

**Trauma is a growing cause of mortality, morbidity and diminished functioning among older Americans.** Nearly 4 million adults aged >64 years incurred traumatic injury in 2013 leading to 1 million hospitalizations and 54,000 deaths.<sup>1</sup> Nearly 425,000 TBI and 260,000 admissions for hip fracture occur among older adults annually, most of which are fall related.<sup>1-3</sup> One fifth of hip fracture patients die within 12 months of injury.<sup>4</sup>

**Trauma impacts older patients more severely than younger patients.** Declining physiological reserves and comorbid conditions among older patients can worsen injury sequelae.<sup>5-7</sup> Also, despite national and regional guidelines to the contrary, injured older Americans are less likely to access sophisticated trauma care than younger patients.<sup>8,9</sup> A decade ago, the National Study on Costs and Outcomes of Trauma (NSCOT) demonstrated 25% greater survival among severely-injured patients treated at trauma (TC) versus non-trauma centers.<sup>10,11</sup> This finding was robust among patients aged <55y; however findings among older adults were equivocal.<sup>10-13</sup> Recent studies of trauma patients aged >64y report reduced mortality and decreased failure-to-rescue in facilities treating larger volumes of older injured patients.<sup>14,15</sup> The few studies examining associations between TC status and short- and long-term outcomes among older trauma patients suggest that in-hospital mortality for trauma is declining, but mortality and disability one-year post-injury are increasing.<sup>16-19</sup> **At present, evidence of the benefits of TC care for older trauma patients remains unclear.**

We hypothesize that certain subgroups of older trauma patients (e.g. those with TBI) may benefit from trauma center care, while others (e.g. those with hip fractures) may not. To test this hypothesis, we will use Medicare claims data merged with: (1) hospital and trauma center identification information from the American Trauma Society and American Hospital Association, (2) injury-severity data generated from ICD-9-CM codes using a validated technique, 3) a novel marker of physiological derangement (conscious status) available from ICD-9-CM codes, and 4) estimated transport times calculated using geographic information system approaches.

The specific aims of our study are as follows:

**Aim 1. To describe the facilities where older patients with traumatic injury receive care in the US from 2007-2014 and identify factors associated with treatment at different TC levels.** Using Medicare data, descriptive techniques and ordered logistic regression for TC level will examine relationships between patient characteristics, injury-severity, and geography associated with treatment at: a) Level I, b) Level II, or c) the combined grouping of Level III through non-trauma centers. Novel adaptation and validation of ICD Programs for Injury Characterization modules in SAS for use with the most up-to-date Medicare data available through Medicare's Virtual Research Data Center will be used to calculate injury and comorbidity measures.

Hypothesis: Patient, injury, and geographic characteristics independently predict treatment by TC level.

**Aim 2. To examine possible effects of TC care on outcomes among older patients with traumatic injury.** We will compare patient mortality, morbidity, LOS, discharge disposition, readmission, cost, and functional status at hospital discharge and at 30, 90, and 365 days between patients treated at TC and non-trauma centers, focusing on differences between patients with TBI (expected to benefit from TC treatment) and hip fractures (expected to experience similar outcomes). To maximize anticipated differences in outcomes, we will compare only the highest versus lowest levels of TC care.<sup>10,11</sup> Included patients will be limited to those within 1h by road of a Level I TC (approximately 46% of older adults),<sup>20</sup> excluding patients not at risk for TC treatment. Functional status will be estimated using Medicare MDS/Oasis data and a calculated measure based on previously validated methodology available for all trauma patients.<sup>21,22</sup>

Hypothesis: Among otherwise similar patients, trauma care at a Level I TC is associated with improved short- and long-term outcomes relative to a non-trauma center, despite higher associated costs.

**Aim 3. To identify possible heterogeneity in the effectiveness of TC and estimate the potential impact of treating older patients at the facility most appropriate for their injury.** Mimicking the methodology and outcomes of Aim 2, we will employ multiple interaction proportional hazard modeling, accelerated failure time modeling, and counterfactual techniques (Markov chain/random field modeling) to estimate possible benefits of increasing triage to the optimal care setting. Variations in costs will be further explored across injury types and patient characteristics to examine possible cost-saving strategies, such as treating specific low-risk patients in non-trauma center settings.

Hypothesis: Benefits attributable to TC care vary by injury type, severity, and patient characteristics.

**Findings from this study could lead to improved pre-hospital triage among older adults with traumatic injury, potentially optimizing patient outcomes and reducing treatment costs for injured older adults.**