

Abstract:

Trauma systems facilitate efficient triage, distribution, and treatment of patients requiring acute trauma care by connecting prehospital providers, trauma centers, other hospitals, rehabilitation facilities, and follow-up care providers. We examined the impact of trauma systems on disaster preparedness and determined which features of trauma systems enable improved response to disasters. Twenty-two articles were analyzed, including reports of various trauma systems' previous disaster response, comparisons of preparedness in areas with trauma systems to those without, and examinations of the role of trauma systems in preparing for and responding to disasters. Four aspects of trauma systems emerged as being valuable for disaster preparedness and response: communication, triage, transport, and training. These elements help trauma systems achieve timely and appropriate distribution and care of disaster victims. This review demonstrates the importance of establishing a network of care that enables trauma systems to effectively prepare for and respond to disasters.

Keywords:

trauma center; disasters; disaster medicine; hospitals; mass casualty incident; network; pediatrics

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The Impact of Trauma Systems on Disaster Preparedness: A Systematic Review

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Natural and manmade disasters may result in large numbers of mass casualties requiring urgent medical care. Numerous studies have demonstrated that critically injured victims receive better care if treated at trauma centers, which are organized and prepared to respond to injuries on a daily basis.¹⁻³ However, in the event of a large-scale disaster, it is unlikely that a single trauma center will be able to manage the large influx of mass casualties alone, particularly large numbers of pediatric patients who require specialized equipment and care.^{4,5} Many trauma centers are positioned within statewide or regional trauma systems, which exist to facilitate efficient distribution of and optimal care for patients requiring acute trauma care. By connecting prehospital providers, trauma centers, other hospitals, rehabilitation facilities, and follow-up care providers, trauma systems are designed to enhance the

health care and wellness of their respective communities, regions, and states.

Given their fundamental role in distributing and providing care to critically injured individuals, trauma systems could provide a foundation for the United States' disaster preparedness infrastructure. In recent years, with the devastating impact of mass casualty incidents (MCIs), such as September 11, 2001, Hurricane Sandy, and the Boston Marathon bombings, the importance of a coordinated response to provide efficient and timely health care to disaster victims has come to light. In response, the Health Resources and Services Administration and National Highway Traffic Safety Administration (NHTSA) have repeatedly emphasized that trauma systems should form the basis for disaster preparedness.⁶

A growing body of literature has examined the role of trauma systems in responding to disasters and facilitating disaster preparedness. Some investigators have analyzed the past response of a trauma system to an isolated incident as a means of understanding how trauma systems enhance preparedness and response. Others have compared how disaster preparedness differs depending on trauma system coverage. Still, others have qualitatively assessed and described the roles of trauma systems in preparedness and response to MCIs.

In this study, we synthesized the body of literature regarding the impact of US trauma systems on disaster preparedness. The objective of this systematic review is to determine the importance of trauma systems in disaster preparedness and to define what particular aspects of trauma systems facilitate enhanced response to disasters and MCIs. Because trauma systems are poised and organized to respond to injuries on an everyday basis, we predict that they enable improved response to large-scale incidents and disasters. Findings of the present review will inform the development of improved trauma systems and provide rationale for the expansion of current trauma systems coverage.

METHODS

We designed a systematic review of studies and articles evaluating the impact of trauma systems on disaster preparedness. This review was designed on the basis of recommendations from the Cochrane Handbook for Systematic Reviews Version 5.0.2⁷ and was conducted in compliance with the PRISMA Statement (www.prisma-statement.org).

Study Eligibility

Published, peer-reviewed articles examining the impact of trauma systems on disaster preparedness

were eligible for inclusion in the review. Eligible articles were originally published in English and examined trauma systems within the United States. Trauma systems were considered to include both trauma centers verified by the American College of Surgeons (ACS) and those designated according to another state or regional system. In addition, preparedness was required to be discussed on an institutional level for any type of MCI or disaster.

Three types of articles were considered eligible for inclusion: (1) evaluations of disaster preparedness through assessment of a trauma system's response to a prior disaster or MCI, (2) assessments of disaster preparedness in region(s) with trauma system coverage versus region(s) without trauma system coverage, and (3) qualitative examinations and/or reviews of the role of trauma systems in disaster preparedness.

Search Strategy

To identify relevant studies, PubMed, Web of Science, the Cochrane Library of Systematic Reviews, the Cumulative Index of Nursing and Allied Health (CINAHL) database, the Turning Research Into Practice (TRIP) Database, and Google Scholar were searched from inception to May 2014. The search protocol was iterative and developed in consultation with a medical librarian. The strategy used combinations of keywords, medical subject headings, and Boolean operators, depending on the controlled text options for each database. The following keywords and medical subject headings were used in the search strategy: *disaster, mass casualty, multicasualty, mass casualty incident, disaster planning, public health preparedness, preparedness, readiness, surge capacity, trauma system, trauma center, and regional medical program* (Appendix Tables A1 and A2). Appropriate wildcards were used in all searches to account for plurals in search terms.

Study Selection

After the searches above were completed, duplicates were sorted and excluded using EndNote software version X5.0.1 (Thomson Reuters, 2011). Additional articles were identified by reviewing the bibliographies of selected articles. The most recent electronic search and manual searches were completed in May 2014.

Articles were considered for inclusion in 3 stages of review. First, titles were reviewed to exclude irrelevant articles that did not meet the eligibility criteria delineated above. By default, articles whose subjects could not be deciphered on the basis of title review alone were considered eligible during this stage. Second, abstracts of the remaining articles were reviewed for eligibility. One researcher

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