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Samuel Labi. Efficacies of roadway safety improvements across functional subclasses of rural two-lane highways. Pages 231-239.

Introduction: Highway crash occurrence is a leading cause of unnatural deaths, and highway agencies continually seek to identify engineering measures to reduce crashes and to assess the efficacy of such measures. Most past studies on the effectiveness of roadway improvements in terms of crash reduction considered all rural two-lane sections as a single category of roads. However, it may be hypothesized that the differences in the mobility and accessibility characteristics that are reflected in (and due to) the different design standards between different functional subclasses in the rural two-lane highway system can lead to differences in efficacies of safety improvements at these subclasses. This paper investigates the efficacy of roadway improvements, in terms of crash reduction, at the various subclasses of rural two-lane highways. Methods: An empirical analysis of safety performance at each of the three subclasses of rural two-lane highways was carried out using the negative binomial modeling technique. For each subclass, crash prediction models were developed separately for the three levels of crash severity: property-damage only, injury, and fatal/injury. The crash factors that were considered include lane width, shoulder width, pavement surface friction, pavement condition, and horizontal and vertical alignments. After having developed the safety performance functions, the effectiveness (in terms of the extent of crash reduction, for different levels of crash severity) of highway safety enhancements at each highway subclass were determined using the theoretical concepts established in past literature. These enhancements include widening lanes, widening shoulders, enhancing pavement surface friction, and improving the vertical or horizontal alignment. Results and Conclusion: The study found that there is empirical evidence to justify the decomposition of the family of rural two-lane roads into its constituent subclasses for purposes of analyzing the effectiveness of safety enhancement projects and thus to avoid underestimation or overestimation of benefits of safety improvements at this class of highways.

- **Keywords:** Highway safety; fatal crashes; crash reduction; rural-two lane roads; Safety improvement

Lorenzo G. Cena, Nir Keren, Wen Li, Alicia L. Carriquiry, Michael D. Pawlovich, Steven A. Freeman. A Bayesian assessment of the effect of highway bypasses in Iowa on crashes and crash rate. Pages 241-252.

Introduction: A common contention is that the construction of highway bypasses negatively impacts the economy of local communities by reducing pass-by traffic for businesses. However, as access to specific business' account records is limited, this impact is difficult to quantify. Another common contention is that bypasses contribute to a reduction in overall crashes in the community and in the surrounding areas. Even though a large number of bypasses have been constructed in the State of Iowa over the past several years, their actual impact in terms of traffic safety has not been quantified. Objectives: This study seeks answers to the following questions: (a) Are bypasses in Iowa associated with a reduction in crash frequencies and crash rates on the bypassed highway? (b) Do bypasses in Iowa introduce a reduction of overall crash frequencies and rates or do they merely shift crashes from the highways through the communities to the bypasses with no significant overall reduction? Method: We obtained crash information from the Iowa DOT at 19 sites on which a bypass was constructed sometime during the past 23 years. We also obtained the same information at six sites used as comparison sites on which no bypasses were constructed at least until 2005. We then employed a Bayesian approach to estimating the association between the construction of the bypass and crash rates, while also accounting for other factors. Results: The construction of bypasses in Iowa is associated with a significant increase in traffic safety both on the main road through town and on the combined main road and bypass roadway.

- **Keywords:** highway bypass; traffic; crash; crash rate; safety

Carlo Caponecchia, Ian Sheils. *Perceptions of personal vulnerability to workplace hazards in the Australian construction industry. Pages 253-258.*

Introduction: The importance of risk perception for workplace safety has been highlighted by the inclusion of risk appraisals in contemporary models of precautionary behavior at work. Optimism bias is the tendency to think that negative events are less likely to happen to oneself than to the average person, and is proposed to be related to the reduced use of precautions. Method: Building on studies of optimism bias for workplace hazards using samples with heterogeneous risk profiles, the current study aimed to investigate whether optimism bias is present in a sample of workers exposed to similar workplace hazards. 175 Australian construction workers completed a brief survey that asked them to rate the likelihood of common construction industry hazards occurring to them and to the average worker of the same age doing the same job. Significant levels of optimism bias were found for many hazards (including being electrocuted, being trapped in a confined space, falling from heights, and causing someone else to have an injury). Results: Optimism bias was not related to perceived controllability, contrary to findings in other domains, yet consistent with findings of optimism bias for workplace hazards. Optimism bias was not found to be related to a reduction in safe work behaviors, though this may be due to difficulties in measuring safe or precautionary behavior, such as social desirability. Impact on industry: That most workers think that hazards are less likely to happen to them than to the average worker presents a significant problem because it may ameliorate the efficacy of safety programs, yet constitutes a largely unexplored opportunity for improving workplace safety performance.

- **Keywords:** Optimism bias; Risk perception; Construction industry; Invulnerability; Workplace safety; Controllability

Paul O'Connor, Samuel E. Buttrey, Angela O'Dea, Quinn Kennedy. *Identifying and addressing the limitations of safety climate surveys. Pages 259-265.*

Introduction: There are a variety of qualitative and quantitative tools for measuring safety climate. However, questionnaires are by far the most commonly used methodology. Method: This paper reports the descriptive analysis of a large sample of

safety climate survey data (n = 110,014) collected over 10 years from U.S. Naval aircrew using the Command Safety Assessment Survey (CSAS). Results: The analysis demonstrated that there was substantial non-random response bias associated with the data (the reverse worded items had a unique pattern of responses, there was an increasing tendency over time to only provide a modal response, the responses to the same item towards the beginning and end of the questionnaire did not correlate as highly as might be expected, and the faster the questionnaire was completed the higher the frequency of modal responses). It is suggested that the non-random responses bias was due to the negative effect on participant motivation of a number of factors (questionnaire design, lack of a belief in the importance of the response, participant fatigue, and questionnaire administration). Conclusions: Researchers must consider the factors that increase the likelihood of non-random measurement error in safety climate survey data and cease to rely on data that are solely collected using a long and complex questionnaire. Impact on Industry: In the absence of valid and reliable data it will not be possible for organizations to take the measures required to improve safety climate.

- **Keywords:** Safety climate; Safety culture; Survey; Questionnaire; Measurement error

Daniel R. Mayhew, Herb M. Simpson, Katherine M. Wood, Lawrence Lonero, Kathryn M. Clinton, Amanda G. Johnson. *On-road and simulated driving: Concurrent and discriminant validation*. Pages 267-275.

Introduction: A converging pair of studies investigated the validity of a simulator for measuring driving performance/skill. Study 1: A concurrent validity study compared novice driver performance during an on-road driving test with their performance on a comparable simulated driving test. Results: Results showed a reasonable degree of concordance in terms of the distribution of driving errors on-road and errors on the simulator. Moreover, there was a significant relationship between the two when driver performance was rank ordered according to errors, further establishing the relative validity of the simulator. However, specific driving errors on the two tasks were not closely related suggesting that absolute validity could not be established and that overall performance is needed to establish the level of skill. Study 2: A discriminant validity study compared driving performance on the simulator across three groups of drivers who differ in their level of experience - a group of true beginners who had no driving experience, a group of novice drivers who had completed driver education and had a learner's permit, and a group of fully licensed, experienced drivers. Results: The findings showed significant differences among the groups in the expected direction -- the various measures of driving errors showed that beginners performed worse than novice drivers and that experienced drivers had the fewest errors. Collectively, the results of the concurrent and discriminant validity studies support the use of the simulator as a valid measure of driving performance for research purposes. Impact on industry: These findings support the use of a driving simulator as a valid measure of driving performance for research purposes. Future research should continue to examine validity between on-road driving performance and performance on a driving simulator and the use of simulated driving tests in the evaluation of driver education/training programs.

- **Keywords:** Driver education; Evaluation; Driving skill; Driving simulator; Performance validation

Wen Hu, Anne T. McCartt, Eric R. Teoh. *Effects of red light camera enforcement on fatal crashes in large US cities*. Pages 277-282.

Objective: To estimate the effects of red light camera enforcement on per capita fatal crash rates at intersections with signal lights. Methods: From the 99 large U.S. cities with more than 200,000 residents in 2008, 14 cities were identified with red light camera enforcement programs for all of 2004–2008 but not at any time during 1992–1996, and

48 cities were identified without camera programs during either period. Analyses compared the citywide per capita rate of fatal red light running crashes and the citywide per capita rate of all fatal crashes at signalized intersections during the two study periods, and rate changes then were compared for cities with and without camera programs. Poisson regression was used to model crash rates as a function of red light camera enforcement, land area, and population density. Results: The average annual rate of fatal red light running crashes declined for both study groups, but the decline was larger for cities with red light camera enforcement programs than for cities without camera programs (35% vs. 14%). The average annual rate of all fatal crashes at signalized intersections decreased by 14% for cities with camera programs and increased slightly (2%) for cities without cameras. After controlling for population density and land area, the rate of fatal red light running crashes during 2004–2008 for cities with camera programs was an estimated 24% lower than what would have been expected without cameras. The rate of all fatal crashes at signalized intersections during 2004–2008 for cities with camera programs was an estimated 17% lower than what would have been expected without cameras. Conclusions: Red light camera enforcement programs were associated with a statistically significant reduction in the citywide rate of fatal red light running crashes and a smaller but still significant reduction in the rate of all fatal crashes at signalized intersections. Impact on Industry: The study adds to the large body of evidence that red light camera enforcement can prevent the most serious crashes. Communities seeking to reduce crashes at intersections should consider this evidence.

- **Keywords:** Red light cameras; Fatal crash rates; Signalized intersections; Red light running; Large cities

James C. Fell, Michael Todd, Robert B. Voas. *A national evaluation of the nighttime and passenger restriction components of graduated driver licensing.* Pages 283-290.

Introduction: The high crash rate of youthful novice drivers has been recognized for half a century. Over the last decade, graduated driver licensing (GDL) systems, which extend the period of supervised driving and limit the novice's exposure to higher-risk conditions (such as nighttime driving), have effectively reduced crash involvements of novice drivers. Method: This study used data from the Fatality Analysis Reporting System (FARS) and the implementation dates of GDL laws in a state-by-year panel study to evaluate the effectiveness of two key elements of GDL laws: nighttime restrictions and passenger limitations. Results: Nighttime restrictions were found to reduce 16- and 17-year-old driver involvements in nighttime fatal crashes by an estimated 10% and 16- and 17-year-old drinking drivers in nighttime fatal crashes by 13%. Passenger restrictions were found to reduce 16- and 17-year-old driver involvements in fatal crashes with teen passengers by an estimated 9%. Conclusions: These results confirm the effectiveness of these provisions in GDL systems. Impact on Public Health. States without the nighttime or passenger restrictions in their GDL law should strongly consider adopting them. Impact on Industry: The results of this study indicate that nighttime restrictions and passenger limitations are very important components of any GDL law.

- **Keywords:** Graduated Driver Licensing (GDL); Novice drivers; Night restrictions; Passenger limitations; Fatal crash involvements; Effectiveness

Judy A. Stevens, Elizabeth N. Haas, Tadesse Haileyesus. *Nonfatal bathroom injuries among persons aged ≥ 15 years—United States, 2008.* Pages 311-315.

Problem: Information about where nonfatal unintentional injuries occur is limited, but bathrooms commonly are believed to be a hazardous location. Methods: Data from a nationally representative sample of hospital emergency departments (ED) was used to quantify and characterize nonfatal unintentional bathroom injuries among people aged ≥

15 years. Results: In 2008, an estimated 234,094 nonfatal bathroom injuries were treated in EDs. Most injuries (81.1%) were caused by falls and 37.3% of injuries occurred when bathing, showering, or getting out of the tub or shower. Both injury and hospitalization rates increased with age. Summary: These results suggest that bathrooms tend to be most hazardous for persons in the oldest age groups. Impact on Industry: Bathroom injuries among all household members might be reduced by increasing awareness about potentially hazardous activities in the bathroom combined with simple environmental changes such as adding grab bars inside and outside the tub or shower.

- **Keywords:** Aged; Bathroom; Injury; Falls; Elderly; Older adult