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Cost Analysis of 48 Burn Patients in a Mass Casualty Explosion Treated at Chang Gung Memorial Hospital

Alexandra L. Mathews, BS¹, Ming-Huei Cheng, MD, MBA, FACS², John-Michael Muller, MA³, Miffy Chia-Yu Lin, MSc⁴, Kate W.C. Chang, MA, MS⁵, and Kevin C. Chung, MD, MS⁶

¹Research Assistant, Section of Plastic Surgery, Department of Surgery, The University of Michigan Medical School

²Department of Plastic and Reconstructive Surgery, Center for Tissue Engineering, Chang Gung Memorial Hospital, College of Medicine, Chang Gung University

³Medical Student, University of Michigan Medical School

⁴Department of Plastic and Reconstructive Surgery, Center for Tissue Engineering, Chang Gung Memorial Hospital, College of Medicine, Chang Gung University

⁵Research Analyst, Section of Plastic Surgery, Department of Surgery, The University of Michigan Health System

⁶Professor of Surgery, Section of Plastic Surgery, Assistant Dean for Faculty Affairs, The University of Michigan Medical School

Abstract

Introduction—Little is known about the costs of treating burn patients after a mass casualty event. A devastating Color Dust explosion that injured 499 patients occurred on June 27, 2015 in Taiwan. This study was performed to investigate the economic effects of treating burn patients at a single medical center after an explosion disaster.

Methods—A detailed retrospective analysis on 48 patient expense records at Chang Gung Memorial Hospital after the Color Dust explosion was performed. Data were collected during the

Corresponding author: Kevin C. Chung, MD, MS, Section of Plastic Surgery, The University of Michigan Health System, 1500 E. Medical Center Drive, 2130 Taubman Center, SPC 5340, Ann Arbor, MI 48109-5340, Phone: 734-936-5885, Fax: 734-763-5354, kecchung@med.umich.edu.

Permission Note

The institutional review board of Chang Gung Memorial Hospital in Taiwan approved all aspects of this cost analysis study.

The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Conflict of Interest Statement

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acute treatment period between June 27, 2015 and September 30, 2015. The distribution of cost drivers for the entire patient cohort (n=48), patients with a percent total body surface area burn (%TBSA) ≥ 50 (n=20), and those with %TBSA <50 (n=28) were analyzed.

Results—The total cost of 48 burn patients over the acute 3-month time period was \$2,440,688, with a mean cost per patient of \$50,848 $\pm$ 36,438. Inpatient ward fees (30%), therapeutic treatment fees (22%), and medication fees (11%) were found to be the three highest cost drivers. The 20 patients with a %TBSA ≥ 50 consumed \$1,559,300 (63.8%) of the total expenses, at an average cost of \$77,965 $\pm$ 34,226 per patient. The 28 patients with a %TBSA <50 consumed \$881,387 (36.1%) of care expenses, at an average cost of \$31,478 $\pm$ 23,518 per patient.

Conclusions—In response to this mass casualty event, inpatient ward fees represented the largest expense. Hospitals can reduce this fee by ensuring wound dressing and skin substitute materials are regionally stocked and accessible. Medication fees may be higher than expected when treating a mass burn cohort. In preparation for a future event, hospitals should anticipate patients with a %TBSA ≥ 50 will contribute the majority of inpatient expenses.

Keywords

Cost Analysis; Burns; Burn care; Mass casualty; Inpatient hospitalization

Introduction

In the current economy, health care institutions are increasingly scrutinized for their management of costs, specifically their efforts to reduce the national burden of growing health care expenditure¹. Compared to other forms of trauma, burns are one of the most costly injuries for health care systems². Burn patients require prolonged hospitalization, extensive numbers of treatment sessions, and often undergo multiple surgical procedures³. In an effort to identify potential sources of high expense in the management of burn individuals, many studies have retrospectively examined the cost of delivering burn care at diverse institutions^{4–6}. Some of these studies undertook a detailed inventory of cost for a small number of patients, whereas others surveyed longitudinal cohorts^{4,5}. Despite differences in methodologies, researchers demonstrated that burn care is an expensive therapy both in terms of total spending as well as cost per patient. Given the intensive resources necessary for treating these patients, advance preparation becomes crucial to saving more lives⁷. Cost studies remain an important tool in promoting this anticipated resource allocation, and also in developing specific cost-reduction strategies for the treatments consumed².

Although recent studies have analyzed costs of diverse patient cohorts, a cost analysis in the wake of a mass casualty burn event has not been fully examined. The care of patients following a mass burn accident is different from typical burn management because of the extensive simultaneous consumption of physician services and materials for burn wound coverage⁸. Additionally, treatment supplies including costly wound dressing materials and skin substitutes become limited after mass burn accidents, which may increase the length of a patient's hospital stay and result in increased charges^{8,9}. These observations suggest the

costs of treating mass casualty burn populations differ from caring for individual burn patients.

We performed a cost analysis of inpatient hospital expenses at Chang Gung Memorial Hospital (CGMH) after the June 27, 2015 Color Dust explosion at the Formosa Waterpark in Taiwan to assess the economic effects of treating burn patients after a mass trauma event. The patients involved in the explosion were sprayed with a thick cloud of colored dust powder while attending a stage show¹⁰. The powder ignited, causing extensive burns and inhalation injuries among 499 of the partygoers. This disaster presented a unique patient population to the regional hospitals in Taiwan, with a low mean age of 22 years (15–37) and a large mean burn surface area of 43.5%¹⁰. The cost distribution of resources used to treat the CGMH patients was analyzed to identify the most significant cost drivers in caring for an acute mass burn patient population. Furthermore, the distribution of cost drivers was compared among the entire cohort, the severely burned patients with percent total body surface area burned (%TBSA) ≥ 50 , and less severely burned patients with %TBSA < 50 .

Methods

After obtaining institutional review board approval for data collection and analysis, we examined expense records for 48 patients injured in the Formosa Waterpark Color Dust explosion who were treated at CGMH. This analysis included all inpatient expenses beginning June 27, 2015 and ending September 30, 2015. This period encompassed the acute phase of care that included key treatments and extensive hospitalization. To assess the complete cost of care, we included both living and deceased patients who received treatment during this acute period.

To ensure accuracy, we cross-checked each patient record against hospital billing records at CGMH and Taiwan's National Health Insurance (NHI). The cost data were reported in units of insurance points because Taiwan's health care institutions use a reimbursement system based on a schedule set by the NHI department¹¹. The fee schedule sets the maximum reimbursement points for each medical service claimed. These are then reimbursed according to annual budget allocations. For this study we assumed full reimbursement rates for all patient costs, using the conversion equation 1 point = 1 New Taiwan (NT) dollar. We then used a July 2015 exchange rate to approximate the value assessed in US dollars (\$31 NT dollars = \$1 USD).

Each patient record was examined for demographic and expense statistics. These included gender, age, %TBSA burned, number of admits, total days of hospital treatment, days spent in intensive care, respirator and Extracorporeal Membrane Oxygenation (ECMO) use, and summaries of burn treatments. We then calculated summary expense statistics for the whole patient group (n=48), and also by subgroups of %TBSA ≥ 50 (n=20) and %TBSA < 50 (n=28). These statistics describe the total cost of inpatient burn care, and mean costs per patient, per day of hospitalization, per ICU/Burn ICU day, per Burn Ward/general hospital ward day, and per 1% burn surface area. We calculated overall means in each category from individual patient means because of population heterogeneity (e.g. some patients had short hospital stays and others had prolonged ones). For example, each individual patient's total

cost per day was averaged first, and then the overall cohort average was calculated based on these values.

Next we compared cost drivers between three cohorts: the entire set of patient expense records, the patients with %TBSA ≥ 50 , and patients with %TBSA < 50 . Cost driver categories were defined according to divisions in Taiwan's NHI fee schedule¹². Appendix 1 displays the items for reimbursement included in each of these insurance categories. We analyzed each expense category to show overall spending on separate cost drivers, and also to show expenses by the cohort subgroups.

Finally, we retrieved a breakdown of wound care materials consumed by the CGMH burn patients during their entire recovery. This dataset covered materials used from June 27, 2015 to February 29, 2016. Using this breakdown, we calculated material fees with price per dressing unit figures. Additionally, we calculated the cumulative surface area treated with dressings and skin substitutes, and also the costs by patient cohort (burn %TBSA ≥ 50 or < 50) for each wound care material subcategory.

Results

The expense records for patient burn treatment between June 27th, 2015 and September 30th 2015 at CGMH included 22 male (46%) and 26 female (54%) patients. Patient age ranged from 15–37 years with a mean of 22 ± 4.6 years. The mean percent TBSA was $43.5\% \pm 20$, and the mean length of hospital stay was 57 ± 29.6 days, with a mean number of times admitted of 1.33. Each 1% TBSA burned corresponded to a mean hospital stay of 1.34 days. Seven patient expense records included intubation charges, 7 reported fasciotomy procedures, 14 recorded debridement, and 40 reported STSG fees. One expense record included ECMO use for cardiomegaly with heart failure, and 2 reported amputations. Two patient accounts recorded deaths owing to sepsis and organ failure, giving a mortality rate of 4.2 %. (Table 1)

The total cost of burn care for the patient cohort at CGMH during this time period was \$2,440,688, with a mean total cost per patient of $\$50,848 \pm \$36,438$, (range \$3,153 – 145,622). The mean total cost per day of hospitalization was \$863. In addition to housing patients in its Burn Center ICU and Burn Ward, the hospital's emergency planning service established a new, temporary adjunct ICU (20 beds) to accommodate the influx of mass burn patients. The average cost for ICU (Burn ICU and Adjunct ICU) rooms was \$186/day, and average cost for the unit wards was \$167/day. The mean cost of care per 1% of burn surface area in this population was \$1,079. (Table 2) The total individual cost per patient by %TBSA is graphed in Figure 1.

Differences in expense contributions based on %TBSA patient groups are also highlighted in Table 2. The 20 patients with %TBSA ≥ 50 consumed \$1,559,300 (63.8%) of CGMH's expenses, at an average cost of $\$77,965 \pm \$34,226$ per patient. The 28 patients with %TBSA < 50 consumed \$881,387 (36.1%) of care expenses, at an average cost of $\$31,478 \pm \$23,518$ per patient. Mean cost per day and per 1% burn area in the %TBSA ≥ 50 group were \$1,181

and \$1,204 respectively, whereas in the patients with %TBSA <50 these were \$636 and \$989.

The three main cost drivers for the whole patient cohort (n=48) were inpatient ward fees (30%), therapeutic treatment fees (22%), and medication fees (11%). These same three cost drivers also represent the highest fee categories in the %TBSA ≥50 population at 28%, 20%, and 13% respectively. They were also the three largest cost sources for the patients with %TBSA <50, measuring 34%, 25%, and 9%, respectively. (Figure 2)

CGMH spending totals during the acute treatment period according to NHI reimbursement categories appears in Table 3. Overall spending on inpatient ward fees, therapeutic treatments, and medications was \$741,326, \$532,356, and \$277,978 respectively. Patients with %TBSA ≥50 contributed the majority of expenses in every cost driver category except psychiatric treatments.

Lastly, the wound dressing and skin substitute materials used longitudinally from the burn event until February 29, 2016 were Allevyn, Duoderm, Aquacel, Comfeel, Acticoat, Biobrane, Mepilex, cadaver skin, and silicone sheets. The total area treated with wound care materials was 300.7 square meters. Of this total area, 244.5 square meters (81%) were required by the 20 patients with a %TBSA ≥50. The overall cost of these materials was \$211,706 for the entire patient cohort and \$162,794 for patients with a %TBSA ≥50. (Table 4)

Discussion

In a previous study, the experience from CGMH in response to the Formosa Color Dust explosion in Taiwan was used to highlight the importance of advance preparation in the management of mass casualty burn scenarios¹⁰. Budgeting for the cost of caring for patients injured in a burn event is an important component of disaster planning. Previous studies investigating the cost of burn care at local institutions have identified potential sources of high expense in burn care management^{4–6,13,14}. However, these analyses do not completely apply to the care of patients after a mass casualty incident owing to the extensive amount of hospital resources and manpower required. Therefore, our cost analysis of direct inpatient expenses for those treated at CGMH after the Formosa Color Dust explosion provides insight into the distribution of hospital resources utilized in a mass burn scenario.

We found the inpatient ward cost (30%) represented the largest overall direct expense for treating the burn patients. This result is consistent with previous cost studies that have examined the economic management of typical burn populations^{2,5}. In our study, we found that for each day added to a patient's stay, the patient care and facility fees included in this category contributed the largest additional proportion to overall costs. Inpatient therapeutic treatment fees (22%) were shown to represent the second highest overall cost driver in the mass burn patients. This fee category covered many of the routine inpatient therapeutic burn treatments, such as debridement, dressing and wound management, occlusive dressing applications, hyperbaric oxygen therapy, ventilator use, ECMO management, all catheterizations, and vitals monitoring. The separation of this fee category from the inpatient

ward fees provides added clarity to the true cost management of this mass burn event. Many burn studies group both facilities and treatments together in the same cost category^{5,14,15}. However, our analysis shows the separate fee proportion between the ward costs versus the therapeutic treatments. According to this analysis, about one-third of patient expenses were from the ward facility fees, whereas one-fifth were from the therapeutic treatments. Therefore the ward fee for each added day of hospitalization drove costs at a higher rate than the separate fee for the treatments given to patients.

Medication fees were found to be the next most expensive category in this patient cohort (11%), followed by surgery fees (10%), and dressing materials (8%). Previous cost studies have noted surgery² and artificial dressing materials^{6,16} as the expensive components of burn care. In this study, the high medication cost category may have resulted owing to the unique nature of mass casualty burn care. Typical burn management for the treatment of individual burn patients encourages early excision and auto-grafting to reduce the risk of infection^{6,17,18}. However in mass casualty scenarios, the initial rapid influx of burn patients paired with a greater severity of burn injuries increases the difficulty of providing early excision and auto-grafting to every patient^{16,18}. As a result, the patients injured in the Taiwan event required increased and prolonged use of variable antibiotics and antifungal agents, and experienced additional waiting time for artificial skin substitutes to become available. Because of this, medication fees became a higher cost driver in this patient cohort compared to the cohorts in previous burn studies^{2,6,16}.

In our analysis of CGMH patient burn surface area, we found that in virtually every category, the 20 mass burn patients (41% of 48 patients) with %TBSA ≥ 50 required the majority of hospital resources (63.8%). Although this subset represented less than half of the patients treated at CGMH, their resource consumption far exceeded that of patients with %TBSA <50 in overall costs (\$1,559,300 vs. \$881,387) and in costs per patient (\$77,965 vs \$31,478). Their cost per day was almost double the less severely burned patients' (\$1,181 vs \$636), indicating the higher daily demand they placed on hospital resources. Table 3 shows they also consumed the majority of hospital resources in 15 out of 16 cost driver divisions, and required over 60% of available resources in 11 of these categories. Because of this, our study agrees with Haikonen et al.'s observation that the resource burden of treating large burns increases sharply¹⁹. Their study proposed a non-linear relationship between burn size and resource consumption, with expenses per 1% TBSA much higher in patients with larger burns. However, our investigation of a mass burn cohort demonstrated a basic linear relationship between %TBSA and total cost (Figure 2, $R^2=0.654$). Mass casualty burn populations may absorb costs at a different rate compared to individual burn patients. For example, treating multiple patients with a %TBSA ≥ 50 may be more economically efficient due to the consolidation of hospital resources. This suggests hospitals equipped to treat influxes of mass burn patients can expect to allocate available resources in direct proportion to burn surface area.

To promote cost-effectiveness in burn care, researchers have recommended the mean length of stay per burn patient should not exceed more than 1 day per 1% TBSA burned^{6,20}. We found that all burn patients treated at CGMH from the dust explosion stayed in the hospital an average of 1.34 days per 1% TBSA burned. There are many possible explanations for the

increased hospital length of stay, and thus increased patient costs, associated with the mass casualty burn event in Taiwan. Most burn patients require treatment with artificial dressing materials and numerous operations⁶. In standard burn care for individual patients, these artificial dressing materials are readily available and surgical delays are minimal. However, mass casualty surges stress this efficiency⁷. The magnitude of the Taiwan event resulted in an influx of burn patients to 43 hospitals in Taiwan, with most patients requiring surgical treatment¹⁰. Hospitals in Taiwan ran out of both Biobrane and Allevyn after only one week¹⁰. Only 8.3% of CGMH patients received these substitutes at the initial treatment, leaving a few patients' wound coverage delayed until these artificial dressing materials could be imported from other countries 4 weeks later. Furthermore, cadaveric skin graft was limited initially; however, it was emergently imported by the government and reallocated to each hospital for wound coverage after debridement had been performed. These delays resulted in slightly extended hospital stays, and consequently inpatient ward charges assumed a larger portion of patient costs.

Preparing larger storehouses of these skin substitutes at a regional level may help reduce total expenditures during future mass burn surges. A previous study of CGMH's experience with this burn population recommended stockpiling at least 2 weeks' worth of dressing supplies to decrease wound treatment delays¹⁰. These CGMH patients had a mean burn surface area of 43.5%, or 8,700 cm² (at an average 20,000cm² body surface area in adults). A study by Horner et al. found that in patients with <40% burn, 1cm² of allograft was required per 1cm² of burn area²¹. By this estimate, a cohort of this size would require at least 417,600cm² of cadaver skin and other skin substitutes for initial treatment. Therefore for hospitals of CGMH's capacity, advance stockpiling of 450,000cm² (45m²) of these materials may improve treatment efficiency and avoid added ward costs after a mass burn.

As a final consideration, CGMH's mean expense of \$50,848 for each of the 48 mass burn patients in this three month period after the explosion represents a highly elevated expense in relation to Taiwan's annual healthcare budgeting. In the most recent report of Taiwan's per capita healthcare spending, Chan stated \$982 US per year was spent per patient in 2006, whereas the US per capita healthcare spending was \$6,714 in the same period²². Because the average spending on CGMH's mass burn patients was 50 times higher in comparison to Taiwan's annual per capita healthcare spending amount (\$50,848 vs. \$982), our study reinforces previous claims that more resources should be devoted to the prevention of burn injuries^{15,19,23}. The millions of dollars spent by Taiwan's hospitals on patient care for the 499 mass burn patients from Formosa Waterpark can justify more aggressive preventive measures. Further public education on combustible materials and the prevention of flash fires, or perhaps stricter regulations on chemical materials used at public events should all be considered.

This study has some limitations. Burn care expenses are difficult to quantify completely because of the complex and individual nature of burn treatments. Some of the patient expense records were incomplete due to reporting lapses, for instance during patient transfers between hospitals. Initial emergency room fees are also not reported in this study. Also, billing data differed from the clinical data in regards to patients requiring intubation, fasciotomy, and debridement. This suggests the overall expense of this mass burn event is

higher in actuality than the figures we reported. Furthermore, we provided a cost breakdown of dressing materials consumed to identify the materials that were most costly. Cadaveric skin may have represented a considerable portion of total dressing material expenses; however, the cost per unit of cadaveric skin was not reported in the dataset we received. In addition, clinical detail regarding the depth of patient burns and the extent of grafting procedures performed may have offered additional insight into the cost management of mass casualty burn patients, but these data were not available in this analysis. Finally, some of the factors influencing costs in Taiwan's health care system may not be generalizable to all countries because of international variations in health system protocols. However, more research on Taiwan's insurance model could yield value for other health care systems considering alternate approaches to cost control measures.

Conclusion

The results from this study offer guidance for future resource allocation in the wake of a mass casualty burn event. We found inpatient ward costs to be the most significant direct-inpatient cost driver for those treated at CGMH after the Color Dust explosion, followed by therapeutic treatment fees. Medication fees, surgery fees, and dressing material charges were also found to represent a large portion of inpatient costs. Following a mass casualty burn event, hospitals should be prepared to allocate the majority of costs to patients with a %TBSA ≥ 50 . In addition, because dressing materials and other supplies became limited and definitive wound coverage was delayed, it was medically indicated that extended antibiotic use was the appropriate treatment because of the open wounds. Future efforts towards cost-reducing methods should be directed at decreasing inpatient length of stay and reducing extended antibiotic use, while maintaining the quality of patient care. In preparation for a mass casualty event, we also recommend regionally stockpiling cadaveric allografts and skin substitutes with up to 45m² per large burn-treatment institution, which can contribute to improving patient outcomes and decreasing costs.

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Appendix 1. Taiwan NHI Reimbursement Categories

Cost Category	Explanation	Sample included items
Inpatient Ward	Fee per occupied bed day, facilities and administration fees, nursing care, building facilities fees, utilities, waste management, electronic record management, administration fees	Burn center ICU, regular ICU, burn ward, and regular acute ward fees, all nursing care, incidental ward materials
Therapeutic Treatments	Patient interventions and treatments	Debridement, wound dressings, wound management, line and tube placements,

Cost Category	Explanation	Sample included items
		respirator management, bronchoscopy, respiratory suctioning, heating lamp/blanket, ECMO circuit management, oxygen inhalation, CPAP/bi-PAP, HBOT burn treatment, special dialysis, CPR, cardioversion
Medications	All prescription medications	Antibiotics, pain medications, synthetic supplements, hormone treatments
Surgical Operations	All operating room procedures and materials required	STSG, fasciotomy, and amputation
Special Materials	Materials not included in routine patient care	Wound dressing materials such as Allevyn, Duoderm, Aquacel, Comfeel, Acticoat, Biobrane, Mepilex, cadaver skin, and silicone sheets
Blood and Blood Products	Blood and bone marrow transfusions	RBCs, plasma, platelets, pheresis products, bone marrow
Laboratory Testing	Lab tests, lab personnel, testing reagents, equipment, administration fees	Urinalysis, blood components, biochemical markers, toxicology, transfusion screening, immune function and assays, cardiopulmonary functioning, ultrasounds, EEG, biopsies, radioisotope scans/PET, endoscopy
Anaesthesia	Anaesthesia materials and management	Local and general anaesthetics, their administration, PACU recovery monitoring, anaesthesia for lab tests
Rehabilitation Treatments	Inpatient rehabilitation services	Physical therapy, occupational therapy, speech therapy
Physician Examinations	Patient evaluations, consults, treatment plan management	Daily examination fees for regular ward, burn wards, ICU beds, and discharge planning fees
Enteral Nutrition	Fee for enteral feedings, both normal and special diet	Osmolite nutrition supplement
Radiologic Treatments	All radiologic studies, image-guided procedures, radiation therapy	X-ray films, CT angiography, MRI contrast, stent placements, transcatheter procedures, radiation treatments, radiosurgery, ablation
Prescription Services	All pharmacy operations	Dispensing medications, adjusting prescriptions, medication refills, preparation fees, preparing TPN
Injections	Injection administration	IV Drip, arterial injections, TPN administration, Intraarticular injections
Psychiatric Treatments	All psychiatric services	Individual and group psychotherapy, psychiatric screening and evaluation, psychiatric nursing care
Hemodialysis	Dialysis treatments and fluid exchanges	Hemodialysis, pheresis procedures, CAPD, CVVH, blood lavage

Figure 1. Scatterplot graph of total patient costs according to %TBSA. Linear R^2 coefficient = 0.654.

Figure 2. Bar chart showing main cost driver categories in entire CGMH cohort, and %TBSA ≥ 50 , and %TBSA < 50 cohorts.

Table 1

Patient and Treatment Demographics *

Category	Value (% of cohort)
Gender	
Male	22 (46%)
Female	26 (54%)
Mean age (SD)	22.2 (4.6)
Mean % TBSA (SD)	43.5% (20)
9	2 (4%)
10–19	4 (8%)
20–49	22 (46%)
50	20 (42%)
Mean Hospital Length of Stay in days (SD)	57 (29.6) [†]
Mean Number of Times Hospitalized (SD)	1.33 (0.52)
Patients Receiving Intubation	7 (15%) [‡]
Patients Receiving Fasciotomy	7 (15%) [‡]
Patients Receiving Debridement	14 (29%) [‡]
Patients Receiving STSG	40 (83%)
Patients Receiving ECMO	1 (2%)
Patients Receiving Amputation	2 (4%)
No. of Patient Deaths	2 (4%)

* All NHI expense records were cross-checked with CGMH's patient accounts. Only verified patients' accounts from the acute treatment period were included in this study.

[†] A total of 7 patients remained hospitalized beyond September 30th.

[‡] Billing data differed from clinical data in regards to patients requiring intubation, fasciotomy, and debridement. Actual demographics (clinical data) of patients receiving the following interventions are: Intubation = 29, Fasciotomy = 23, Debridement = 43.

Table 2**Acute Treatment Period Cost Statistics (in \$USD)**

Cost Metrics	Total Cohort	(SD)*	%TBSA	50	(SD)*	%TBSA <50	(SD)*
Total Cost of Burn Care	2,440,688		1,559,300			881,387	
Total Cost per Patient	50,848	± 36,438	77,965	± 34,226		31,478	± 23,518
Patient Cost Per Day of Hospitalization	863	± 468	1,181	± 528		636	± 236
Patient Cost Per ICU/Burn ICU Ward Day	186	± 4	186	± 5		187	± 4
Patient Cost Per Burn Ward/General Ward Day	167	± 71	199	± 39		144	± 64
Patient Cost per 1% Burn Area	1,079	± 500	1,204	± 443		989	± 527

* SD values represent the spread of individually calculated patient means.

Table 3**Acute Treatment Period Cost Drivers Breakdown (\$USD)**

Category	CGMH Cohort (N=48)		%TBSA 50 (N=20)		%TBSA <50 (N=28)	
	Category Total Cost	Category Subtotal*	Category % †	Category Subtotal*	Category % †	
Total Inpatient Ward Fees	741,326	439,695	59%	301,631	41%	
Therapeutic Treatments	532,356	317,635	60%	214,721	40%	
Medications	277,978	195,489	70%	82,489	30%	
Surgical Operations	234,658	170,411	73%	64,247	27%	
Wound Care Materials	190,732	138,002	72%	52,730	28%	
Blood and Blood Products	118,996	88,238	74%	30,758	26%	
Laboratory Testing	98,534	63,542	64%	34,992	36%	
Anesthesia	93,986	61,199	65%	32,787	35%	
Rehabilitation Treatments	62,082	34,259	55%	27,823	45%	
Physician Examination	59,839	31,969	53%	27,870	47%	
Enteral Nutrition	9,297	6,397	69%	2,900	31%	
Radiologic Treatments	8,690	5,607	65%	3,083	35%	
Prescription Services	7,692	4,068	53%	3,624	47%	
Injections	3,737	2,385	64%	1,352	36%	
Psychiatric Treatments	699	322	46%	377	54%	
Hemodialysis	83	83	100%	0	0%	

* Dollar amounts indicate the contribution of each patient group to total spending in a cost category.

[†] Percentages express the patient group category subtotal divided by category total cost.

Table 4**Wound Dressing and Skin Substitute Materials Breakdown ***

Cohort	Allevyn	Duoderm	Aquacel	Comfeel	Acticoat	Biobrane	Cadaver	Mepilex [†]	Silicone Sheet [†]	Sulfadiazine [†]
CGMH										
Units[‡] Applied	28.34	139.48	80.52	8.75	18.56	21.84	3.17	not specified	40	2488
Expense	\$10,142	\$29,995	\$50,433	\$6,337	\$35,174	\$33,594	not reported	\$212	0	\$45,819
%TBSA 50										
Units[‡] Applied	16.46	116.03	64.86	8.06	15.84	20.8	2.48	0	34	1477
Expense	\$5,894	\$24,953	\$40,625	\$5,832	\$30,019	\$28,271	not reported	0	0	\$27,200
%TBSA <50										
Units[‡] Applied	11.88	23.45	15.66	0.69	2.72	1.04	0.69	not specified	6	1011
Expense	\$4248	\$5,042	\$9,808	\$505	\$5,155	\$5,323	not reported	\$212	0	\$18619

* The wound care materials breakdown covers a longer period than the 3-month acute phase cost study period. This is because the wound materials dataset had a different origin and was collected separately from the NHI acute phase expense records. All dressings and skin substitutes included here pertain to the time period June 27 2015 until February 29 2016. It was not possible to limit this cost dataset to the same three-month time period. Seven patients remained at CGMH beyond the three-month time period; therefore, this longitudinal cost of wound care materials appears slightly larger than the NHI-based acute phase expenses.

[‡] Units= square meters

[†] Units for Mepilex, Silicone Sheets, and Sulfadiazine were unspecified.