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- Organization and Delivery of Burn Care
- Psychosocial and Functional Outcomes of Older Adults Following Burn Injury
- The Impact of Resuscitation Fluid Volume Received on Outcome
- Development of Validated Patient Reported Outcome Measurement Tools for Burn Survivors

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Advances in critical care and surgical management have significantly improved survival following burn injury. In 2007, survival following extensive burn injury has become the rule rather than the exception. Accordingly, the emphasis of burn care and research has shifted towards optimizing the outcome of burn survivors. Within the overall theme of burn injury outcomes, my research has evolved into four domains: organization and delivery of burn care; psychosocial and functional outcomes of older adults following burn injury, the impact of fluid resuscitation volumes on outcome and the development of validated instruments for assessment of burn outcomes.

Organization and Delivery of Burn Care

Burn care is a resource-intensive endeavor requiring specialized equipment and personnel. While the optimal national structure for delivery of burn care has long been debated, the need for organized systems and quality measures of burn care has received increased attention in light of recent concerns for mass casualty disaster planning. Our research in this domain has focused on the concept of regionalization of burn care; that is, a system in which a single center provides care over a defined geographic area as exists currently in the Pacific Northwest. The initial study performed on this topic was “An Outcome Analysis of Patients Transferred to a Regional Burn Center: Does Transfer Status Impact Survival?” published in the international journal *Burns* in December 2006. This was a retrospective cohort study comparing the outcomes of patients transferred to our regional burn center with those of patients admitted to the burn center directly from the field. While there have been numerous previous studies demonstrating worse outcomes for trauma patients transferred to trauma centers from preliminary care facilities,

there were previously no studies examining the outcome of transferred burn patients. In this study, we found that there was no difference in outcome between patients transferred to our burn center from a preliminary care facility and patients admitted directly from the field—a critical requisite for the delivery of burn care over a large geographic area in which patients will often receive initial care at a hospital without a burn center.

The next project in this domain examined the complications that occurred during the long-distance transport of a cohort of patients admitted to the UW Burn Center from 2000-2003, and the manuscript “An Analysis of Long Distance Transport of Burn Patients to a Regional Burn Center” has been recently published in the *Journal of Burn Care and Research*. This study demonstrated that patients can be transported safely and efficiently over long distances to a regional burn center. This finding has important implications for the organization of burn care nationally, given the decreasing number of American burn centers and the decreasing number of burn surgeons. In addition, these findings also have important implications for national disaster planning that must rely on safe and efficient triage and transport of burn injured patients in a mass casualty event.

Ongoing studies in this domain include an analysis of the geographic distribution of burn centers relative to population density and an analysis of population access to burn centers by ground and air transport utilizing two different geography databases. In addition, studies comparing the outcome of patients treated at verified burn centers (verified by the American College of Surgeons/American Burn Association Verification Committee) with those treated at non-verified burn centers utilizing data from the national Healthcare Utilization Program National Inpatient database are underway. Similar studies have been performed for non-burn trauma patients but have not been done for burn patients.

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Psychosocial and Functional Outcomes of Older Adults Following Burn Injury

Older adults are at increased risk for burn injury for a number of reasons and are at increased risk for adverse outcomes. The majority of the literature on elderly burn patients has focused merely on factors that influence survival, with less attention on the psychosocial and functional outcomes of those patients that survive their injuries. We have recently completed a study using data from the National Institute on Disability and Rehabilitation Research multicenter database examining the long-term functional outcome, health related quality of life and psychological distress in a cohort of burn patients age 55 and older. A second project examining the impact of extent of burn injury and pre-injury comorbidities on morbidity and outcome utilizing data from the UW Burn Registry is currently underway. The findings from these two studies will be used to design an interventional strategy aimed at improving the outcome of older adults following burn injury. In addition, we are examining national trends in older adult burn injury and outcome utilizing the American Burn Association National Burn Repository.

The Impact of Resuscitation Fluid Volume Received on Outcome

Fluid resuscitation is a critical component of the acute care of a burn patient. There has been a recent trend towards larger volumes of fluid being administered following burn injury that has been purported to increase injury complications. We have recently published two studies examining the trend over the past 30 years towards larger volumes of fluid administered to burn patients: “Is Supra-Baxter Resuscitation in Burn Patients a New Phenomenon?” and “‘Opioid Creep’ Is Real and May Be the Cause of ‘Fluid Creep.’” The first paper reported that the volume of fluids administered to a cohort of patients in 2000

was significantly higher than that administered to an age and injury-matched cohort from 1977. In the subsequent paper we examined the potential role of increased opioid administration over the same time period.

More recently, we reported on the complication of orbital compartment syndrome in patients who received large volumes of fluid resuscitation in the manuscript “Elevated Intraocular Pressure: Another Untoward Effect of Massive Fluid Resuscitation,” which was published in the *Journal of Trauma*. This clinical study demonstrates the association between large fluid volumes received and the possible development of orbital compartment syndrome in a group of severely burned patients. Detection and treatment of orbital compartment syndrome can be critical to the prevention of ocular complications including decreased vision.

To better examine the factors influencing the need for large volumes of fluid resuscitation and to verify the long hypothesized association between increased fluids received and risk for adverse outcome, we analyzed the data collected as part of the multicenter NIH-funded “Inflammation and Host Response to Injury” project. The results of this study are reported in the manuscript “The Association Between Fluid Administration and Outcome Following Major Burn Injury: A Multicenter Study,” which has been accepted for publication in the *Annals of Surgery*. This is the first manuscript in the burn literature utilizing prospectively collected multicenter data to demonstrate an association between large volumes of fluid received and increased risk of adverse outcomes including mortality.

Ongoing studies in this research domain are focused on development of better statistical models that can predict adverse outcome based on fluids received, and plans are underway to try and develop an interventional study that will utilize alternatives to narcotics in the early post-injury period which may reduce fluid volume requirements.

Development of Validated Patient Reported Outcome Measurement Tools for Burn Survivors

Effective assessment of the impact of burn injury on psychosocial and functional outcomes and development of effective intervention and rehabilitation strategies are contingent on the availability of reliable burn-specific outcome measurement tools. Traditionally, burn research studies have relied on functional and psychosocial assessment surveys, which have been developed and validated using non-burn survivor populations. The validity of these tools for burn survivors has not been assessed.

As the first step in this project, we are performing a systematic review of the literature to determine which patient reported outcome (PRO) instruments have been used for burn outcome studies and which of these have been previously validated. We will then develop a concept bank of issues that are critical to burn survivors functional, psychosocial and community integration aptitude. This concept bank will be developed from focus groups with burn survivors themselves as well as from focus groups with burn providers. It will also be used in the content validity assessment of currently available PROs and as the first step in the development of a PRO validated for burn survivors.

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