

MEDICAL EDUCATION

Problems and Costs That Could Be Addressed by Improved Burn and Wound Care Training in Health Professions Education

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Abstract

The current system of burn care delivery attempts to meet the needs of the nearly 500 000 patients in the United States who require medical treatment annually. However, specialization of care and lack of fundamental burn and wound care knowledge among graduating medical trainees has unintended consequences, leaving the system inefficient, with inherent inequities in care delivery and with the potential to be overwhelmed in a mass casualty event. While increasing accessibility to specialty burn centers through technology could mitigate some of these problems, increased education is more practical. The implementation of a formal wound care curriculum in medical school would address the problems associated with chronic wounds in the United States. Additionally, this curriculum would be a natural extension of exposure to the basics of burn care, a relevant skill set in any specialty.

The Current State of Burn Care

Nearly 500 000 patients in the United States require medical treatment for burn injuries annually, and 40 000 of those patients require acute inpatient hospitalization.¹ Significant advances in the field of burn care have led to improved survival across all age groups. In the mid-twentieth century, half of patients with burn wounds in excess of 43% total body surface area (TBSA) would die.² Now, most patients are expected to survive with burn areas up to 60% or 70%TBSA,² but more than 3000 patients still die annually from burn-related injuries.¹

Looking globally, the economic impact of burns is considerable. In fact, the incidence of burns severe enough to require medical attention ranked fourth in global injuries in 2004.³ Thankfully, most burn injuries are not severe enough to cause death, but 90% of the worldwide deaths from burn injuries are in [low- and middle-income countries](#).³ While prevention is undoubtedly the most important aspect of reducing the impact of burn injuries, it is impossible to eliminate them. This means that equitable and efficient allocation of burn care is of paramount importance.

It is undeniable that there has been significant progress in burn care: optimization of fluid resuscitation, advances in critical care, topical antimicrobials, and improvements in timing of excision and grafting of full thickness (third-degree) burns are just a few examples. And much of this progress can be attributed to research efforts and centralization of care at specialized burn centers. As part of this push to improve early and aggressive referral to burn centers, the American Burn Association (ABA) published referral criteria targeted at increasing early triage to appropriate centers.⁴ Here, we discuss these referral criteria and show that there have also been unforeseen challenges in the delivery of burn care that cannot be fully addressed solely by specialized centers. Perhaps the largest impact can be made by training nonburn clinicians, and this training needs to start at the earliest stages of medical education—medical school and residency.

Referral Criteria Lead to Inequities in Care Delivery

As understanding of burn wound care and treatment of the burn patient improved, specialized centers began to outpace the care that could be offered at nonburn centers. Accordingly, there was a push to consolidate the care of burn patients at these specialized centers. This strategy was not just aimed at improved survival, however. Delayed or inappropriate treatment of burn wounds can have late complications that are functional (e.g., scar contractures), psychosocial (e.g., depression, posttraumatic stress), or both.⁵⁻⁷ These sequelae in turn can affect quality of life via their impact on social reintegration and return to work.

The ABA referral criteria attempted to mitigate both problems facing burn patients: early survival in severe burns and long-term complications in less severe burns. However, these criteria, as established, are based largely on expert opinion and fail to take into account differences in regional resources, making their application potentially problematic in some instances. Under the current system, all patients with burns that “involve the face, hands, feet, genitalia, perineum, or major joints” should be referred to a burn center for definitive management.⁴ It’s unlikely that anyone would question the wisdom of referring a six-year-old girl with a full-thickness burn to her face and lips to a burn center, but what about quarter-sized superficial partial thickness (i.e., second-degree) hot water scald to the back of the hand?

Overtriage has been one of the consequences of broad referral criteria. Carter et al. reported that 41% of patients referred to their regional burn center with less than 10% TBSA burns were either sent home from the emergency department or discharged within 24 hours of arrival,⁸ implying that these patients likely could have been handled on an outpatient basis or perhaps did not need specialty burn care at all. An additional 30% of these patients went home within 48 hours,⁸ a group that could have likely been handled on an outpatient basis. Similarly, Kashefi et al. estimated a 20% overtriage rate, specifically among patients that were transferred by air.⁹

These questions seem insignificant in regions such as Southern California, where there are five burn centers within driving distance.¹⁰ But the reality is much different for a patient being evaluated in Montana, where there is no burn center. In addition to Montana, there are several other states without a burn center and several more with only one for the entire state.¹⁰ Some critics might argue that this degree of overtriage is acceptable when some centers are already facing issues of late or absent referrals for more serious burns,¹¹ but we argue that this challenge should be met with increased education for clinicians at referring centers, not more aggressive referral criteria.

Fortunately, the ABA is attempting to tackle part of this problem already via its Organization and Delivery of Burn Care Committee. As a member of the committee, the second author (VCJ) is currently part of a working group that is reevaluating the transfer criteria. The goal of this work is to provide clear, concise criteria for determining not only whether patients should be referred to a burn center but also when such a referral should take place (i.e., immediate transfer versus outpatient referral). Local and regional infrastructure, resources, and relationships will always impact how such guidelines are applied. While problems of over- and undertriage will always exist, the goal is to mitigate them.

The Consequences of Overtriage

Unfortunately, the increased triage of burn patients to burn centers, partly resulting from the implementation of ABA referral criteria, has come at the expense of increased discomfort among general practitioners (medical and surgical) with caring for the burned patient, which can be inferred from the increasing number of referrals despite decreasing overall burn size.¹² This problem is compounded by a broader issue facing the medical community—rapidly increasing specialization of care. Some of the trend toward increasing specialization is in response to the exponentially increasing amount of medical knowledge—requiring specialization for competency. Medicolegal concerns and increasingly packed emergency departments and primary care offices are likely also factors. But, as we move towards increasingly specialized care, the economics of this system of medical care delivery is drawn into question. At what point does the system become unsustainable? That question is not unique to burn care and is outside of the scope of this piece. However, the “super” specialization of burn care delivery certainly also raises questions about its ethicality.

Burn injury is already a burden carried disproportionately by those of lower socioeconomic status, as increased frequency and severity of burns have been associated with lower educational status, lower income, and substandard living conditions.¹³ While it is undeniable that centralization of burn services has allowed for the standardization of care, it has diminished what nonburn clinicians can offer. And while burn centers are able to provide resources that a general hospital might not be able

to offer, the cost of specialty burn care is significantly higher than general medical admission costs.¹⁴ For lower-income people, lost wages alone might make travel to a burn center, much less payment for services rendered, impossible. This leaves them to settle for inadequate or even nonexistent treatment for their burns. The population of patients that is most adversely affected by burns thus has the least access to burn care services.

A Disaster Waiting to Happen

The responsibility for the inpatient management of US burn patients rests largely with 128 identified burn centers. Currently, 60% of acute hospitalizations related to burn injury take place at one of these centers, each averaging approximately 200 admissions per year for burns or major wounds.¹ While this system is currently sustainable with the baseline number of burns, there is significant concern that it would be overwhelmed by natural disaster or terrorism. An estimated 20% to 30% of injuries related to mass casualty events are burn related, and a major event could quickly overwhelm this resource-limited system.¹⁵ The burn community is aware of this fact, and [disaster planning](#) focuses on optimizing available resources and prioritizing triage to burn centers in the event of a mass burn event.¹⁶ However, this plan is predicated on emergency room physicians, surgeons, and general practitioners having enough experience and burn education to effectively manage patients with severe injuries for up to 72 hours and to provide definitive care for those with less severe injuries.

The most straightforward method for handling disaster preparedness, as well as access disparities in regions without burn centers, would be to increase the accessibility of burn specialists. However, this goal doesn't necessarily need to be accomplished by increasing the number of burn surgeons or burn centers. In 2009, Saffle et al. reported their experience with a Salt Lake City-based telemedicine program, which connected local emergency departments with burn specialists via video conference.¹⁷ They showed that pre-arrival estimates of burn size made by burn specialists were an improvement over those made by referring physicians and that both referring and receiving physicians reported a high level of satisfaction with the telemedicine program. Costs of burn care could potentially be reduced even further by using pre-existing smartphones, as they don't require significant investment in new technology and might increase the utility of telemedicine even further.¹⁸ Moreover, improved utilization of technology has the potential to reduce overtriage and improve pre-arrival care. While [telemedicine](#) would mitigate some of the inequities of burn care delivery, it fails to address the underlying problem—lack of burn education.

Inadequate Burn and Wound Education

As mentioned previously, there is now a nearly insurmountable fund of medical knowledge that needs to be conveyed during a physician's short time in medical school. So why should burn care be prioritized? Why should every physician be at least familiar

with basic burn care and competent in the effective triage of these patients? Burns differ from other disease processes in a few key ways that make education about their care essential:

1. *Unpredictable volume.* While burn injuries can be tracked and estimated, a single mass causality event could quickly overwhelm local resources, requiring nonspecialists to provide care.
2. *High variability in severity of injuries.* Burns vary from fingertip stove burns (for which patients may not even seek medical care) to whole body burns from a structure fire, and much of this spectrum does not require specialty care.
3. *Unequal distribution.* Rural areas have been shown to have higher hospitalization rates for burns and to treat more severe burns than urban areas,^{19,20} and access to a major burn center may be hundreds of miles away.

While many might argue that the time constraints of medical education prevent adding dedicated burn care education, it can easily be implemented as part of a larger, much-needed wound care curriculum. Currently, most medical schools do not have a dedicated wound care curriculum.²¹ This means that most students graduating from medical school lack competency in practical wound care.

Estimates place the number of patients affected by chronic wounds (i.e., wounds that fail to follow the normal healing process and time) at 6.5 million.²² And chronic wounds cost the US medical system roughly \$37 billion annually.²³ These wounds are frequently associated with other chronic medical problems,²² and, as the population ages, chronic wounds will continue to increase in prevalence.²² Wounds are a growing problem that medical education needs to address, and the implementation of burn education as part of a larger wound care curriculum would be a natural addition. After this initial introduction, further practical training should take place during residency. Again, this training could take place as part of a larger dedicated wound care curriculum.

Conclusion

The burned patient has benefited from the centralization of care for major burns at specialized centers. However, the sustainability of the system, especially if forced to handle a major disaster, is uncertain. The current model is hampered primarily by the growing inexperience of nonburn physicians and disparities in access. Some of these problems could potentially be mitigated using technology (e.g., telemedicine) or clarifying the current burn referral criteria. However, common knowledge among physicians about the basics of burn and wound care would go a long way towards improving effective triage, redundancy when specialists are not immediately available, and quality of overall care.

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