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Nicolas Clabaux, Jean-Yves Fournier, Jean-Emmanuel Michel.
Powered two-wheeler drivers' risk of hitting a pedestrian in towns.

Introduction: The risk of collision between pedestrians and powered two-wheelers is poorly understood today. The objective of this research is to determine the risk for powered two-wheeler drivers of hitting and injuring a pedestrian per kilometer driven in towns and to compare this risk with that run by four-wheeled vehicle drivers. Method: Using the bodily injury accidents recorded by the police on nine roads in the city of Marseille in 2011 and a campaign of observations of powered two-wheeler traffic, we estimated the risk per kilometer driven by powered two-wheeler drivers of hitting a pedestrian and compared it with the risk run by four-wheeled vehicle drivers. Results: The results show that the risk for powered two-wheeler drivers of hitting and injuring a pedestrian is significantly higher than the risk run by four-wheeled vehicle drivers. On the nine roads studied, it is on average 3.33 times higher (95% CI: 1.63; 6.78). Taking four more years into account made it possible to consolidate these results and to tighten the confidence interval. Conclusion: There does indeed seem to be problems in the interactions between pedestrians and powered two-wheeler users in urban traffic. These interaction problems lead to a higher risk of hitting and injuring a pedestrian for powered two-wheeler drivers than for four-wheeled vehicle drivers. The analysis of the police reports suggests that part of this increased risk comes from filtering maneuvers by powered two-wheelers. Practical applications: Possible countermeasures deal with the urban street layout. Measures consisting in reducing the width and the number of traffic lanes to a strict minimum and installing medians or pedestrian islands could be an effective way for the prevention of urban accidents between pedestrians and powered two-wheelers.

- **Keywords:** Powered two-wheelers; Motorcycle; Moped; Pedestrian; Crash risk

Peter Tuckel, William Milczarski, Richard Maisel. ***Pedestrian injuries due to collisions with bicycles in New York and California.***

Introduction': Scant attention has been given to pedestrians injured in accidents resulting from collisions with cyclists. This scholarly neglect is surprising given the growing popularity of cycling. This study examines the incidence of pedestrians injured by cyclists in New York between 2004 to 2011 and in California from 2005 to 2011. The study also profiles the pedestrians injured in these two states during these two time frames. Method: The data for this study are based upon patient-level hospital records from New York and California. The data for New York comes from the Statewide Planning

and Research Cooperative System (SPARCS) under the auspices of New York State's Department of Health. The data for California come from two sources: the Healthcare Cost and Utilization Project (HCUP) and the California Office of Statewide Health Planning and Development. Results: The rate of pedestrians injured in collisions with cyclists has decreased over time. This decline has occurred despite the increase in the number of cyclists in these states during this same time period. Two possible explanations for this decline are: (a) less exposure of children to cyclists, and (b) improvements in the cycling infrastructure. Practical applications: Although the rate of injuries to pedestrians from collisions with cyclists has been decreasing, improvements to the cycling infrastructure will need to continue. Bike lanes, particularly protected bike lanes, have been shown to be an effective way of reducing cycling-pedestrian accidents. The results of the current study are consistent with this research. Educational campaigns aimed at cyclists that emphasize the safety of all road users – including pedestrians – will also need to continue to assure that this downward trend in the number of accidents is not reversed.

- **Keywords:** Pedestrians; Cyclists; Pedestrian-cyclist accidents; Injury; Epidemiology

Carl Bonander, Finn Nilson, Ragnar Andersson. *The effect of the Swedish bicycle helmet law for children : an interrupted time series study.*

Background: Previous population-based research has shown that bicycle helmet laws can reduce head injury rates among cyclists. According to deterrence theory, such laws are mainly effective if there is a high likelihood of being apprehended. In this study, we investigated the effect of the Swedish helmet law for children under the age of 15, a population that cannot be fined. Method: An interrupted time series design was used. Monthly inpatient data on injured cyclists from 1998–2012, stratified by age (0–14, 15 +), sex, and injury diagnosis, was obtained from the National Patient Register. The main outcome measure was the proportion of head injury admissions per month. Intervention effect estimates were obtained using generalized autoregressive moving average (GARMA) models. Pre-legislation trend and seasonality was adjusted for, and differences-in-differences estimation was obtained using adults as a non-equivalent control group. Results: There was a statistically significant intervention effect among male children, where the proportion of head injuries dropped by 7.8 percentage points. There was no evidence of an intervention effect on the proportion of head injuries among female children. Conclusion: According to hospital admission data, the bicycle helmet law appears to have had an effect only on male children. Practical applications: This study, while quasi-experimental and thus not strictly generalizable, can contribute to increased knowledge regarding the effects of bicycle helmet laws.

- **Keywords:** Legislation; Bicycling; Policy; Intervention; Injury control

Kristen A. Conner, Gary A. Smith. *The impact of aggressive driving-related injuries in Ohio, 2004–2009.*

Objective: This study describes the medical and financial impact (hospital charges) of aggressive driving-related injuries in Ohio. Methods: Statewide crash and hospital databases were probabilistically linked for 2004 through 2009. Descriptive analyses and multivariate regression modeling of multiply-imputed data on motor vehicle occupants involved in aggressive driving-related crashes were performed. Results: There were 821,136 motor vehicle occupants involved in aggressive driving-related crashes in Ohio from 2004 through 2009; injuries were sustained by 15.0%. The rate of aggressive driving-related crashes was highest among drivers ages 16 to 19 years (3787.1 crashes per 100,000 licensed drivers). Aggressive driving-related inpatients accrued more than \$250.8 million in hospital charges and 28,366 inpatient days of treatment in 2004 through 2009. Occupants ages 16 to 19 years had higher odds of sustaining injury when involved in aggressive driving-related crashes (OR = 1.10;

95% CI=1.07, 1.12; $p < 0.001$), but lower odds of death, inpatient admission, ISS ≥ 16 , and rehabilitation. Discussion: Aggressive driving-related injuries have a substantial medical and financial impact in Ohio. Practical Applications: Compared with other highway safety issues, prevention efforts aimed specifically at aggressive driving are lacking. Targeted enforcement and public awareness campaigns are needed.

- **Keywords:** Motor vehicle crash; Injury; Aggressive driving; Medical outcomes; Hospital charges

Anam Ardeshiri, Mansoureh Jiehani. *A speed limit compliance model for dynamic speed display sign.*

Introduction: Violating speed limits is a major cause of motor vehicle crashes. Various techniques have been adopted to ensure that posted speed limits are obeyed by drivers. This study investigates the effect of dynamic speed display signs (DSDSs) on drivers' compliance with posted speed limit. Method: An extensive speed data collection upstream of, adjacent to, and downstream of DSDS locations on multiple road classes with different speed limits (25, 35, and 45 mph) was performed short-term and long-term after DSDS installation. Conventional statistical analysis, regression models, and a Bayesian network were developed to assess the DSDS's effectiveness. Results' conclusions: General compliance with speed limit (upstream of the DSDS location), time of day, day of week, duration of DSDS operation, and distance from the DSDS location were significantly correlated with speed limit compliance adjacent to the DSDS. While compliance with the speed limit due to the DSDS increased by 5%, speed reduction occurred in 40% of the cases. Practical applications: Since drivers were likely to increase their speed after passing the DSDS, it should be installed on critical points supplemented with enforcement.

- **Keywords:** DSDS; Speed limit; Speed compliance; Bayesian network

Wei Hao, Janice Daniel. *Motor vehicle driver injury severity study under various traffic control at highway-rail grade crossings in the United States.*

Introduction: Based on the Federal Railway Administration (FRA) database, approximately 62% of the collisions at highway-rail crossings occurred at locations with active controls (gate and flashing lights), followed by passive controls (cross bucks and stop signs) with approximately 28% of accidents. Method: The study applied an ordered probit model to explore the determinants of driver injury severity under various control measures at highway-rail grade crossing in the United States. Results: The analysis found that schedule factor (peak hour), visibility, motor vehicle speed, train speed, driver's age, area type, traffic volume and highway pavement impact driver injury severity at both active and passive highway-rail crossings. Practical Applications: For both active and passive control highway-rail grade crossings, speed control for both trains and vehicles will significantly reduce driver injury severity. However, the level of influence by vehicle speed and train speed at passive control is higher compared with active control. Paving highways at highway-rail grade crossings will also help to reduce driver injury severity at highway-rail crossing accidents.

- **Keywords:** Injury Severity; Control devices; Highway-rail grade crossing; Accidents; Ordered probit model

Joanna Kica, Kenneth D. Rosenman. *Surveillance for work-related skull fractures in Michigan.*

Objectives: The objective was to develop a multisource surveillance system for work-related skull fractures. Methods: Records on work-related skull fractures were obtained from Michigan's 134 hospitals, Michigan's Workers' Compensation Agency and death certificates. Cases from the three sources were matched to eliminate duplicates from more than one source. Workplaces where the most severe injuries occurred were referred to OSHA for an enforcement inspection. Results: There were 318 work related skull fractures, not including facial fractures, between 2010 and 2012. In 2012, after the inclusion of facial fractures, 316 fractures were identified of which 218 (69%) were facial fractures. The Bureau of Labor Statistic's (BLS) 2012 estimate of skull fractures in Michigan, which includes facial fractures, was 170, which was 53.8% of those identified from our review of medical records. The inclusion of facial fractures in the surveillance system increased the percentage of women identified from 15.4% to 31.2%, decreased severity (hospitalization went from 48.7% to 10.6% and loss of consciousness went from 56.5% to 17.8%), decreased falls from 48.2% to 27.6%, and increased assaults from 5.0% to 20.2%, shifted the most common industry from construction (13.3%) to health care and social assistance (15.0%) and the highest incidence rate from males 65 + (6.8 per 100,000) to young men, 20-24 years (9.6 per 100,000). Workplace inspections resulted in 45 violations and \$62,750 in penalties. Conclusions: The Michigan multisource surveillance system of workplace injuries had two major advantages over the existing national system: (a) workplace investigations were initiated hazards identified and safety changes implemented at the facilities where the injuries occurred; and (b) a more accurate count was derived, with 86% more work-related skull fractures identified than BLS's employer based estimate. Practical Applications: A more comprehensive system to identify and target interventions for workplace injuries was implemented using hospital and emergency department medical records.

- **Keywords:** Occupational injuries; Traumatic brain injury (TBI); Enforcement inspections; Public health surveillance; Injury prevention

Chen Chen, Yuanchang Xie. *Modeling the safety impacts of driving hours and rest breaks on truck drivers considering time-dependent covariates.*

Introduction: Driving hours and rest breaks are closely related to driver fatigue, which is a major contributor to truck crashes. This study investigates the effects of driving hours and rest breaks on commercial truck driver safety. Method: A discrete-time logistic regression model is used to evaluate the crash odds ratios of driving hours and rest breaks. Driving time is divided into 11 one hour intervals. These intervals and rest breaks are modeled as dummy variables. In addition, a Cox proportional hazards regression model with time-dependent covariates is used to assess the transient effects of rest breaks, which consists of a fixed effect and a variable effect. Results: Data collected from two national truckload carriers in 2009 and 2010 are used. The discrete-time logistic regression result indicates that only the crash odds ratio of the 11th driving hour is statistically significant. Taking one, two, and three rest breaks can reduce drivers' crash odds by 68%, 83%, and 85%, respectively, compared to drivers who did not take any rest breaks. The Cox regression result shows clear transient effects for rest breaks. It also suggests that drivers may need some time to adjust themselves to normal driving tasks after a rest break. Overall, the third rest break's safety benefit is very limited based on the results of both models. Practical applications: The findings of this research can help policy makers better understand the impact of driving time and rest breaks and develop more effective rules to improve commercial truck safety.

- **Keywords:** Survival analysis; Discrete-time logistic regression; Hours of Service; Cox proportional hazards model; Driver fatigue

Alex K. Julius, Brian Kane, Maria T. Bulzacchelli, H. Dennis P. Ryan III.
Compliance with the ANSI Z133.1 — 2006 safety standard among arborists in New England.

Introduction: Arboriculture is hazardous work. A consensus safety standard exists, but little is known about compliance with it. This study aimed to determine whether accreditation and certification are associated with safety practices and to identify specific safety practices adhered to most and least. Method: Sixty-three tree care companies in southern New England were directly observed on job sites. Adherence to the American National Standards for Arboricultural Operations (ANSI Z133.1 — 2006) was compared across companies that were accredited, non-accredited with certified arborists on staff, and non-accredited without certified arborists on staff. Results: Companies with accreditation or certified arborists demonstrated greater safety compliance than those without. However, low compliance was found across all company types for personal protective equipment (PPE) use, chain saw safety, and chipper safety. Conclusions: Greater attention to PPE, chain saw, and chipper practices is warranted across the industry. Safety in non-accredited companies without certified arborists especially needs improvement. Practical Application: Only partial compliance was found among accredited companies and companies with certified arborists. Intervention strategies are needed for all company types for the use of PPE and safer use of chain saws and chippers.

- **Keywords:** Arboriculture; Tree care; Occupational safety standards; Safety practices; Accreditation

Rachel W. Jones Ross, Sheila T.D. Cordazzo, Charles T. Scialfa.
Predicting on-road driving performance and safety in healthy older adults.

Introduction: This study evaluated the ability to predict the on-road driving of older drivers using a battery of laboratory-based instruments. Methods: The Roadwise Review, a brief Hazard Perception Test and several tests of vision were given to 65 cognitively healthy, licensed older drivers (M=74 years, SD=9 years). They also participated in a standardized driving assessment of approximately 18 km, along a mixed residential and commercial route. Results: Raw scores on the Roadwise Review did not predict accumulated points, or automatic disqualifications, but could predict who would pass or fail the on-road evaluation. The number of serious problems (excluding head and neck flexibility) that were identified by the Roadwise Review was a significant predictor of automatic disqualifications, and a significant predictor of passing or failing the on-road assessment. The Hazard Perception Test approached significance when predicting accumulated points and was a significant predictor of automatic disqualifications, as well as pass/fail outcomes. Conclusions: The best model for predicting passing or failing the on-road assessment included the Hazard Perception Test, color vision, and, a measure of walking speed from the Roadwise Review, which yielded a sensitivity of 82% and a specificity of 69% (AROC=.80). Future work will need to determine how these tests can be used with other information (e.g., medical history) to yield better diagnoses of fitness to drive, particularly among those who are medically at risk.

- **Keywords:** Driving performance; Older adults; Roadwise Review; Hazard Perception Test

Kitty J. Hendricks.
Youth on racial minority operated U.S. farms, 2008 : demographics and injuries.

Introduction: To obtain injury surveillance data for youth on racial minority operated farms, the National Institute for Occupational Safety and Health developed the Minority Farm Operator Childhood Agricultural Injury Survey (M-CAIS) in collaboration with the U.S. Department of Agriculture. Methods: Using a regionally stratified telephone survey

of U.S. minority operated farm households, M-CAIS data were collected for youth less than 20 years of age. Results: There were an estimated 37,443 youth living on racial minority operated U.S. farms in 2008, almost half (46%) of these youth worked on the farm. Racial minority farm operators hired 6,443 youth, and reported an estimated 775,991 youth relative and other visitors on the farm. These youth suffered an estimated 516 injuries (5.9 injuries/1000 farms). Conclusions: Household youth had an injury rate of 7.8 injuries/1000 household youth and a work-related injury rate of 6.9 injuries/1000 working household youth. Practical applications: The research enables agricultural safety and health researchers, practitioners, and educators to identify priorities and design trainings and interventions to minimize the risk of farm hazards to youth on racial minority farm operations in the United States.

- Keywords: Minority; Agriculture; Injury; Youth; Surveillance

Sunnye Mayes, Michael C. Roberts, Cathleen Odar Stough. *Risk for household safety hazards : socioeconomic and sociodemographic factors.*

Introduction: Many unintentional injuries to young children occur in the home. The current study examines the relation between family socioeconomic and sociodemographic factors and risk factors for home injury. Methods: Presence of household hazards was examined in 80 families with toddler-aged children. Parental ability to identify household hazards in pictures was also assessed. ANOVAs and Pearson product-moment correlations examined the relationship between presence of household hazards, knowledge to identify hazards, and factors of yearly family income, parental age, parental education, parental marital status, child ethnicity, and the number of children living in the home. Results: A greater number of hazards were found in the homes of both the lowest and highest income families, but poorer knowledge to identify household hazards was found only among parents of the lowest income families and younger parents. Across family socioeconomic status, parent knowledge of hazards was related to observed household hazards. Conclusions: The relationship between family income and risk for injury is complex, and children of both lower and higher SES families may be at risk for injury. Practical applications: While historically particular focus has been placed on risk for injury among children in low income families, injury prevention efforts should target reducing presence of household hazards in both high and low SES families.

- **Keywords:** Unintentional injury; Injury prevention; Safety hazards; Home safety

Ali Tavakoli Kashani, Rahim Rabieyan, Mohammad Mehdi Besharati. *A data mining approach to investigate the factors influencing the crash severity of motorcycle pillion passengers.*

Introduction: Motorcycle passengers comprise a considerable proportion of traffic crash victims. During a 5 year period (2006–2010) in Iran, an average of 3.4 pillion passengers are killed daily due to motorcycle crashes. This study investigated the main factors influencing crash severity of this group of road users. Method: The Classification and Regression Trees (CART) method was employed to analyze the injury severity of pillion passengers in Iran over a 4 year period (2009–2012). Results: The predictive accuracy of the model built with a total of 16 variables was 74%, which showed a considerable improvement compared to previous studies. The results indicate that area type, land use, and injured part of the body (head, neck, etc.) are the most influential factors affecting the fatality of motorcycle passengers. Results also show that helmet usage could reduce the fatality risk among motorcycle passengers by 28%. Practical Applications: The findings of this study might help develop more targeted countermeasures to reduce the death rate of motorcycle pillion passengers.

- **Keywords:** Motorcycle pillion passengers; Crash severity; Classification and regression trees

Jessica S. Jermakian, Kathleen D. Klinich, Nichole R. Orton, Carol A.C. Flannagan, Miriam A. Manary, Laura A. Malik, Prabha Narayanaswamy. *Factors affecting tether use and correct use in child restraint installations.*

Introduction: Field studies show that top tethers go unused in half of forward-facing child restraint installations. Method: In this study, parent volunteers were asked to use the Lower Anchors and Tethers for Children (LATCH) to install child restraints in several vehicles to identify tether anchor characteristics that are associated with tether use. Thirty-seven volunteers were assigned to four groups. Each group tested two forward-facing child restraints in four of 16 vehicle models. Logistic regression models were used to identify predictors of tether use and correct use. Results: Subjects used the tether in 89% of the 294 forward-facing child restraint installations and attached the tether correctly in 57% of the installations. Tethers were more likely to be used when the anchor was located on the rear deck as typically found in sedans compared with the seatback, floor, or roof. Tethers were less likely to be attached correctly when there was potentially confusing hardware present. No vehicle tether hardware characteristics or vehicle manual directions were associated specifically with correct tether routing and head restraint position. Conclusion: This study provides laboratory evidence that specific vehicle features are associated with tether use and correct use. Practical applications: Modifications to vehicles that make tether anchors easier to find and identify likely will result in increases in tether use and correct use.

- **Keywords:** Child passenger safety; Children; Child restraints; LATCH; Tether

Phuong Nguyen-Hoang, Ryan Yeung. *Dollars for lives : the effect of highway capital investments on traffic fatalities.*

Introduction: This study examines the effect of highway capital investments on highway fatalities. Methods: We used state-level data from the 48 contiguous states in the United States from 1968 through 2010 to estimate the effects on highway fatalities of capital expenditures and highway capital stock. We estimated these effects by controlling for a set of control variables together with state and year dummy variables and state-specific linear time trends. Results: We found that capital expenditures and capital stock had significant and negative effects on highway fatalities. Conclusion: States faced with declines in gas tax revenues have already cut back drastically on spending on roads including on maintenance and capital outlay. If this trend continues, it may undermine traffic safety. Practical application: While states and local governments are currently fiscally strained, it is important for them to continue investments in roadways to enhance traffic safety and, more significantly, to save lives.

- **Keywords:** Traffic fatalities; Highway expenditures; Capital expenditures; Capital stock