



Academic-community partnerships improve outcomes in pediatric trauma care ☆☆☆



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ABSTRACT

Background: To address the specialized needs of injured children, pediatric trauma centers (PTCs) were established at many large, academic hospitals. This study explores clinical outcomes observed for injured children treated at an academic-sponsored community facility.

Methods: In partnership with an academic medical center in a major metropolitan area, a not-for-profit community hospital became a designated Level II PTC in October 2010. Data for injured children <15 years old treated prior to PTC designation from January 2000 to September 2010 were prospectively collected using the Trauma and Emergency Medicine Information System and compared to data collected after PTC designation from January 2011 to December 2013.

Results: Overall, 681 injured children were treated at the community hospital from January 2011 to December 2013. Children treated after PTC designation were less likely to undergo computed tomography (CT) (50.9% vs. 81.3%, $p < 0.01$), even when controlling for age, gender, injury type, injury severity, and year (OR 0.18, 95%CI 0.08–0.37). Specifically, fewer head (45.7% vs. 68.7%, $p < 0.01$) and abdominal CTs (13.2% vs. 26.5%, $p < 0.01$) were performed. Hospital length of stay was significantly shorter (2.8 ± 3.7 days vs. 3.7 ± 5.9 days, $p < 0.01$). Mortality was low overall, but also decreased after PTC designation (0.4% vs. 2.0%, $p = 0.02$).

Conclusions: These results indicate that academic-community partnerships in pediatric trauma care are a feasible alternative and may lead to improved outcomes for injured children.

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The delivery of high quality, timely trauma care for acutely injured children is paramount. Consequently, pediatric trauma centers (PTCs) have been established to address the specialized needs of injured children. Receiving care at a PTC is associated with lower mortality rates, successful nonoperative management of blunt injury and improved functional recovery [1–5]. However, the vast majority of

injured children do not receive care at a PTC, with up to 90% receiving care at a non-children's hospital [6,7]. This is primarily due to limited distribution of specialized care and lack of pediatric surgeons and specialists in a given region [2,8].

As pediatric trauma resource distribution varies widely, many question whether trauma centers with additional qualifications for children may be just as effective as free standing PTCs. For example, injured children treated at an adult hospital with a pediatric trauma unit may have similarly improved outcomes compared to those treated at a free-standing PTC [9–11]. Thus, broader definitions of alternative pediatric-specific trauma systems could bridge disparities in pediatric trauma care delivery in the United States.

Grown from a local desire for increased access to pediatric trauma care followed by public policy endorsement, a not-for-profit, community hospital and adult trauma center became a Level II PTC for a region of Los Angeles County with a population of 1.8 million. Historically, injured children in the area accessed pediatric trauma care at the regional level. After PTC designation, injured children immediately had access to specialty care at the local level. This study describes the unique

Abbreviations: PTC, pediatric trauma center; ISS, Injury Severity Score; TEMIS, Trauma and Emergency Medicine Information System; CT, computed tomography; LOS, length of stay.

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partnership between an academic medical center and community hospital and explores the improved clinical outcomes observed after PTC designation.

1. Methods

1.1. Data source

A retrospective cohort study was performed after obtaining IRB approvals from the University of California, Los Angeles and Northridge Hospital Medical Center. Data were obtained from the Trauma and Emergency Medicine Information System (TEMIS) utilized by the Northridge Hospital trauma department and other Los Angeles County trauma centers to prospectively record injury specific data points for each activated trauma treated. This dataset includes emergency medical system pre-hospital information as well as demographic, injury specific and clinical information for each injured person and activated trauma treated in the emergency department. In order for a patient's clinical information to be collected in TEMIS, they must have at least one *International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM)* injury diagnostic code within the range of 800–959.9. Exclusions include all diagnostic codes within the following ranges, unless an additional injury that meets criteria exists: 905–909.9 (late effects of injury), 910–924.9 (superficial injuries/insect bites), 930–939.9 (foreign bodies). V-codes for patients involved in trauma but without injury were not included.

1.2. PTC designation

PTC designation occurred after establishing a working partnership between Northridge Hospital Medical Center and Mattel Children's Hospital at UCLA. Northridge Hospital is a not-for-profit community hospital and Level II adult trauma center serving a potential catchment area of approximately 500,000 children. Mattel Children's Hospital at UCLA is a tertiary-quaternary care, pediatric academic medical center and Level I PTC serving the greater Los Angeles area. Level I and Level II PTC designations are defined according to California and Los Angeles County Department of Health Services [12]. Prior to Level II PTC designation, injured children treated at Northridge Hospital were cared for by adult trauma surgeons entirely or subsequently transferred to regional PTCs, with potential delay in definitive treatment. Due to a local, high-profile infant death after a motor vehicle collision requiring transport to a regional PTC, legislation to assist funding a new PTC to serve the area was introduced in 2005 by a bill sponsored for general trauma care needs. Northridge Hospital was the only active adult trauma center of several in the area that also had pediatric intensive care unit capabilities and pediatric services infrastructure.

Table 1 outlines the Los Angeles County requirements for Level II PTC designation. At Northridge Hospital, the pediatric trauma program medical director was a pediatric surgeon with dual appointments at Mattel Children's Hospital and Northridge Hospital, along with five other pediatric surgeons. The trauma nurse coordinator already employed for the adult trauma service functioned as the pediatric trauma nurse coordinator. The pediatric trauma director and coordinator provide for the implementation of the trauma level requirements and coordinate with the local county emergency medical system agency. The pediatric trauma team is a multidisciplinary group of immediate responders responsible for the initial resuscitation and management of the pediatric trauma patient. Back up call schedules for the pediatric and adult trauma surgeons are activated when needed for operative cases. For sub-specialty services requiring transfer outside of Northridge Hospital, contracts were made with UCLA some pediatric surgical and medical specialty services who took part in a call pool sharing coverage of Northridge Hospital and Mattel Children's Hospital at UCLA.

Table 1

Northridge Hospital Medical Center responders to pediatric trauma activation and level II PTC designation requirements.

Pediatric Trauma Response Team:	Pediatric Surgeon and Adult Trauma Surgeon Pediatric Intensivist, Anesthesiologist Emergency Medicine Physician Pediatric Critical Care Nurse, Emergency Trauma Nurses x 2 Operating Room Charge Nurse, Emergency Technician, Respiratory Therapist, Blood Bank Technician, Radiology Technologist
PTC Designation Requirements:	
Pediatric Trauma Program Medical Director	Board-certified surgeon with experience in pediatric trauma care
Pediatric Trauma Nurse Coordinator	Registered nurse with qualification and may also be the trauma nurse coordinator/manager for an adult trauma service
Pediatric Specialty Departments and Services	Surgical: Neurologic, obstetric/gynecologic**, ophthalmologic, oral or maxillofacial or head and neck, orthopedic, plastic, urologic, microsurgery/reimplantation** Non-Surgical: Anesthesiology, cardiology, critical care, emergency medicine, gastroenterology, general pediatrics, hematology/oncology, infectious disease, neonatology, nephrology, neurology, pathology, psychiatry, pulmonology, radiology, rehabilitation/physical medicine**, adolescent medicine**, child development**, genetics**, neuroradiology**, psychiatry**, allergy/immunology**, dentistry**, endocrinology** Facility capabilities: PICU, Pediatric service, ER, Operating room, Burn center**, Physical therapy, Rehabilitation**, Clinical lab and blood bank, Acute hemodialysis, Respiratory therapy, Occupational therapy, Speech therapy, Social service, Acute spinal cord management, Potential organ donor protocol, Community outreach program, Continuing education program, SCAN (suspect child abuse and neglect) team, Aeromedical transport plan, Child life program
Pediatric Emergency Response	Available with qualified pediatric surgical and nonsurgical specialists in-house, immediately available, and/or promptly available on-call as directed.

** May be provided through a written transfer agreement with a hospital that has a department, division, service, or section that provides this service.

1.3. Study cohort

Northridge Hospital became a designated Level II PTC on October 4, 2010. Demographic, clinical and injury specific data points for each injured child <15 years old treated from January 2000–September 2010 were retrospectively collected (pre-PTC) and compared to prospective data collected from January 2011 to December 2013 (post-PTC). One patient who was initially admitted as an activated trauma in the post-PTC group ultimately did not have an *ICD-9-CM* injury code that qualified for inclusion in the TEMIS dataset and therefore was excluded from this analysis. Patient age, injury severity score (ISS) and hospital length of stay (LOS) were analyzed as continuous variables. ISS was further categorized into mild, moderate and severe categories. A score of 0–9 was considered mild injury, 10–14 moderate and ≥ 15 severe. If a patient was admitted as an activated trauma but discharged from the Emergency Department the same day, their LOS was counted as one day. Mortality was defined as any trauma related in hospital death. All other analyzed outcomes were evaluated as dichotomous, categorical variables. Type of CT scan performed was determined based on the type of radiologic study performed and the anatomical body part studied as recorded in TEMIS. Discharge destination was defined as the level of post-hospital care received after discharge from Northridge Hospital. Transfer to an acute care facility after PTC designation typically occurred due to patient insurance preferences after patient stabilization, and rarely occurred for need of higher level pediatric trauma care. Transfer to another trauma center

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