-TRAC. This study uses data from FAST-TRAC-controlled intersections in Oakland County and compares a wide variety of geometric, traffic, and crash characteristics to similar intersections in metropolitan areas elsewhere in Michigan. Data from 498 signalized intersections are used to conduct a cross-sectional analysis. Negative binomial models are used to estimate models for three dependent crash variables. Multinomial logit models are used to estimate an injury severity model. A variable tracking the presence of FAST-TRAC controllers at intersections is used in all models to determine if a SCATS-based system has an impact on crash occurrences or crash severity. **Results:** Estimates show that the presence of SCATS-based controllers at intersections is likely to reduce angle crashes by up to 19.3%. Severity results show a statistically significant increase in non-serious injuries, but not a significant reduction in incapacitating injuries or fatal accidents.

- **Keywords:** Traffic safety; Adaptive traffic control; Crash frequency; Crash severity

Mahdi Pour-Rouholamin, Huaguo Zhou. *Investigating the risk factors associated with pedestrian injury severity in Illinois*. Pages 9-17.

Introduction: Pedestrians are known as the most vulnerable road users, which means their needs and safety require specific attention in strategic plans. Given the fact that pedestrians are more prone to higher injury severity levels compared to other road users, this study aims to investigate the risk factors associated with various levels of injury severity that pedestrians experience in Illinois. **Method:** Ordered-response models are used to analyze single-vehicle, single-pedestrian crash data from 2010 to 2013 in Illinois. As a measure of net change in the effect of significant variables, average direct pseudo-elasticities are calculated that can be further used to prioritize safety countermeasures. A model comparison using AIC and BIC is also provided to compare the performance of the studied ordered-response models. **Results:** The results recognized many variables associated with severe injuries: older pedestrians (more than 65 years old), pedestrians not wearing contrasting clothing, adult drivers (16–24), drunk drivers, time of day (20:00 to 05:00), divided highways, multilane highways, darkness, and heavy vehicles. On the other hand, crossing the street at crosswalks, older drivers (more than 65 years old), urban areas, and presence of traffic control devices (signal and sign) are associated with decreased probability of severe injuries. **Conclusions and practical applications:** The comparison between three proposed ordered-response models shows that the partial proportional odds (PPO) model outperforms the conventional ordered (proportional odds—PO) model and generalized ordered logit model (GOLM). Based on the findings, stricter rules to address DUI driving is suggested. Educational programs need to focus on older pedestrians given the increasing number of older people in Illinois in the upcoming years. Pedestrians should be educated to use pedestrian crosswalks and contrasting clothing at night. In terms of engineering countermeasures, installation of crosswalks where pedestrian activity is high seems a promising practice.

- **Keywords:** Pedestrian crash; Injury severity; Safety; Ordered-response model; Model comparison

Ruth A. Shults, Tamara M. Haegerich, Geeta Bhat, Xinjian Zhang. *Teens and seat belt use: What makes them click?* Pages 19-25.

Problem: Motor vehicle crashes kill more adolescents in the United States than any other cause, and often the teen is not wearing a seat belt. **Methods:** Using data from the 2011 Youth Risk Behavior Surveys from 38 states, we examined teens' self-reported seat belt use while riding as a passenger and identified individual characteristics and environmental factors associated with always wearing a seat belt. **Results:** Only 51% of high school students living in 38 states reported always wearing a seat belt when riding as a passenger; prevalence varied from 32% in South Dakota to 65% in Delaware. Seat belt use was 11 percentage points lower in states with secondary enforcement seat belt laws compared to states with primary enforcement laws. Racial/ethnic minorities, teens living in states with secondary enforcement seat belt laws, and those engaged in substance use were least likely to always wear their seat belts. The likelihood of always being belted declined steadily as the number of substance use behaviors increased. **Discussion:** Seat belt use among teens in the United States remains unacceptably low. Results suggest that environmental influences can compound individual risk factors, contributing to even lower seat belt use among some subgroups. **Practical applications:** This study provides the most comprehensive state-level estimates to date of seat belt use among U.S. teens. This information can be useful when considering policy options to increase seat belt use and for targeting injury prevention interventions to high-risk teens. States can best increase teen seat belt use by making evidence-informed decisions about state policy options and prevention strategies.

- **Keywords:** Motor vehicles; Seat belts; Risk factors; Policy; Teen passenger belt use

Lixin Jiang, Tahira M. Probst. *Transformational and passive leadership as cross-level moderators of the relationships between safety knowledge, safety motivation, and safety participation*. Pages 27-32.

Introduction: While safety knowledge and safety motivation are well-established predictors of safety participation, less is known about the impact of leadership styles on these relationships. **Method:** The purpose of the current study was to examine whether the positive relationships between safety knowledge and motivation and safety participation are contingent on transformational and passive forms of safety leadership. **Results:** Using multilevel modeling with a sample of 171 employees nested in 40 workgroups, we found that transformational safety leadership strengthened the safety knowledge–participation relationship, whereas passive leadership weakened the safety motivation–participation relationship. **Conclusions:** Under low transformational leadership, safety motivation was not related to safety participation; under high passive leadership, safety knowledge was not related to safety participation. **Practical Applications:** These results are discussed in light of organizational efforts to increase safety-related citizenship behaviors.

- **Keywords:** Transformational leadership; Passive leadership; Safety participation; Safety knowledge; Safety motivation

Ed Wood, Stacy Salomonsen-Sautel. *DUID prevalence in Colorado's DUI citations*. Pages 33-38.

Introduction: There are limited studies that measure the prevalence of driving under the influence of drugs (DUID) based upon impairment measures because most prevalence studies are based on drug tests. The aim of this study was to provide the first estimate of DUID prevalence in Colorado using data collected by Colorado law enforcement officers in vehicular homicide (VH) and vehicular assault (VA) cases, and reported in court records. **Methods:** The four research questions of this study were

answered by completing independent t-tests or Mann–Whitney U tests, Pearson chi-square analyses or Fisher's exact tests, and Kruskal–Wallis tests. **Results:** Seventy percent (119 out of 170) of the cases involved alcohol only and 30% (51 out of 170) involved drugs. Of the latter cases, 32 cases involved a combination of alcohol and drugs and 19 cases identified drugs only, with no alcohol. Marijuana was the most commonly cited drug (23 cases); however, it was the sole impairing substance identified in only three cases. **Conclusion:** Polydrug use was very common among DUID cases, which makes it difficult to identify which drug or drugs caused the impairment responsible for the Driving Under the Influence citation. This study revealed tha (a) drugged driving is a frequent cause of DUI citations in cases charged with VH or VA; (b) that polydrug use, rather than marijuana, is the most common cause of drugged driving in Colorado; and (c) that current warrant procedures render blood test results meaningless in cases of marijuana-impairment. **Practical application:** States should collect and analyze DUID data to ensure legislators focus on the right DUID problems to improve biological testing for drugs, adopt more appropriate roadside testing, and enact stronger DUID laws to protect the public.

- **Keywords:** Drugged driving; Polydrug use; Impairment; Vehicular homicide; Vehicular assault

António Couto, Marco Amorim, Sara Ferreira. *Reporting road victims: Assessing and correcting data issues through distinct injury scales*. Pages 39-45.

Introduction: The most common measurement for road accidents relies in police reports; however, there is a high portion of underreporting and misclassification, mainly concerning elderly causalities, urban accidents, slightly injured, users of two-wheeled vehicles, and car occupants. **Methods:** In order to assess these issues, road accidents occurring in the Porto Metropolitan Area, Portugal, covering a 6-year period (2006–2011) were analyzed based on police and hospital datasets. By linking hospital data with police data, it is possible to evaluate the misclassification of the victims' severity by the police regarding the maximum abbreviated injury scale (MAIS) classification. Additionally, considering that 29% of the victims recorded by hospitals were not reported by the police, which is in line with the reality of other EU countries, underreporting is further investigated. Thus, we used econometric and statistics tools to measure the correlation between different available data to identify possible causes of underreporting and misclassification. In this sense, factors contributing to the misclassification of casualties by the police are identified using a univariate analysis. On the basis of the linked police–hospital data, and considering those factors and the police classification, a probabilistic model was developed to estimate a MAIS-based classification for all individuals included in the police accident records. Results: The results of misclassification indicate a significant over-classification of severe injury by the police. Additionally, a systematic police underreporting phenomenon of around 30% was found. **Conclusions and Practical Applications:** Finally, comparing estimated results and actual data, we were able to produce non-fatality adjustment coefficients to estimate the total casualties taking into account the underreporting and misclassification phenomena and to compare them with the Portuguese and European realities.

- **Keywords:** Abbreviated injury scale; Underreporting; Misclassification; Injury severity

Cher Carney, Karisa K. Harland, Daniel V. McGehee. *Using event-triggered naturalistic data to examine the prevalence of teen driver distractions in rear-end crashes*. Pages 47-52.

Introduction: While teen driver distraction is cited as a leading cause of crashes, especially rear-end crashes, little information is available regarding its true prevalence.

The majority of distraction studies rely on data derived from police reports, which provide limited information regarding driver distraction. **Method:** This study examined over 400 teen driver rear-end crashes captured by in-vehicle event recorders. A secondary data analysis was conducted, paying specific attention to driver behaviors, eyes-off-road time, and response times to lead-vehicle braking. **Results:** Among teens in moderate to severe rear-end crashes, over 75% of drivers were observed engaging in a potentially distracting behavior. The most frequently seen driver behaviors were cell phone use, attending to a location outside the vehicle, and attending to passengers. Drivers using a cell phone had a significantly longer response time than drivers not engaged in any behaviors, while those attending to passengers did not. Additionally, in about 50% of the rear-end crashes where the driver was operating/looking at a phone (e.g., texting), the driver showed no driver response (i.e., braking or steering input) before impact, compared to 10% of crashes where the driver was attending to a passenger. **Conclusions:** The high frequency of attending to passengers and use of a cell phone leading up to a crash, compounded with the associated risks, underlines the importance of continued investigation in these areas. **Practical applications:** Parents and teens must be educated regarding the frequency of and the potential effects of distractions. Additional enforcement may be necessary if Graduated Driver Licensing (GDL) programs are to be effective. Systems that alert distracted teens could also be especially helpful in reducing rear-end collisions.

- **Keywords:** Rear-end crashes; Teen drivers; Distraction; Cell phone; Passengers

Geetha M. Waehrer, Ted R. Miller, Delia Hendrie, Deborah M. Galvin. *Employee assistance programs, drug testing, and workplace injury*. Pages 53-60.

Introduction: Little is known about the effects of employee assistance programs (EAPs) on occupational injuries. **Materials and methods:** Multivariate regressions probed a unique data set that linked establishment information about workplace anti-drug programs in 1988 with occupational injury rates for 1405 establishments. **Results:** EAPs were associated with a significant reduction in both no-lost-work and lost-work injuries, especially in the manufacturing and transportation, communication and public utilities industries (TCPU). Lost-work injuries were more responsive to specific EAP characteristics, with lower rates associated with EAPs staffed by company employees (most likely onsite). Telephone hotline services were associated with reduced rates of lost-work injuries in manufacturing and TCPU. Drug testing was associated with reductions in the rate of minor injuries with no lost work, but had no significant relationship with lost-work injuries. **Practical applications:** This associational study suggests that EAPs, especially ones that are company-staffed and ones that include telephone hotlines, may prevent workplace injuries.

- **Keywords:** EAP; Anti-drug programs; Drug-free workplace policy; Drug testing; Occupational injury

Hamed Ahangari, Carol Atkinson-Palombo, Norman W. Garrick. *Progress towards zero, an international comparison: Improvements in traffic fatality from 1990 to 2010 for different age groups in the USA and 15 of its peers*. Pages 61-70.

Introduction: In January 2015, the United States Department of Transportation (USDOT) announced that the official target of the federal government transportation safety policy was zero deaths. Having a better understanding of traffic fatality trends of various age cohorts—and to what extent the US is lagging other countries—is a crucial first step to identifying policies that may help the USDOT achieve its goal. **Method:** In this paper we analyze fatality rates for different age cohorts in developed countries to

better understand how road traffic fatality patterns vary across countries by age cohort. Using benchmarking analysis and comparative index analysis based on panel data modelling and data for selected years between 1990 and 2010, we compare changes in the rate of road traffic fatality over time, as well as the absolute level of road traffic fatality for six age groups in the US, with 15 other developed countries. **Results-Conclusions:** Our findings illustrate tremendous variations in road fatality rates (both in terms of the absolute values and the rates of improvement over time) among different age cohorts in all of the 16 countries. Looking specifically at the US, our analysis shows that safety improvements for Youngsters (15-17 years old) was much better than for other age groups, and closely tracked peer countries. In sharp contrast, Children (0-14 years old) and Seniors (+65 years old) in the US, fare very poorly when compared to peer countries. For example, in 2010, Children in the US were a stunning five times more likely to experience a road traffic fatality than Children in the UK. **Practical Applications:** This startling statistic suggests an immediate need to explore further the causes and potential solutions to these disparities. This is especially important if countries, including the US, are to achieve the ambitious goals set out in Zero Vision initiatives.

- **Keywords:** Age cohort road safety analysis; International comparative studies; Zero Death Vision; Road Safety Improvements; Panel data analysis

Gaurav Nanda, Kathleen M. Grattan, MyDzung T. Chu, Letitia K. Davis, Mark R. Lehto. *Bayesian decision support for coding occupational injury data*. Pages 71-82.

Introduction: Studies on autocoding injury data have found that machine learning algorithms perform well for categories that occur frequently but often struggle with rare categories. Therefore, manual coding, although resource-intensive, cannot be eliminated. We propose a Bayesian decision support system to autocode a large portion of the data, filter cases for manual review, and assist human coders by presenting them top k prediction choices and a confusion matrix of predictions from Bayesian models. **Method:** We studied the prediction performance of Single-Word (SW) and Two-Word-Sequence (TW) Naïve Bayes models on a sample of data from the 2011 Survey of Occupational Injury and Illness (SOII). We used the agreement in prediction results of SW and TW models, and various prediction strength thresholds for autocoding and filtering cases for manual review. We also studied the sensitivity of the top k predictions of the SW model, TW model, and SW–TW combination, and then compared the accuracy of the manually assigned codes to SOII data with that of the proposed system. **Results:** The accuracy of the proposed system, assuming well-trained coders reviewing a subset of only 26% of cases flagged for review, was estimated to be comparable (86.5%) to the accuracy of the original coding of the data set (range: 73%–86.8%). Overall, the TW model had higher sensitivity than the SW model, and the accuracy of the prediction results increased when the two models agreed, and for higher prediction strength thresholds. The sensitivity of the top five predictions was 93%. **Conclusions:** The proposed system seems promising for coding injury data as it offers comparable accuracy and less manual coding. **Practical Applications:** Accurate and timely coded occupational injury data is useful for surveillance as well as prevention activities that aim to make workplaces safer.

- **Keywords:** Bayesian models; Narrative analysis; Occupational injury; Text classification; Decision support system

Debra Houry, Grant Baldwin. *Announcing the CDC guideline for prescribing opioids for chronic pain*. Pages 83-84.

This guideline provides recommendations for primary care providers who are prescribing opioids for chronic pain outside of active cancer treatment, palliative care, and end-of-life care. The guideline addresses: (a) when to initiate or continue opioids for chronic pain;

(b) opioid selection, dosage, duration, follow-up, and discontinuation; and (c) assessing risk and addressing harms of opioid use. This guideline is intended to improve communication between providers and patients about the risks and benefits of opioid therapy for chronic pain, improve the safety and effectiveness of pain treatment, and reduce the risks associated with long-term opioid therapy, including abuse, dependence, overdose, and death (Dowell D, Haegerich TM, Chou R. CDC Guideline for Prescribing Opioids for Chronic Pain — United States, 2016. MMWR Recomm Rep 2016;65:1–49. DOI: http://dx.doi.org/10.15585/mmwr.rr6501e1.)

- **Keywords:** Opioids; Chronic pain; Prescription drug