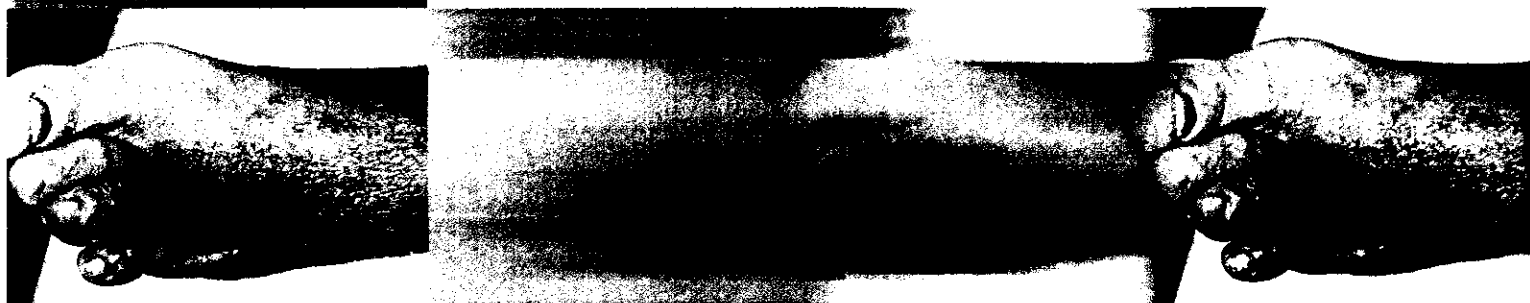


CONTEMPORARY TOPICS
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THE ROLE OF "WOUND BURDEN" IN DETERMINING THE COSTS ASSOCIATED WITH WOUND CARE

Matthew Q. Pompeo, MD

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The Role of "Wound Burden" in Determining the Costs associated with Wound Care

- Matthew Q. Pompeo, MD

ABSTRACT

Because of the tremendous resources they require to heal, patients with severe wounds present significant challenges to our healthcare system. This study was undertaken to introduce the concept of "wound burden" and its predictive value in anticipating the costs associated with inpatient care for patients with wounds. Wound burden is a new concept that can be used to represent the severity of a patient's skin breakdown; it is defined in this study in terms of number, size, and stage.

A computerized system of wound cost tracking measured the costs involved in delivering optimal wound care to 240 patients in a long-term acute care facility. Patients were stratified in a system that accounted for "wound burden" to determine the degree to which wound burden is related to costs. Costs that pertained to supplies, specialty beds, nutrition, labs, and extra personnel time required to document and care for the wounds were recorded. The concept of "wound burden" was presented and found to be very important in predicting actual costs. Patients with the highest level of wound burden were found to have significantly higher wound costs and total stay costs ($P > 0.0001$). As payment systems change, having data available to justify the resources necessary to allow facilities to continue to care for the most highly wound burdened patients will become increasingly important.

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As modern medicine makes great strides in extending longevity, it also makes possible the survival of increasing numbers of compromised patients who sometimes sustain horrific wounds. The cost of caring for these most frail individuals in a manner that prevents further injury and allows previous injuries to heal is very high because of the multiple factors that must be controlled – namely, wound environment, pressure relief, nutrition, and comorbid conditions. As the population continues to age as "baby boomers" reach maturity, the costs of caring for these patients will increase greatly.

Optimal care for patients with severe wound problems is often provided in long-term acute care (LTAC) facilities. Unlike acute care hospitals, which benefit by keeping the stays as short as possible, LTAC facilities' diagnostic related group (DRG) exempt status mandates an average length of stay of 30 days. Stays of several weeks or more are usually necessary to allow patients with severe wounds enough time to accomplish significant healing. Long-term acute care facilities excel in caring for these patients because their reimbursement rate allows them to provide the resources and length of stay necessary to allow healing. This combination of resources and longer length of stay separates LTAC facilities from skilled facilities (nursing homes), which often lack critical resources of personnel and equipment, and acute care hospitals, which are not able to provide the necessary time for healing.

Long-term acute care facilities receive patients leaving the acute care hospital environment to continue healing and recuperation before going home or to a skilled unit, as well

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as nursing home patients who have developed wounds and must go to a more empowered setting to try to heal.

Literature Review

The true total cost of wound care in the United States annually is unknown. Studies that have attempted to extrapolate the cost probably grossly underestimate the actual amount. Existing literature underestimates the total cost for several reasons. Even with these limitations, estimates for the yearly cost of wound care for hospital-acquired wounds in acute care hospitals alone are as high as \$3.6 billion.¹

The most glaring shortcoming in most of the studies is that costs are estimated based on acute care hospitals.²⁻⁶ These studies estimate costs to the acute care hospital, but do not estimate total cost of healing, especially for Stage IV wounds that almost never heal in the shortened stays now more prevalent in acute care hospitals. Because the acute care hospital stay is often not the time in which the majority of healing occurs, the cost incurred in LTAC facilities is a very important component of the total cost of wound care.

A second major limitation is that studies often utilize central databases by ICD 9-CM codes, such as 707.0 for decubitus.⁷ This greatly underestimates incidence because many pressure ulcers are not coded. Guralnik found that only one in six patients with a pressure ulcer had it listed as a diagnosis.⁸

This study presents costs representative of care in LTAC units. However, the purpose is not to try to estimate national costs, but instead to try to predict, based on clinical descriptions of wounds, what the cost to the LTAC hospital will be on a per patient basis. Most importantly,

this study divided the groups more accurately than other studies using only a single descriptor, such as wound stage. Specifically, the patients in this study were divided according to stage as well as size and number of wounds (wound burden). As the data show, a huge difference exists between the resources needed to care for a patient with a small Stage III or IV wound and one with multiple advanced wounds. No other literature describes cost utilizing a concept of "wound burden."

Purpose

Because LTAC facilities will likely be reimbursed on a DRG-type system at some point in the future, this study was undertaken to relate the costs of modern wound care to objective clinical data. Eventual LTAC DRG payments must be based on reality and not on arbitrary committee assumptions of nonclinicians. Most importantly, LTAC facilities currently represent an oasis-like healing environment, where patients are given the time and resources to allow healing. Costs for a given patient must be predictable and reimbursed fairly to allow the LTAC oasis to continue to exist.

The study hypothesis was that caring for frail patients with large wounds is very expensive.

Methods

The following "wound burden" scale was created as a way to better describe the actual burden of wounds of a patient and predict the costs of caring for the wounds. This scale was used for all types of wounds and is based on the author's observation that as wounds approached these larger sizes and numbers, they required many more resources (see Table 1 for the wound burden scale and Table 2 for AHCPR staging classifications).

This paper will validate a system of categorization based on wound burden as tested prospectively in more than 200 patients. As clinicians move toward achieving more efficiency in delivering wound care, stratifying patients accurately will become increasingly important.

Wound Care

A computerized database (Odyssey, KCI) was utilized to prospectively gather data on the wound care for 206 patients in a LTAC facility. The data included all patients with Stage II, III, or IV wounds admitted to the facility in 1998. Wound

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KEY POINTS

- For a variety of reasons, the nationwide cost of wound care remains largely unknown, and prospective payment or diagnosis-based reimbursement systems may underestimate the actual cost of care for persons with different types of pressure ulcers.
- To test the author's hypothesis that caring for people with extensive wounds is more expensive than managing people with more shallow and less extensive wounds, a wound burden scale was created. To test its validity as a predictor for cost of care, wound and cost data was prospectively collected on 206 patients in one long-term acute care facility.
- Significant differences were found between the daily wound care and total patient stay costs of patients with a low versus a high wound burden, and costs increased with every increase in wound burden class.

care was provided by a physician-led wound team comprised of physical therapists and nurses dedicated solely to wound care. The philosophy of the program was to proceed as rapidly as possible through the inflammatory stage of wound healing, which often entails physician-administered sharp debridement in appropriate patients. Very little enzymatic debridement and no growth factors, electrical stimulation, or hyperbaric oxygen treatments were utilized. Specialty approaches such as vacuum-assisted closure were utilized on some large cavitory wounds. Pulsatile lavage was used occasionally. Collagen was used on many smaller clean wounds to stimulate granulation. Moist wound healing was utilized by appropriate dressing selection, such as hydrocolloids, hydrogels, and film dressings as dictated by the individual properties of each wound. Nutritional parameters were followed very closely by the dietitian and wound physician with an emphasis on increasing calories and protein as necessary based on serum pre-albumin or albumin and weight gain. Specialty surfaces were most often low-air-loss, with some use of air-fluidized therapy among patients who did not improve on low-air-loss therapy.

Therapists and a dedicated wound nurse gathered data for all wound patients with Stage II or higher wounds in the facility. The cost data included wound care supplies, nutritional products, and specialty beds; an additional feature allowed time for the personnel, beyond routine nursing, for wound care treatment and documentation. To generate cost data, prices for each product were entered into the database and the program showed actual costs for the various treatments used for each patient. Costs were defined as the cost of supplies to the facility, not what charges were to be generated.

After the various categories and total cost for each patient were determined, the patients were stratified into groups based on their wound burden scale, and the costs were examined to determine the relevance, if any, of their wound burden. The gathering of this data did not require any deviation from the usual wound data gathered on these patients and in no way compromised the patients' rights or dignity.

Multiple statistical techniques were used to help describe the study data and results, including descriptive statistics and analysis of variance (ANOVA). Descriptive statistics included frequencies and the average and amount of variation (standard deviation) associated with the various continuous measures of length of stay, daily

**TABLE 1
WOUND BURDEN SCALE**

| Stage/Size (area) | Class |
|--|-------|
| Stage II less than 5 sq cm | 1 |
| Stage II greater than 5 sq cm | 2 |
| Multiple stage II or single Stage III less than 5 sq cm | 3 |
| Stage IV less than 5 sq cm | 4 |
| Stage III or IV greater than 5 sq cm or Multiple Stage III or IV | 5 |

Area refers to the product of length x width as measured by standard institution routine.

**TABLE 2
AHCPR STAGING CLASSIFICATIONS**

| | |
|------------------|---|
| Stage I | Nonblanchable erythema of intact skin |
| Stage II | Partial-thickness skin loss involving epidermis, dermis, or both |
| Stage III | Full-thickness skin loss involving damage or necrosis of subcutaneous tissue that may extend to, but not through, underlying fascia |
| Stage IV | Full-thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures |

cost related to wound care, total cost per patient stay for wound care, and total patient stay cost within each wound-burden class.

Next, a one-way ANOVA was performed to determine if the averages among the wound-burden classes were statistically different, followed by Duncan multiple range test to determine which classes were different from each other.

Results

Table 3 shows the number of patients in various wound burden classes, each class's average length of stay, average daily cost of wound care, average total stay cost for wound care, and average total cost per patient stay. The *P*-values from analysis of variance testing appear at the bottom of the table. The Duncan multiple range test indicates that the average length of stay, average wound cost per day, average total cost of wound care, and average total patient stay cost in wound burden class 5 are significantly higher than in classes 1 through 4. Classes 1 and 2

have significantly shorter lengths of stays and total wound care costs than classes 3 and 4.

Classes 1, 2, and 3 have significantly shorter average wound costs per day and average total patient stay costs than class 4. Because this population

had high wound burdens, the costs for the highly wound-burdened patients are based on a large number of patients.

Figure 1 shows the escalation in daily wound care costs as a function of wound burden. Figure 2 shows the escalation in total stay wound costs as a function of wound burden. Note that these costs are only for wound care, not the total costs in caring for the patient. To appreciate how the wound care costs relate to total patient cost, data from the study LTAC facility and a second LTAC facility over the same time period were averaged for various categories not directly related to wound care. Table 4 shows average daily costs for all patients (with and without wounds) for various categories representing 4,009 patient days in two separate LTAC facilities. The relationship of these nonwound costs compared to costs attributed to the wound care is shown in Figure 3.

TABLE 3
THE EFFECT OF WOUND BURDEN CLASS ON LENGTH OF STAY AND VARIOUS COSTS

| Wound Burden Class | Number Patients | Average Length of Stay (days) | Average Daily Cost Related to Wound Care (\$) | Average Total Cost for Wound Care (\$) | Average Total Cost per Patient Stay (\$) |
|--------------------|-----------------|-------------------------------|---|--|--|
| 1 | 6 | 28.0 | 19.92 | 451 | 20,135 |
| 2 | 16 | 38.6 | 48.01 | 1,483 | 28,592 |
| 3 | 27 | 41.9 | 91.16 | 4,194 | 33,667 |
| 4 | 71 | 44.1 | 144.35 | 7,207 | 38,228 |
| 5 | 89 | 57.3 | 239.62 | 14,670 | 54,954 |
| Total | 209 | | | | |
| P-value* | | 0.0003 | < 0.0001 | 0.001 | < 0.0001 |

*Analysis of variance.

The cost of the wound care is a significant portion of the total care for the higher wound burdens. Heavily wound-burdened patients tend to have longer stays and higher total daily costs, which together produce higher total stay costs as shown graphically in Figure 4.

Discussion

The cost of caring for a patient with wounds is very much influenced by the wound burden. Numerous and large wounds require more supplies, personnel time to treat and document, special equipment, procedures, and often intensive nutritional intervention. As payment systems are created for both inpatient and outpatient populations, they should more accurately reflect the true costs of properly caring for heavily wound-burdened patients. If compensation for heavily wound-burdened patients is not adequate, facilities either have to jeopardize their own existence by taking financial losses on the patients, or provide inadequate care that is detrimental to the patients

and could result in catastrophic settlements against facilities in today's legal environment. A better option in a climate of inadequate reimbursement would be to have facilities not accept heavily wound-burdened patients.

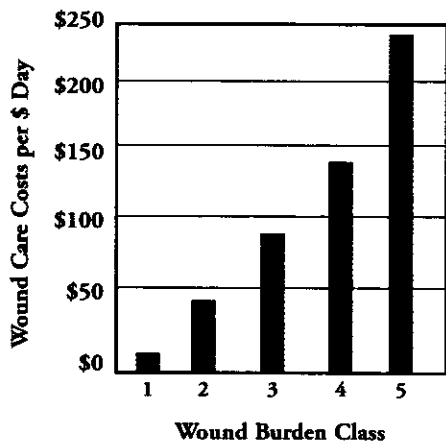


Figure 1
This graph depicts escalation in daily wound care costs as a function of wound burden.

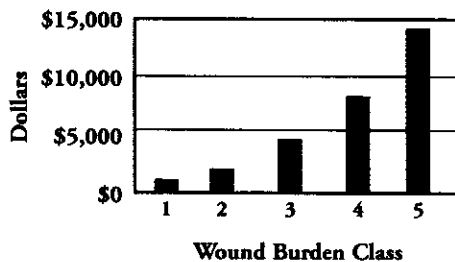


Figure 2
This figure shows escalation in total stay wound cost as a function of wound burden.

Although this study looked at costs in LTAC facilities that utilize more advanced therapies than nursing homes, undoubtedly, heavily wound-burdened patients require more resources in any setting. Dressings have to be changed, pressure has to be relieved, documentation must occur, and nutrition must be monitored closely. The nursing/nursing aid time alone is tremendous to adequately care for these patients. Even a highly restricted and discounted formulary of wound products and specialty beds cannot negate the reality of the resources necessary to care for these patients. Skilled nursing units may not be able to provide even adequate basic care as described in AHCPR guidelines if wound burden is not accounted for and reimbursed fairly. Home care nursing agencies have similar challenges in caring for heavily wound-burdened patients.

Another issue this data suggests is that reduction of wound burden is in itself beneficial because it predicts cost savings in ongoing care of the patient. The Food and Drug Administration currently generally recognizes wound closure only as the primary endpoint in wound studies. Although wound closure is the ultimate, most desirable outcome, it is not a realistic goal for many of the heavily wound-burdened patients, especially over time periods of 30 to 60 days – the upper range for which patients can remain in a LTAC facility. Because most nursing homes do not have the resources to care for, document, and support the needs of a heavily wound-burdened study population, doing studies on wound patients with severe wounds that follow them to closure is

TABLE 4
AVERAGE DAILY COSTS FOR ALL PATIENTS (WITH AND WITHOUT WOUNDS) FOR VARIOUS CATEGORIES

| Cost Area | Average daily cost (\$) |
|-----------------------------|-------------------------|
| Overhead/personnel | 485 |
| Pharmacy | 94 |
| Respiratory | 19 |
| Lab, X-ray, EKG | 41 |
| Occupational/speech therapy | 19 |
| Dialysis/procedures | 45 |
| Total | 703 |

Representing 4,009 patient days in two separate LTAC facilities.

difficult. Essentially, the author's system moves them through different facilities based on what will be allocated financially to their care rather than on what is the best care environment for their needs.

Study Limitations

Actual individual cost data were not collected for the nonwound costs such as respiratory care in patients with wounds. Instead, average costs for patients with and without wounds from two institutions were averaged. Data from a second facility were included to give as large a sample of costs from the LTAC community as possible (4,009 patient days represented). Because it has

been the author's consistent empiric observation that heavily wound-burdened patients have more comorbid conditions, this data probably underestimate the total costs of care for the heavily wound-burdened patients due to the fact that pooled averages of nonwound care costs were used instead of actual costs for the patients.

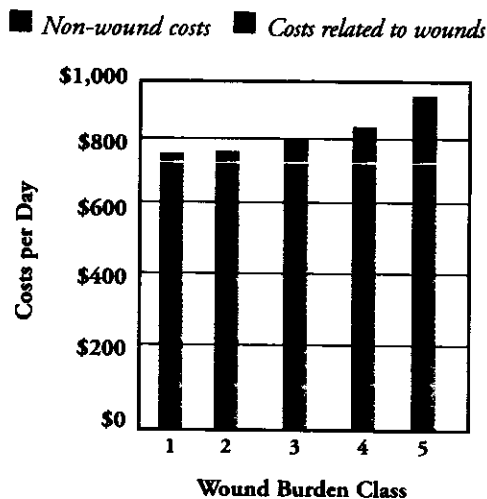


Figure 3
This figure shows the relationship of nonwound care costs compared to wound care costs.

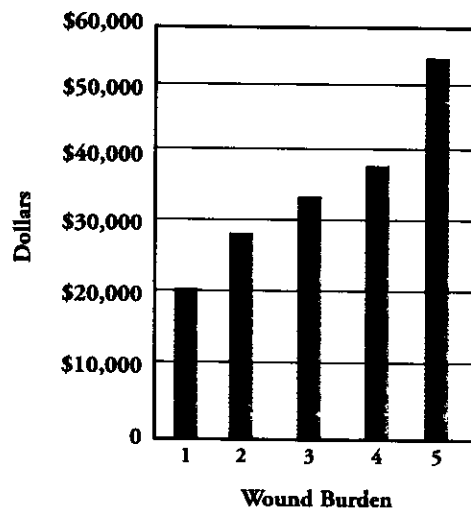


Figure 4
This graph shows that heavily wound-burdened patients tend to have longer stays and higher total daily costs, which together produce higher total stay costs.

Additionally, the wound burden scale used here did not have a category high enough to stratify for the most severe patients seen, such as those with Stage IV wounds greater than 20 cm². This was realized in retrospect, but when this project was started, a widely known system in place to categorize based on a concept of wound burden as related to costs was nonexistent. The author believes that presentation of this data as obtained is important to introduce the concept of wound burden versus cost so that more refinements in this scale can be made or another scale could be studied.

Conclusion

This study validates that the concept that wound burden is highly correlated with costs of wound care as presently applied in LTAC environments. Hopefully, this study will stimulate further validation in other institutions. With LTAC facilities likely facing payment based on DRG-type diagnoses sometime in the future, understanding and demonstrating the relevance of wound burden to costs is important. Any DRG-type system that is eventually proposed for LTAC patients should stratify payment with some system that encompasses "wound burden." This data gives a baseline estimate of current costs based on more than 200 wound patients and 4,000 patient days of care.

The concept of wound burden also can be utilized in comparing outcomes and patient acuity. Without some standardized measurement of wound burden, comparing different systems of care is difficult. Hopefully, this area of research will expand and force payor sources to recognize and account for these costs when future payment rates are created, thus allowing the "oasis of wound healing" present in LTAC environments to continue to exist.

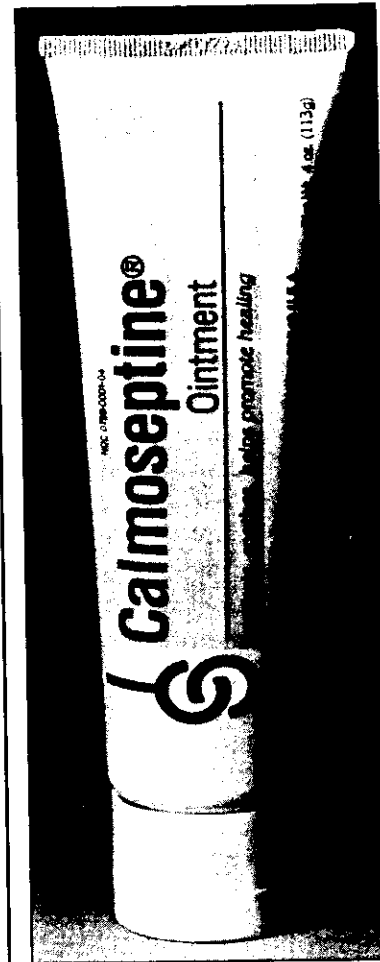
Acknowledgment

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