

# Gregory J. Jurkovich, M.D.

- National Study on Costs and Effectiveness of Trauma Care
- Washington State Trauma Outcomes Project
- Post-Traumatic Stress Disorder in Trauma Patients
- Triage of Trauma Patients from the Field



Professor of Surgery  
Chief, Trauma Service at  
Harborview Medical Center

## FUNDING

Centers for Disease Control and Prevention

• National Center for Injury Prevention and Control

National Highway Traffic Safety Administration

National Institute of Mental Health

## National Study on Costs and Effectiveness of Trauma Care

The University of Washington and Johns Hopkins University have been collaborating on the largest extramural grant ever awarded by the National Center for Injury Prevention and Control of the Centers for Disease Control and Prevention (CDC) for the study of injury. This project, titled “The National Study on Costs and Effectiveness of Trauma Center Care,” has as its principal investigator at Johns Hopkins University Dr. Ellen MacKenzie, Professor of Health Policy, Senior Associate Dean for Academic Affairs in the School of Public Health, and Director of the Johns Hopkins Center for Injury Research. The Principal Investigators at the University of Washington are Dr. Gregory J. Jurkovich, Professor of Surgery, Chief of Trauma at Harborview, and Director of the Acute Care Section of the Harborview Injury Prevention and Research Center (HIPRC) and Dr. Fred Rivara, George Atkins Professor of Pediatrics and past Director of the Harborview Injury Prevention and Research Center.

The purpose of this \$4.8 million, direct-cost grant is to examine variations in trauma care, and outcomes from trauma care, in designated trauma centers compared to non-trauma centers across the United States. Specific outcomes to be addressed include mortality, morbidity, functional outcome, and quality of life status. Estimates of costs associated with care will also be conducted at Level I Trauma Centers, Level II Trauma Centers, and non-trauma centers.

The specific aims of this research project are to:

- Examine variations in trauma care between trauma centers and non-trauma centers;
- Examine the relationship between treatment received and mortality, complications, and functional outcome;
- Estimate the costs of care at trauma centers vs. non-trauma centers; and
- Describe the relationship between cost and effectiveness of care.

The products from this study have been remarkable. Just a few of them are:

- Determination of for which types of patients and kinds of injuries trauma center care has better outcomes than care in non-trauma centers.
- The most complete data available on the cost of trauma and payor mix, and how these vary by type of hospital.
- Relationship between cost of trauma care and outcome.
- Recommendations for the best measures to be used for examining functional outcome of trauma.
- Determination of the types of hospital resources which make the most significant impact on outcome from trauma.
- Determination of the types of pre-hospital resources which make the most significant impact on outcome from trauma.
- Relationship between volume of trauma care and outcome for a wide variety of injury problems.

---

*We have demonstrated a 20% reduction in in-patient deaths at trauma centers vs. non-trauma centers (7.6% vs. 9.5%) and a 25% one-year death rate reduction (10.4% vs. 13.8%). The life-saving beneficial effects of trauma center care are most evident in the younger (age < 55) and more severely injured patients (AIS 4-5)—these patients have nearly a 50% survival advantage if treatment is rendered in a trauma center.*

---

- Determination of how transfer status affects outcome.
- Understanding of how trauma systems interact with trauma center status of hospitals to influence outcomes.

The major publication is in the *New England Journal of Medicine* (MacKenzie et al., 2006), focusing on the mortality advantage seen in trauma centers compared to non-trauma centers. We used propensity-score weighting to adjust for observable differences between patients treated at trauma centers and those treated at hospitals without a trauma center. We have demonstrated a 20% reduction in in-patient deaths at trauma centers vs. non-trauma centers (7.6% vs. 9.5%) and a 25% one-year death rate reduction (10.4% vs. 13.8%). The life-saving beneficial effects of trauma center care are most evident in the younger (age < 55), more severely injured patients (AIS 4-5), with a relative risk of death within 30 days of injury between 0.67 and 0.78 (CI <1.0). Vexing questions remain on why this dramatic beneficial effect is not seen in the elderly, and will be the focus of further studies. Ongoing evaluation of this data set has determined that the best functional outcomes for lower extremity fractures are also obtained in Level I trauma centers. Disappointingly, we have been unable to show any variation in the functional outcome following head injury based on type of acute care provided. Cost effectiveness evaluation is ongoing.

### Washington State Trauma Outcomes Project

Washington State now has a trauma system that has been in place for over eight years. Previous studies (see Nathens et al.) have suggested that it takes about this length of time for a trauma system to mature and to show benefits in life-saving effects of trauma center care. Central Region (conforming geographically to King County) is one of eight

designated trauma and emergency medical regions in the state, and has been collecting trauma registry data for the past eight years.

Each of the eight emergency medical services (EMS) regions within the state has a quality assurance program, and the overall direction of quality assurance activities within the state trauma system is coordinated via the Outcomes Technical Advisory Committee (Outcomes TAC) of the Governor-appointed Trauma and EMS Steering Committee. Dr. Jurkovich is Chair of the Outcomes TAC. This committee, along with personnel from the Harborview Injury Prevention Center and the State Department of EMS and Trauma Care, is analyzing the data in an effort to address a variety of trauma system issues that remain largely unanswered in today's trauma systems. These include such questions as, "How long is too long in the pre-hospital phase of care?"; "How many patients and of what severity are essential to maintain skills and good outcome?"; and "When should you bypass the closest, lowest level trauma center for the highest level trauma center?"

Ongoing or recently completed data analysis includes the outcomes of elderly patients with hip fractures in Central Region trauma and non-trauma hospitals, the distribution of the most severely injured patients (ISS > 15) within the regional trauma centers, Airlift Northwest landing zone delays by site location, the outcome on non-operated splenic injuries, and an assessment of preventable mortality in the region. A comparison of Central Region trauma patient outcomes to a national reference, the Major Trauma Outcome Study, reveals a significantly lower mortality for both adult blunt and penetrating trauma patients treated in the Central Region compared to this national norm.

## Post-Traumatic Stress Disorder in Trauma Patients

A valued addition to the Department of Psychiatry at Harborview Medical Center is Dr. Doug Zatzick. He has a special interest in post-traumatic stress disorder (PTSD) in trauma patients, and is responsible for initiating cooperative studies among the Departments of Surgery, Pediatrics, and Psychiatry on the assessment and treatment of PTSD in trauma patients. PTSD occurs in 20–40% of patients over the course of the year after physical injury. Youth admitted to the hospital for physical injury are at increased risk for recurrent traumatic life events; identifiable risk factors appear to be assault injury and history of injury prior to inpatient admission. Further, in a study comparing PTSD at Harborview and the University of California Sacramento, 58% of 269 randomly selected injury survivors who were screened for PTSD, depressive, and peritraumatic dissociative symptoms demonstrated high levels of immediate post-traumatic distress and/or alcohol abuse/dependence. Regression analyses identified greater prior trauma, non-white ethnicity, and site as significant independent predictors of high levels of post-traumatic distress. Early mental health screening and intervention procedures that target both PTSD and alcohol use should be developed for acute care settings.

Studies conducted at Harborview have also demonstrated that injured adolescents represent a high-risk pediatric population, with almost 40% reporting no source of primary care, 30% showing signs of PTSD, 11% with high depression symptom levels, and 17% with problem alcohol use. The burden of these largely unrecognized and untreated medical psychiatric issues is likely to include significant recidivism.

A growing body of clinical trials research suggests that PTSD may be efficaciously treated with psychotherapeutic and psychopharmacological interventions. Also, there is now evidence that pediatricians can successfully detect and intervene with youth and their families who are suffering from psychosocial disturbances. An additional aim of the investigation is to elucidate the clinical, family and community infrastructures available to support the

implementation of psychosocial interventions for injured youth with PTSD. The overarching goal of the proposed investigation is to provide preliminary data that will inform the development of a larger scale R01-funded randomized intervention trial targeting PTSD and post-traumatic functional impairment among injured adolescents.

In a remarkable blend of basic molecular science and clinical care, some researchers are beginning to investigate the gene expression signatures on peripheral blood cells (monocytes). Preliminary work suggests that such genetic expression is distinct and recognizable and predictive of those who go on to develop PTSD and those who do not (Shefi et al., *Molecular Psychiatry* 2005).

## Triage of Trauma Patients from the Field

Dr. Jurkovich has been the Chair of a task force charged with developing national trauma triage guidelines. With support from the CDC and National Highway Traffic Safety Administration (NHTSA), a diverse working group of health care providers from emergency medicine, pre-hospital care, surgical care, and bioengineering has developed, disseminated and implemented national guidelines for the triage of injured patients from the field. This working group has revised the “Field Triage Document” as published by the American College of Surgeons Committee on Trauma Resource Document of Care of the Injured Patient. The CDC has taken the lead with wide dissemination of these guidelines, and the development of a “tool kit” for implementing these guidelines in trauma system design across the country. A summary article in the *Morbidity and Mortality Weekly Report* explains in detail the rationale behind the guidelines.

This working group has now expanded their scope of activities to include developing the methodology and science behind utilizing crash data from the “black box recorders” on newer model automobiles to predict injury severity and telemedicine transfer of this data directly from the scene to care providers.

## RELATED PUBLICATIONS

1. Nathens AB, Jurkovich GJ, MacKenzie EJ, Rivara FP. A resource-based assessment of trauma care in the United States. *J Trauma* 56:173-178, 2004.
2. Zatzick D, Jurkovich GJ, Russo J, Roy-Byrne P, Katon W, Wagner A, Dunn C, Wisner D, Grossman D, Rivara F. Posttraumatic distress, substance intoxication, and recurrent trauma across Level 1 trauma center sites. *J Trauma* 57:360-366, 2004.
3. Zatzick DF, Roy-Byrne P, Russo J, Rivara FP, Droesch R, Wagner A, Dunn C, Jurkovich GJ, Uehara E, Katon W. A randomized effectiveness trial of stepped collaborative care for acutely injured trauma survivors. *Arch Gen Psychiatry* 61:498-506, 2004.
4. Zatzick DF, Russo J, Rivara FP, Jurkovich GJ, Roy-Byrne P, Katon W. The detection and treatment of patients with posttraumatic distress and substance intoxication in the acute care medical setting. *Gen Hosp Psychiatry* 27:57-62, 2005.
5. Zatzick DF, Russo J, Grossman DC, Jurkovich GJ, Sabin J, Berliner L, Rivara F. Posttraumatic stress and depressive symptoms, alcohol use, and recurrent traumatic life events in a representative sample of injured adolescents and their parents. *J Pediatr Psychol* 31:377-387, 2006.
6. Utter GH, Maier RV, Rivara FP, Mock CN, Jurkovich GJ, Nathens AB. Inclusive trauma systems: Do they improve triage or outcomes of the severely injured? *J Trauma* 60:529-537, 2006.
7. MacKenzie EJ, Rivara FP, Jurkovich GJ, Nathens AB, Frey KP, Egelston BL, Salkever DS, Scharfstein DO. A national evaluation of the effect of trauma center care on mortality. *N Eng J Med* 354:366-378, 2006.
8. Hunt RC, Jurkovich GJ. Field triage: Opportunities to save lives. *Prehosp Emerg Care* 10:282-283, 2006.
9. Sasser S, Hunt RC, Sullivent EE, Wald MM, Mitchko J, Jurkovich GJ, Henry MC, Salomone JP, Wang SC, Galli RL, Cooper A, Brown LH, Sattin RW. Guidelines for field triage of the injured patient. *MMWR Recomm Rep* 23:1-35, 2009.
10. Haas B, Jurkovich GJ, Wang J, Rivara FP, MacKenzie EJ, Nathens AB: The survival advantage in trauma centers: expeditious intervention or experience? *J Am Coll Surg* 208:28-36, 2009.
11. Cooper Z, Rivara FP, Wang J, Mackenzie EJ, Jurkovich GJ: Withdrawal of life sustaining therapy in injured patients: Variations between trauma centers and non-trauma centers. *J Trauma* 66:1327-1336, 2009.
12. Davydow DS, Zatzick DF, Rivara FP, Jurkovich GJ, Wang J, Roy-Byrne PP, Katon WJ, Hough CL, Kross EK, Fan MY, Joesch J, MacKenzie EJ. Predictors of posttraumatic stress disorder and return to usual major activity in traumatically injured intensive care unit survivors. *Gen Hosp Psychiatry* 31:428-435, 2009.
13. Sasser S, Hunt RC, Sullivent EE, Wald MM, Mitchko J, Jurkovich GJ, Henry MC, Salomone JP, Wang SC, Galli RL, Cooper A, Brown LH, Sattin RW. Guidelines for field triage of the injured patients. Recommendations of the national expert panel on field triage. *JEMS* 34:S1-39, 2009.
14. Shafiq T, Rivara FP, Wang J, Jurkovich GJ. Screening of adolescent patients admitted to the trauma service for high-risk behaviors: Who is responsible? *J Trauma* 67:1288-1292, 2009.
15. Ang D, Rivara FP, Nathens A, Jurkovich GJ, Maier R, Wang J, MacKenzie EJ: Complication rates among trauma centers. *J Am Coll Surg* 209: 595-602, 2009.
16. Weir S, Salkever DS, Rivara FP, Jurkovich GJ, Nathens AB, Mackenzie EJ: One year treatment costs of trauma care in the USA. *Expert Rev Pharmacoecon Outcomes Res* 10:187-197, 2010.
17. Mackenzie EJ, Weir S, Rivara FP, Jurkovich GJ, Nathens AB, Wang W, Scharfstein DO, Salkever DS. The value of trauma center care. *J Trauma* 69:1-10, 2010.

## DEPARTMENT CO-INVESTIGATORS

Eileen Bulger, M.D. / Lisa McIntyre, M.D. / Other Co-Investigators / Ellen MacKenzie, Ph.D.; Johns Hopkins University / Avery Nathens, M.D.; University of Toronto / Frederick Rivara, M.D., M.P.H.; UW Department of Pediatrics / Doug Zatzick, M.D.; UW Department of Psychiatry / Richard Hunt, M.D.; CDC-Injury Control Center