Systems-based Practice in Burn Care

Prevention, Management, and Economic Impact of Health Care–associated Infections

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KEYWORDS

• Systems-based practice • Burn injury • Patient safety • Quality improvement
• Health care–associated infections

KEY POINTS

- Age, size of burn, and presence of inhalation injury remain the key predictors of outcome after thermal injury, but the development of health care–associated infections (HAIs) compromises outcomes and increases morbidity and mortality.
- Many HAIs can be prevented, through rigorous application of patient safety protocols, standardization of care, vigilant monitoring, and quality improvement initiatives.
- Systems-based practice serves as both an analytical tool and an interventional opportunity, in which an individual provider, functioning across interconnected microsystems, can leverage those relationships to improve the function of the larger health care system.

INTRODUCTION

The classic determinants of survival after thermal injury are age, burn size, and presence of inhalation injury, but infection remains the leading cause of mortality, ahead of burn shock and organ failure.[1] The American Burn Association estimates that 486,000 patients with burn injury require medical treatment in the United States annually, involving 40,000 hospital admissions and resulting in 3275 deaths.[2] Paramount to achieving improved outcomes and reducing morbidity and mortality are the prevention and effective management of health care–associated infections (HAIs). Due to disruption of the integument, which provides a mechanical and immunologic barrier to pathogens, patients with severe burns are at high risk for both local and systemic infections.

The Centers for Disease Control and Prevention (CDC) identified HAIs as a preventable cause of morbidity and concluded appropriately that these infections represent a major threat to patient

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safety.[3] The HAI Prevalence Survey, published in 2014, exposes the full burden of this problem: approximately 722,000 patients develop HAIs per annum, accounting for approximately 75,000 in-hospital deaths.[4] Although the incidence of HAIs has dropped considerably over the past decade, due to improved surveillance, education, training, feedback, bundles, and checklists, 1 in 25 hospitalized patients still has at least 1 HAI on any given day. Prevention of HAIs, their early diagnosis, and the rational use of antibiotics are largely responsible for these improved outcomes, all tangible benefits of systems-based practice (SBP), in which individual health care providers, teams, clinical microsystems, and the macro-organization work together to improve patient safety.

First introduced in 1999 by the Accreditation Council for Graduate Medical Education, and later adopted by the American Board of Medical Specialties as part of Maintenance of Certification, SBP is a clinical competency in which physicians strive to understand how patient care relates to the health care system, as a whole, and how to utilize and even leverage that system to improve the quality and safety of patient care.[5,6] SBP serves as both an educational tool to measure and enhance performance of clinicians and an analytical model to improve the overall health care system. In contrast to the competency of practice-based learning, which asks, "How can I improve the care of my own patients," SBP poses the question, "How can I improve the system of care?" Because health care is a complex, adaptive system, which contains microsystems that are sometimes aligned but often have competing behaviors, objectives, and opportunities, the importance of systems thinking cannot be overstated. Understanding large organizations, with their interacting, interrelated, and interdependent elements, improves health care not only at the patient level but also for populations of patients.

The purpose of this investigation is to analyze the impact of SBP on the outcomes of burn patients who developed HAIs. Specifically, what measures have been implemented to prevent and treat HAIs at the authors' institution? What is the economic impact of the development of HAIs in these burn patients? In what areas has progress been made, and where does work remain? Finally, what lessons have been learned that can be extrapolated to other health care systems, such that all burn patients can benefit from the authors' experience?

METHODS

Patient Population

The authors performed an institutional review board–approved, retrospective cohort study of all patients admitted to the University of North Carolina (UNC) Jaycee Burn Center, from 1999 to 2012. The initial data set was obtained from a prospectively maintained institutional registry, which was part of the National Burn Repository of the American Burn Association. This database was then cross-referenced and merged with a comprehensive, hospital-wide surveillance registry for all HAIs, as defined by the CDC, for catheter-associated urinary tract infections (CAUTIs) from 2006 to 2012, central line–associated bloodstream infections (CLABSIs) from 1999 to 2012, ventilator-associated pneumonias (VAPs) from 2004 to 2012, and surgical site infections (SSIs) and skin and soft tissue infections (SSTIs) from 2002 to 2012.

The study was conducted at the UNC Hospitals, an 806-bed tertiary/quaternary care facility, which includes a 21-bed burn ICU plus another 20-bed step-down unit for burns and wound care. Active members of the UNC Jaycee Burn Center team include burn and plastic surgeons (all of whom are board certified in surgical critical care), dedicated anesthesiologists, infectious disease specialists, hospital epidemiologists, nurses proficient in advanced burn care, occupational and physical therapists, nutritionists, pharmacists, recreational therapists, social workers, and chaplains. Almost all patients were housed in single, isolated ICU beds as well as semiprivate step-down beds when stable for transfer. Burn wound precautions for all patients included monitored hand hygiene, gloves, and gowns, for all providers entering ICU rooms.

Data Collection and Study Design

The following data points were extracted from the burn center registry and the surveillance database from hospital epidemiology: age, size of burn, presence of inhalation injury, incidence of HAI, identification of pathogens, length of stay (LOS), mortality, and total hospital charges. These data to were used to

1. Observe the incidence of HAI, CAUTI, CLABSI, and VAP as a function of time
2. Compare those patients who developed index SSIs/SSTIs with those who did not, from 2008 to 2012
3. Understand the changing distribution of pathogens, from 2007 to 2012
4. Create a financial model that would predict the direct medical costs of developing HAIs, specifically at the authors' burn center

Previously published CDC estimates for low, high, and adjusted costs (pegged to the consumer price index) were used for comparison.[7] Impact of