Research Recommendations and Proposed Action Items to Facilitate Trauma System Implementation and Evaluation

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The contemporary movement to ensure that health care delivery systems and rendered services be evidence-based suggests that research evaluating trauma system efficacy should be held to a new standard. In 1998, nationally recognized leaders in trauma system care gathered at the Academic Symposium to Evaluate Evidence Regarding the Effectiveness of Trauma Systems in Skamania, Washington. A primary purpose of this academic meeting was to devise research recommendations that, if adopted, would provide substantial and appropriate evidence of trauma system performance. In addition, "action items" were constituted which intend to facilitate a focused effort among federal agencies, professional organizations, and private foundations in forwarding the evaluation, prevention, and treatment of injury in America. This document contains the conclusions reached by this multidisciplinary group of experts. The intent of this document is to garner support for a focused effort to enhance the quality and depth of understanding regarding the treatment of injury.

Improving the quality of health care that is offered traumatically injured patients requires that delivery systems and rendered services be validated by sound research evidence. This approach ensures that well-intended practices do not result in inappropriate care. The notion of trauma systems is founded on sensible premises. Much of the published information regarding trauma system structure is founded in these suppositions. Several examples include:

1. Injury outcomes will improve by facilitating and coordinating a multidisciplinary system response to injured patients from time of injury through the provision of definitive care.¹
2. Injury outcomes will improve by instituting protocols designed to ensure the timely transfer of injured patients to facilities certified to contain the appropriate services, expertise, and resources needed to treat that patient's specific injuries.²
3. Injury outcomes will improve by concentrating expertise, resources, training, and experience in designated centers.³

Although these suppositions are completely rational, all became guiding principles of trauma systems development based on practical experience rather than robust research findings.⁴ Many good studies have since been conducted to validate the benefit to patient outcomes associated with trauma systems or trauma system components. In the current health care environment, however, the efficacy of medical practices and policies are held to a higher standard of evidence than in the past.

In July of 1998, a symposium was held in Skamania, Washington to review the current published literature regarding the effect of trauma centers and systems upon patient outcomes. On the basis of this information, 92 health care professionals with trauma system experience devised a list of research recommendations and "action items" that would elevate the current level of available...
evidence assessing trauma system effectiveness. Contributors included a multidisciplinary collection of trauma surgeons, emergency physicians, trauma system administrators, research scientists, emergency medical services administrators, and representatives from two federal agencies (i.e., CDC and NHTSA).

The purpose for the development of the research recommendations contained in this document is to stimulate thought regarding how to strengthen the evidence resulting from research evaluating the benefits of trauma system implementation. In an effort to facilitate this new level of scientific inquiry, action items are also included that attempt to provide resources allowing definitive conclusions to be drawn regarding the optimal processes of care that maximize the recovery of injured Americans. The realization of these additional resources would also facilitate the formulation of a national injury surveillance system, allowing investigators to identify specific regions with excess injury rates and assess the standard of injury care in varying regions of the country.

METHODS

Development of Research Recommendations

Prior to the symposium, registered participants were divided into six small groups (approximately 17 people per group). A predetermined group facilitator and scribe were assigned to each group. At the symposium, small group sessions were held after each of three evidence table presentations. During each of the three small group sessions, group facilitators were instructed to lead discussions regarding novel research methods that could be used to assess trauma system effectiveness. During the first session, small groups were asked to identify outcome measures that would advance our understanding of trauma system performance. Resulting discussions were transcribed, reviewed, tallied, and the six most frequently mentioned outcome measures were retained for further refinement.

During the second small group session, participants were asked to develop appropriate and robust research designs and sampling schemes for each of the six identified outcome measures. During the final session, participants identified statistical models or analytical techniques appropriate for each outcome measure, taking into consideration the chosen research design and sampling frame. The resulting six research outlines were randomized and included on the closing session survey. Participants were then asked to rank each research outline according to the following: "When considering future endeavors to assess trauma system effectiveness, please rank the relative importance of each research outline (1 to 6 [1 = 'most important'])."

Development of Action Items

Prior to the symposium, enrollees were asked to submit "research, legislative, or system recommendations (i.e., action items) that would enhance our ability to plan, implement, manage, or evaluate trauma systems based on definitive scientific evidence." Submitted action items were edited, combined (if appropriate), and prepared for consideration during the small group sessions. During the first session, participants were asked to identify one of the prepared action items (or develop a new item) to be considered by the group. During the second and third group sessions, participants discussed and refined the language associated with the action item.

After each of the small group sessions, drafted action items were aggregated and distributed to all participants during plenary sessions. This process ensured that each group was aware of
complementary or competing efforts in other groups. Because of the complexity of the issues being considered, participants voluntarily organized two ancillary sessions to debate refinements to the drafted action items. During the closing session, each proposed action item was presented to the assembly and comments or revisions were entertained. Following commentary from the floor, the mediator called for an assembly vote. An action item was adopted if a "substantial majority" approved the item.

RESULTS

Research Recommendations

Listed below are the six research outlines developed during the small group sessions, ranked in descending order of importance (rank #1 = most important). These research outlines represent the combined thought and vision of symposium participants regarding the future direction and quality of investigation needed to ensure that trauma system performance is evaluated based on substantial and appropriate evidence.

Rank #1

Outcome Variable:

Functional Status/Quality of Life.

Study Design and Sample:

A controlled prospective (or retrospective cohort) study utilizing patients appropriate to the research question. Data may be captured by following cases longitudinally (telephone or return visit) or by linking existing data (e.g., rehabilitation data). Prospective evaluations should include long-term follow-up data necessary to address the research question.

Analytical Technique:

Multivariate modeling.

Rank #2

Outcome Variable:

Death.

Study Design and Sample:

A controlled prospective or retrospective design using injury type (or severity) appropriate for the research question. Data collection window should be broad enough to capture deaths in an appropriate spectrum of locations (e.g., prehospital, emergency department, in-hospital, follow-up). Retrospective analyses utilizing existing linked databases should limit follow-up to 30 to 60 days.

Analytical Technique:
Multivariate logistic/log-linear modeling or appropriate survival models (e.g., proportional hazards model).

*Rank #3*

*Outcome Variable:*

Death Incidence Rates.

*Study Design and Sample:*

An assessment of a specific injury or cause of death that accounts for the overall population, ensuring that "true" incidence or prevalence rates can be calculated. The sample would include patients across the appropriate spectrum of care and should include a standard population for comparison.

*Analytical Technique:*

Rate ratio or incidence density ratio.

*Rank #4*

*Outcome Variable:*

Bench Marking.

*Study Design:*

An assessment of trauma system compliance with available evidence-based guidelines or established standards across the continuum of care. Examples would include compliance with emergency medical services response time standards, or adherence to severe head injury management guidelines.  

*Analytical Technique:*

May involve quantitative or qualitative data analyses.

*Rank #5*

*Outcome Variable:*

Process of Care.

*Study Design and Sample:*

Comparative (controlled) evaluations of system accessibility, transport practices, resource utilization, and patient satisfaction within the same system (i.e., temporal analysis) or across matched systems. The sample would include all patients across the spectrum of care appropriate for the research question.
Analytical Technique:
Multivariate modeling.

Rank #6

Outcome Variable:
Cost.

Study Design and Sample:
A cohort (or case-control) analysis of the cost of care rendered to seriously injured patients within a trauma system matched to similar patients outside of a trauma system. Sample would include injured patients appropriate to the research question with costs assessed across the continuum of care (e.g., prehospital, emergency department, in-hospital, follow-up).

Analytical Technique:
Cost per injury, cost/value, cost per quality-adjusted life year gained.

Approved Action Items

Listed below are 11 action items developed and endorsed by participants at the Academic Symposium to Evaluate Evidence Regarding the Effectiveness of Trauma Systems. These items represent the collaborative efforts of a multidisciplinary group of experts dedicated to enhancing the quality of research methods used to assess trauma system effectiveness. Each health care discipline endorsed these recommendations based on perceived long-term benefits to the clientele (i.e., patients) they serve. Participants recognized that these recommendations should impact the quality of research conducted in clinical, health services, and prevention settings. Thus, these action items endorse efforts to establish valid and generalizable research methods across the continuum of care. In addition, these recommendations itemize accomplishable goals that would heighten public awareness regarding the burden of injury, enhance governmental efforts to support consistent, high-quality trauma care, and subscribe to a multidisciplinary approach when developing future strategic plans for trauma care and injury control. The following action items are categorized as (1) research priorities; (2) legislative/regulatory priorities; and (3) system component priorities. Action items under each priority appear in random order.

Research Priorities

Recommendation #1.
Research is needed to define, develop, test, and implement new tools (or utilize existing tools in other academic fields) to measure risk-adjusted mortality, functional outcomes, financial outcomes, and patient satisfaction for use in trauma system research.

Recommendation #2.
Research is needed to evaluate the cost-effectiveness (e.g., cost per quality-adjusted life year gained)
of trauma systems. These studies should include all components of a trauma system, such as prevention, prehospital care, hospital care, and rehabilitation.

**Recommendation #3.**

Congress should establish a "National Institute of Injury" within the National Institutes of Health to support research funding for trauma, burns, and related critical care.

**Recommendation #4.**

Research is needed to examine organizational, medical, economic, political, and community characteristics that facilitate or impede the development and maintenance of trauma systems.

**Legislative/Regulatory Priorities**

**Recommendation #5.**

Federal agencies and national organizations should support/improve public awareness of injury as a major health problem.

**Recommendation #6.**

The National Center of Health Statistics should combine all injury deaths into one category.

**Recommendation #7.**

The Centers for Disease Control and Prevention and the Council for State and Territorial Epidemiologists should include additional index injuries to the list of reportable conditions.

**Recommendation #8.**

Federal support of state trauma system planning and development should be reinstituted to reinvigorate the implementation of trauma systems. A national organization, through a multidisciplinary process, should assume responsibility and cost for a periodic survey of the status of trauma systems in each state or appropriate sub-state region. As a requirement for this support, states should document their actions or plans to optimize the deployment of trauma care resources, including, but not limited to, designating the appropriate number of trauma centers based on a nonpartisan needs assessment. In addition, a mechanism for evaluating community needs and endorsement of trauma care delivery should be a mandatory component of trauma systems. This process would include community problem identification, addressing injury prevention and treatment needs, rehabilitation, and interfacing with community interest groups and public agencies.

**Recommendation #9.**

Using a national consensus process involving a spectrum of national organizations and communities interested in trauma care and prevention, construct a "Trauma Systems for the Future" document including current status, a future vision, and an implementation strategy based on valid and reliable data.
(At the time of publication, The National Highway Traffic Safety Administration (NHTSA), together with the Centers for Disease Control (CDC) and The Maternal and Child Health Bureau (MCHB), had sponsored the development of a multidisciplinary steering committee to guide the development of a consensus national vision for the future of trauma systems on the basis of this recommendation.)

**System Component Priorities**

**Recommendation #10.**

Establish and maintain a statistically useful national trauma data system for reference. Data items should include the prehospital, hospital, and rehabilitation data needed for ongoing evaluation of prevention activities and trauma care outcomes. These data items should be an integral part of the patient care record. Uniform data elements should be developed and a set of data points implemented.

**Recommendation #11.**

Appropriate medical and nursing professional associations should work with health data standards organizations and federal agencies to develop, evaluate, disseminate, and maintain a national uniform data set for hospital inpatient trauma care. The uniform inpatient trauma record generated using this data set must first and foremost serve the needs of direct patient care, but it must also provide data needed for ongoing evaluation of trauma care at the hospital and trauma system levels.

**COMMENT**

Participants in the 1998 Academic Symposium to Evaluate Evidence Regarding the Effectiveness of Trauma Systems recognize that concerted effort will be required to gain the endorsement of the enclosed research recommendations and actions items by academic, governmental, and private research communities dedicated to injury prevention and treatment. For this reason, participants invite all federal agencies, professional organizations and private foundations to consider this document, endorse it, and support efforts focused on these issues.

**REFERENCES**


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