Reduced Length of Stay in Hospital for Burn Patients Following a Change in Practice Guidelines: Financial Implications

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The objective of this study was to analyze the financial implications of the implementation of new institutional practice guidelines including greater outpatient care and earlier operative intervention in a provincial burn center. A retrospective review was performed including all patients admitted to the Burn Unit with burns up to 20% TBSA between August 2005 and July 2009, including 2 years before and after the new guidelines were introduced. Daily costs for the burn unit were used to calculate this portion of cost. Length of stay (LOS) was based on actual data and representative clinical scenarios. Two hundred sixty-four patients were included. Mean LOS decreased from 10.3 to 3.9 ($P < .01$) and 21.0 to 13.3 ($P > .05$) for nonoperative burns 0 to 10% and 10 to 20% TBSA, respectively. Mean LOS for operative burns decreased from 16.6 to 12.9 and 32.3 to 29.8 days for 0 to 10% and 10 to 20% TBSA, respectively ($P > .05$). Burn patient management requires significant financial resources, and LOS has a large impact on cost. Given per diem rates of Can$1,663, scenario analysis shows potential cost savings of Can$19,956 per patient for operative and nonoperative burns <20% TBSA. With an average of 66 such patients treated each year, potential annual cost savings are Can$1.3 million. If outcomes are not compromised, earlier operative management and greater outpatient care can translate into significant cost savings. A prospective analysis capturing all costs and patient quality of life is required for further assessment. (J Burn Care Res 2012;33:e275–e279)

A recent institutional review at our Canadian University-based burn center showed a shift to earlier operative management and earlier discharge of nonsurgically treated patients after changes in burn care protocols.[1] The revised burn care practice guidelines were instituted in August 2007 with the goal of performing early excision and grafting when indicated and shifting toward outpatient management for patients with burns of superficial or indeterminate depth smaller than 20% TBSA. The standard burn dressing was also changed from silver sulfadiazine dressings (Flamazine®, Smith & Nephew, London, UK) to nanocrystalline silver dressings (Acticoat®, Smith & Nephew, London, UK). The change in practice guidelines specifically included three main changes:

- Early excision and grafting: patients are assessed at 24 to 72 hours postburn. If the burn is determined to be deep dermal or full thickness, excision and grafting will be performed at the next available time (usually there is 1 day per week allocated to burn surgery).
- Shift toward outpatient management for patients with burns of superficial or mid-dermal depth <20% TBSA. After the burn depth assessment, if patients have appropriate pain control and home supports they are discharged with follow-up at the weekly burn clinic. After 2 weeks if burns are still nonhealing, patients are brought to the operating room to undergo excision and

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grafting on the next available day (with a goal of surgery at less than 3 weeks after burn injury). Previously, many patients remained in hospital instead of being followed as outpatients.
- Standard burn dressing change: daily silver sulfadiazine dressings were changed to nanocrystalline silver dressings after the burn depth assessment was performed to decrease the number of dressing changes and to allow weekly dressing changes for patients being managed as outpatients.

The study of the changes showed an overall decrease in length of stay (LOS), but it was unclear to what extent this decrease translated to cost savings.

There are many scenarios with a range of reasonable management strategies in burn care, specifically in treating mid-dermal burns. If outcomes are equivalent, cost can help guide management. Health care professionals are being required to justify costs in the current environment of limited resources and the expectation that funds be used efficiently.[2–6] The Royal College of Physicians and Surgeons of Canada has advocated the role of "Manager" as a role for specialists and includes the wise allocation of finite health care resources.[7] Even the popular media has drawn attention to the importance of the wise use of limited health care resources.[8,9]

Previous studies have been performed regarding burn care, outcomes, and costs. The change in outcomes in cohorts of children with medium-sized burns after changing from inpatient silver sulfadiazine dressings (Flamazine®, Smith & Nephew, London, UK) to outpatient nanocrystalline silver dressings (Acticoat®, Smith & Nephew, London, UK) resulted in a significant reduction in LOS (13.83–0.83 days, $P < .001$), with a reduction in complications and no increase in the need for skin grafting.[10] Similarly, Fong et al[11] compared the effectiveness and costs of silver sulfadiazene and nanocrystalline silver dressings. They concluded that Acticoat® reduced the incidence of burn wound cellulitis, antibiotic use, LOS in hospital, and cost. Another study described a program of early excision, increased outpatient care, and aggressive discharge planning.[12] Their goal was to perform excision within 24 hours of admission, or as soon as the patient was stable for surgery, with either immediate autografting or temporary cadaver or porcine grafting when the depth was uncertain. Coordinated discharge planning began soon after admission, which increased the use of the outpatient clinic. A significant decrease in LOS for small and large burns was demonstrated, although patients with incompletely excised burns due to uncertain burn depth at the time of early excision required readmission for further excision.

Mathews et al[13] describe a cost reduction program at their burn unit that was implemented to decrease resource usage and LOS without sacrificing quality of care. First, the five highest cost expenditure items were identified. The rationale for their use was reviewed and a "cost-effective, clinically appropriate standards of care" was created. This resulted in significant reductions in use and costs. Additional efforts to decrease LOS through early discharge planning were made allowing discharge with small remaining open wounds and resulting in significant decreases in LOS, with no change in rates of infection, readmission, or mortality.

The purpose of our study is to retrospectively review our institution's data before and after the implementation of new practice guidelines. We then seek to analyze the financial implications of the change in burn practice guidelines to help guide management and to make recommendations for future studies.

METHODS

This study is based on a retrospective database review that was performed of all patients admitted to BC Professional Firefighters' Burn Unit in Vancouver, British Columbia, Canada, with burns less than 20% TBSA from August 2005 to July 2007 and from August 2007 to July 2009. Data extracted included LOS and number of patients, TBSA, LOS in days per TBSA, and operative vs nonoperative cases. Patients treated before the change in practice guidelines (August 2005 to July 2007, termed "pre") were compared with those treated after the change (August 2007 to July 2009, termed "post"). For patients discharged and then readmitted, LOS included the total of all days of admission. Patients with burns greater than 20% TBSA or requiring an intensive care unit (ICU) admission were excluded from the analysis due to their heterogeneity and increased costs.

Internal institutional costs for our burn unit were obtained from the finance department. The per diem rate for our burn unit is $1663 Canadian (Can$), which includes fixed overhead costs, nursing, allied health and support staff costs, and dressing supplies. It does not include pharmacy charges, physician fees, or operative costs. Note that the per diem rates reflect hospital costs and not charges to patients or third-party payers.

Costs related to LOS were calculated by multiplying LOS by the per diem rate. All calculations were performed in Microsoft Excel 2008 for Mac® (Microsoft Corporation, Redmond, WA).

Table 1. Length of stay by TBSA category

	Operative			Nonoperative		
TBSA	**Pre**	**Post**	*P*	**Pre**	**Post**	*P*
0–10%	16.6 ± 13.8 (41)	12.9 ± 12.2 (55)	.169	10.3 ± 14.6 (51)	3.9 ± 3.6 (40)	.004
10–20%	32.3 ± 19.5 (24)	29.8 ± 18.8 (24)	.654	21.0 ± 27.0 (20)	13.3 ± 14.7 (9)	.434

Values shown are mean ± SD of length of stay in days.
Number of patients is shown in parenthesis.
Pre = August 1, 2005, to July 31, 2007.
Post = August 1, 2007, to July 31, 2009

RESULTS

Table 1 displays LOS by TBSA category for operative and nonoperative cases, comparing the 2-year periods before and after the change in guidelines. There was no statistically significant difference in LOS for operative cases, but overall the trend is to reduce burns <20% TBSA. There was a significant reduction in LOS for small (<10%) nonoperative cases with greater outpatient management, from 10.3 to 3.9 days ($P < .01$). By applying the per diem rate of $1663, this 6-day reduction for small nonoperative burns results in a cost reduction from $17,129 to $6,486 ($10,643) per patient.

Tables 2 and 3 present the changes in costs attributable to the per diem charges, obtained by applying the daily rate of $1663.

DISCUSSION

Burn care is both complex and expensive, and a consideration of costs is required in addition to the assessment of clinical success.[3] While the treatment of most superficial and deep burns is usually clear, more options exist for mid-dermal burns.[14] Depending on the burn center, practices can be geared toward more aggressive early excision or may have a preference for conservative management followed by operative if required after follow-up. Operating room access also plays an important role in these decisions.

Two representative scenarios, based on expert opinion, were generated to interpret the implications of the policy changes addressed in this study. In the first scenario (conservative treatment), a previously healthy 40-year-old man presents immediately after a flame burn to his lower extremity. The burn is assessed to be 10% TBSA, with a superficial to mid-dermal depth. His burn is managed in two ways. Under the first treatment option, he is admitted to the burn unit for dressing care, pain control, and regular wound reassessments. After 14 days, his burns healed and was discharged with follow-up arranged in the burn clinic. Under the second treatment option, he is admitted to the burn unit for dressing care and pain control but discharged after final burn depth determination at 2 days with adequate pain control through oral medications and nanocrystalline silver dressings. He is seen weekly at the outpatient burn clinic where his wounds are assessed and his dressings changed. After 14 days, his burns healed.

The second scenario is identical in presentation. The first treatment option is analogous to that above with the patient admitted to the burn unit, but after 14 days his wounds are still open and the decision is made to proceed with excision and skin grafting. He remains in hospital for a total of 21 days. Under the second option, he is discharged after 2 days as in the first scenario above and readmitted once his wounds are noted to require excision on burn clinic

Table 2. Change in costs for operative cases

TBSA	LOS (Pre)	LOS Cost ($) (Pre)	LOS (Post)	LOS Cost ($) (Post)	Change in LOS Cost ($)
0–10%	16.6	27,606	12.9	21,453	6,153
10–20%	32.3	53,715	29.8	49,557	4,157

Pre = August 1, 2005, to July 31, 2007.
Post = August 1, 2007, to July 31, 2009.
LOS, length of stay in days.

Table 3. Change in costs for nonoperative cases

TBSA	LOS (Pre)	LOS Cost ($) (Pre)	LOS (Post)	LOS Cost ($) (Post)	Change in LOS Cost ($)
0–10%	10.3	17,129	3.9	6,486	10,643
10–20%	21.0	34,923	13.3	22,118	12,805

Pre = August 1, 2005, to July 31, 2007.
Post = August 1, 2007, to July 31, 2009.
LOS, length of stay in days.

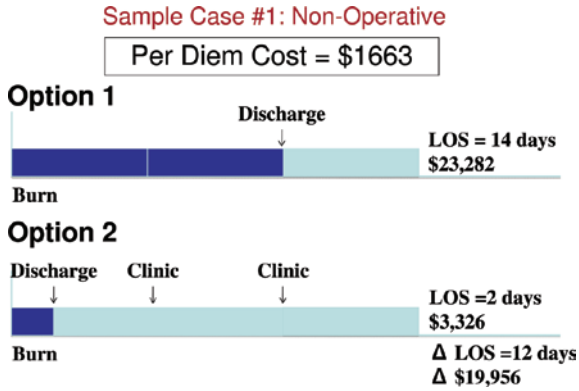

Figure 1. Scenario analysis for nonoperative case.

follow-up. He remains in hospital for a total of 7 days on the second admission for a total LOS of 9 days.

Figures 1 and 2 display the LOS and cost implications of the treatment options in scenarios 1 and 2, respectively. Both scenarios result in a 12-day reduction in LOS, which results in a $19,956 reduction in cost (from $34,923 to $14,967). Over the study period, there was an average of 66 patients per year with burns <20% TBSA who were treated either operatively or nonoperatively, implying potential annual cost savings of $1.3 million. Earlier excision and skin grafting can also result in LOS savings, although our limited data did not show a significant difference for these patients.

There are both advantages and disadvantages associated with outpatient vs inpatient burn care. In addition to cost savings, there is the potential for improved infection control, spontaneous mobilization, and psychological ease in an outpatient setting. Although there is less monitoring, pain control must be controlled with oral analgesics and it involves more patient education before discharge.[10,15] Access to the multidisciplinary burn team as outpatients

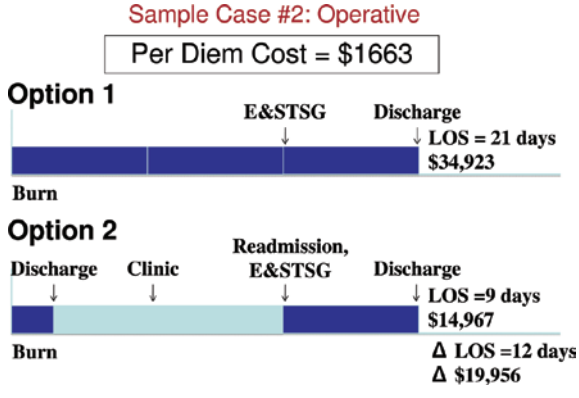

Figure 2. Scenario analysis for operative case.

is critical for patients with large burns[16] but is also important for those with smaller burns.

We assumed that outcomes were comparable for patients treated as inpatients or outpatients, which was supported by previous studies.[1,10,12,13] However, few studies assess quality of life in the postburn period. Such a study would be helpful to further analyze outcomes including exercise tolerance and quality of life.[2,17,18]

This study was designed to illustrate the effect of one key driver of costs and is subject to various limitations. The most important limitation is incomplete cost data due to confidential hospital pricing agreements and lack of patient specific cost tracking. Outpatient costs were not calculated, but this would have a minimal impact on our analysis due to the relatively small costs of outpatient visits compared with a single day in the burn unit. The cost of 1 day in the hospital ($1663) is equivalent to seven visits in the burn clinic ($238). A typical burn clinic visit includes a physician assessment and nurse dressing change. The $238 figure includes physician charges, nursing costs, dressing supplies, and clinic capital costs, according to our hospital's finance department. There would be no significant difference in dressing costs in the clinic compared with the hospital. We excluded patients whose stay included an admission to the ICU, which would include larger burns and those patients with inhalational injuries requiring intubation. We think that this helped create a more homogeneous patient population, but as a result we would suggest caution in applying the results of this study to this group of patients.

Although LOS is an important driver of costs, there have been studies that suggest that efforts to reduce LOS do not translate to significant savings. Taheri et al[19] performed a study of costs for trauma patients at their center in Michigan. They analyzed the cost of the last full day in hospital compared with the total cost for the hospital stay and found that incremental costs on the last full day were only 2.4%. For patients with a LOS of only 4 days, the percentage increased to only 6.8%. They described fixed costs as either direct, such as equipment or medical devices that are not identified with a particular patient, or as indirect, such as administrative salaries. Variable costs are expenditures directly related to patient care, such as dressing supplies, medications, and laboratory tests. They noted that admission costs were split into variable (42%) and fixed (58%) costs, and most variable costs are incurred during the first few days of admission. Therefore, they suggested that efforts to contain costs should focus on process changes in the first few days of admission rather than solely decreasing LOS. Other

authors have noted the importance of focusing cost control strategies on fixed costs rather than simply LOS to maintain efficiencies.[20,21] Although the health insurance and billing systems in the United States have a very different structure from that in Canada or other countries with socialized medicine, the concept of fixed and variable costs is comparable.

Our study's data are limited by low numbers in some categories, their retrospective nature, and heterogeneity, despite our exclusion of patients requiring ICU admission. Our LOS data only included admission to our hospital and did not consider the impact of LOS on rehabilitation or other peripheral hospitals following their acute burn management. We do not think that this would have had a significant impact as most of the patients in our group had relatively small burns and did not require admission to a rehabilitation facility after hospital discharge.

The results of this study highlight the financial impact of clinical decisions and may contribute to the development of clinical practice guidelines. A prospective study that captures all costs, outcomes, and health utilities is required for further analysis.

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