ASSOCIATION OF INJURY FACTORS, NOT BODY MASS INDEX, WITH HOSPITAL RESOURCE USAGE IN TRAUMA PATIENTS

By Felecia A. Lee, PhD, Ashley M. Hervey, MEd, Gina M. Berg, PhD, David L. Acuna, DO, and Paul B. Harrison, MD

Background Allocating resources appropriately requires knowing whether obese patients use more resources during a hospital stay than nonobese patients.

Objectives To determine if trauma patients with different body mass indexes differed in use of resources measured as a multifaceted outcome variable.

Methods A trauma registry was used for a retrospective study of adult patients admitted to a midwestern level I trauma center. Patients were stratified into 3 groups: nonobese (normal weight, overweight), obese, and morbidly obese. Three canonical correlation analyses were used to determine the relationship between patient/injury characteristics and hospital resource usage.

Results In a sample of 9771 patients, 71.2% were nonobese, 23.8% obese, and 5.0% morbidly obese. For patient/injury characteristics, Injury Severity Score and physiological complications were significant variables for all 3 groups. Scores on the Glasgow Coma Scale were significant for nonobese patients only. For resource usage, intensive care unit length of stay and procedures were significant variables for all 3 groups.

Conclusions Associations between body mass index and outcomes have been noted when assessed as independent variables. However, when resource usage was assessed as a multifaceted outcome variable, injury factors (higher Injury Severity Score, lower scores on the Glasgow Coma Scale, more physiological complications) were associated with resource usage (increased length of stay in the intensive care unit and increased number of procedures). These findings provide clinicians a new perspective for evaluating the complex relationship between patient/injury characteristics and hospital resource usage.

Trauma is the most common cause of mortality for persons 1 to 45 years old and is the third leading cause of death in the United States. Obesity is a national epidemic that affects all aspects of health care, including trauma care. According to the Centers for Disease Control and Prevention, 35.1% of US adults 20 years old and older are obese (body mass index [BMI], calculated as weight in kilograms divided by height in meters squared, > 30), and 69% are overweight (BMI > 25). Obesity is a major health concern because of its established relationship with serious medical diseases and increased likelihood of comorbid conditions (eg, diabetes mellitus, hyperlipidemia, heart disease, pulmonary disease). As the number of obese adults continues to increase, the potential number of obese trauma patients with severe injury and complications will also increase.

Management of prehospital and in-hospital trauma care, including complications associated with airway management, surgical procedures, and radiological imaging, of obese patients can be challenging. However, published reports on how obesity complicates hospital stays after trauma are conflicting. Several studies have indicated that obese trauma patients are more likely than nonobese patients to have longer stays in the intensive care unit (ICU) and hospital, more days of mechanical ventilation, more complications, and comorbid conditions, and higher mortality. Other studies have indicated no differences between obese and nonobese patients in mortality, length of stay in the ICU and the hospital, duration of mechanical ventilation, complications, or comorbid conditions.

Care of critically ill trauma patients is resource intensive, technically involved, and expensive because of the need for highly trained staff and modern equipment and the use of diagnostic tests, pharmaceutical agents, and interventions. Allocating resources appropriately requires knowledge of whether or not obese patients use more resources during their hospital stay than do nonobese patients. The ability to reliably predict or assess resource needs according to the population of patients is a starting point for good internal management of resources. In previous research on the effect of a patient’s BMI on resource usage, each usage outcome was assessed independently of other resource usage variables. In those studies, resource usage was evaluated as a secondary outcome by using familiar statistical analyses (t test, analysis of variance, regression analysis) suitable for the research questions. However, in order to best ascertain the association between the complex, multifaceted relationship of patient/injury characteristics and hospital resource usage, the use of multivariate canonical correlation analyses is suggested. Multivariate canonical correlation is beneficial for this analysis because it allows the grouping of variables into 2 sets to identify unique relationships between patient/injury characteristics and hospital resource usage.

Therefore, the purpose of our study was to examine the relationship between patient/injury characteristics and hospital resource usage across BMI categories in a population of trauma patients.

Methods

Patients and Setting

The study was a retrospective review of data in a trauma registry of all adult trauma patients (≥ 18 years old) admitted between 2004 and 2012 at a midwestern level I trauma facility in a predominantly rural state. Exclusion criteria included patients with BMI less than 18.5 (underweight persons are physiologically distinct from persons of other weight classifications), patients who were dead on arrival, and patients with burns (physiological and clinical factors affecting outcomes differ between burn and nonburn patients). Additionally, patients transferred to another acute care facility before 1 week were...
excluded because their final outcomes were not indicated in the registry. Patients were also excluded if anthropometric data (height, weight, trauma registry–calculated BMI) were missing. Approval was obtained from all appropriate institutional review boards.

**Study Variables**

Demographic and clinical data were extracted from the trauma registry. Variables for univariate analysis included sex, race, BMI, mechanism of injury, mortality, and discharge destination. The selection of variables for multivariate analysis was exploratory and based on availability and on variables of interest. Variables representing patient/injury characteristics and hospital resource usage were grouped for statistical analysis. Patient/injury characteristic variables known to be associated with trauma outcomes included age, Injury Severity Score (ISS), and score on the Glasgow Coma Scale (GCS). Number of physiological complications (eg, cardiovascular, gastrointestinal, hematologic, hepatic/pancreatic/biliary/splenic, infectious, musculoskeletal/integumentary, neurological, pulmonary, renal/genitourinary, vascular), hypothesized to be related to resource usage because of increased complications for obese patients, was also included as an injury factor. Hospital resource usage variables included ICU and hospital (non-ICU) lengths of stay, and other. Number of procedures was included to assess “human” resources and included allergy/immunology, anesthesiology, cardiology, head and neck, emergency medicine, family practice, infectious disease, internal medicine, neurology, neurosurgery, obstetrics and gynecology, oral and maxillofacial surgery, ophthalmology, orthopedics, otolaryngology, psychiatry, pulmonary, radiology, renal service, surgery (general, hand, orthopedics, thoracic, trauma, vascular), urology, and other. Number of procedures was included to assess human and material resources; all procedures performed during the course of care were included (eg, surgical, diagnostic). Patients into 3 groups for analyses: nonobese (normal weight and overweight; BMI 18.50-24.99 and 25.00-29.99, respectively), obese (BMI 30.00-39.99), and morbidly obese (BMI > 40.00).

**Statistical Analysis**

The outcome was a composite variable of resource usage, including ICU and hospital lengths of stay, medical consultations, and procedures. Descriptive statistics were summarized by using frequencies (percentages) and means (standard deviations). Continuous variables were compared by using Kruskal-Wallis (nonparametric analysis of variance) and Mann-Whitney (nonparametric t test) tests with Bonferroni adjustments for multiple comparisons. Categorical variables were analyzed by using $\chi^2$ tests.

BMI stratifications were grouped into 3 categories on the basis of previous research for multivariate analysis: nonobese, obese, and morbidly obese. Analyses were completed on each weight classification. Statistical significance was set at $P < .05$. SPSS for Windows, version 20, software (IBM SPSS) was used for all analyses.

 Canonical correlation analysis is an exploratory multivariate statistical analysis of the correlation between 2 separate and distinct sets of variables. Data are obtained on each patient for each set of variables (patient/injury characteristics and hospital resource usage) to determine the dimensions in which the variables are related (see Figure). The optimal linear combination of 1 set of variables (canonical variate) is combined to produce, on each side, a predicted value that has the highest correlations with the predicted value on the other side (forming a pair of canonical variates). Canonical loadings (correlation values) are produced to measure the relationship between every observed variable and its canonical variate (composite). This statistical analysis can be thought of as creating multiple composite variables. In the study reported here, the individual variables age, ISS, GCS score, and physiological complications represent the first composite variable (patient/injury characteristics) and the individual variables ICU length of stay, hospital length of stay, medical consultations, and procedures represent a second composite variable (hospital resource usage). The analysis indicates the relationship between the 2 composite variables. Canonical correlation analysis is a useful technique when the underlying dimensions representing the combinations of variables are unknown.
The Glasgow Coma Scale score was a significant variable for nonobese patients only.

Results

Of the 9771 study patients in the final sample, 71.2% (n = 6958) were nonobese (3517 normal weight and 3441 overweight), 23.8% (n = 2329) were obese, and 5.0% (n = 484) were morbidly obese (Table 1). The majority, 61.9% (n = 6053) were men, and 89.1% (n = 8655) were white. The mean age was 45.88 years (SD, 21.5). The mean ISS was 10.77 (SD, 9.6). The most common mechanisms of injury were motor vehicle crash (33.8%), fall (33.1%), and other (33.1%; eg, sports injury, off-road vehicle). The majority of patients (77.3%) were discharged home, 19.3% were discharged to continued care, and 3.4% were discharged to nonhome sites (eg, mental health facility, other acute care hospital). Mean hospital length of stay was 3.12 days (SD, 4.9), and ICU length of stay was 1.47 days (SD, 3.6). The majority of the patients (95.3%) survived (Table 2).

Canonical Correlation Analyses

Canonical correlation analyses (Table 3) indicated the first canonical correlation pair was significant for the nonobese ($r = 0.76$; accounting for 58% of the variance), obese ($r = 0.77$; accounting for 59% of the variance), and morbidly obese ($r = 0.76$; accounting for 58% of the variance). This finding indicated that for each BMI classification, a significant linear association existed between patient/injury characteristics and resource utilization.

Patient/Injury Characteristics. ISS was a significant variable for the nonobese (0.61), obese (0.37), and morbidly obese (0.30) patients. Physiological complications were also a significant variable for the nonobese (0.94), obese (0.70), and morbidly obese (0.74). The GCS score was a significant variable for nonobese patients only (0.45). Age was not a significant variable in any analysis.

Hospital Resource Usage. ICU length of stay was a significant variable for the nonobese (0.50), obese (0.56), and morbidly obese (0.35) patients. Procedures were also a significant variable for the nonobese (0.54), obese (0.53), and morbidly obese (0.67). Neither hospital length of stay nor medical consultations were significant variables in any analysis.

Discussion

In this exploratory study, we used canonical correlation analysis to examine the relationship between patient/injury characteristics and hospital resource usage across BMI categories. Statistically significant results from preliminary univariate tests (Tables 1 and 2) indicated differences between BMI populations and justified separate canonical correlation analyses. Injury factors (ISS, GCS score [only significant in nonobese population], and physiological complications) were related to hospital resource usage. As ISS and physiological complications increased, ICU length of stay increased and patients required more procedures. These findings were similar across the obese and morbidly obese populations. The only significant differences were apparent in the nonobese population; GCS was a significant factor associated with hospital resource utilization in this group.

Injury factors accounted for the most variance in hospital resource usage in these trauma patients, and similar associations have been observed by others. Vincent et al. assessed differences in hospital resource utilization in terms of acute care length of stay, units of blood transfused, number of days of mechanical ventilation, and hospital charges between non–morbidly obese and morbidly obese patients and found no differences. BMI was not related to hospital resource usage, and ISS was highly predictive of length of stay and hospital charges. They concluded that orthopedic trauma teams can expect similar outcomes regardless of BMI in patients with acetabular fractures. Dhungel et al. determined that hospital length of stay, ICU length of stay, and duration of mechanical ventilation did not differ significantly between normal weight, overweight, obese, and morbidly obese patients. In addition, studies have indicated that with adjustments for ISS, BMI is not a significant factor in determining mortality. Furthermore, in many studies, obese patients had more complications than did nonobese patients.
Table 1
Characteristics of patients in the study

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total</th>
<th>Nonobese</th>
<th>Obese</th>
<th>Morbidly obese</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9771 (100)</td>
<td>6958 (71.2)</td>
<td>2329 (23.8)</td>
<td>484 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Age, mean (SD), y</td>
<td>45.88 (21.5)</td>
<td>45.80 (22.5)</td>
<td>46.27 (19.1)</td>
<td>45.23 (17.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Injury Severity Score, mean (SD)</td>
<td>10.77 (9.6)</td>
<td>10.95 (9.5)</td>
<td>10.49 (9.7)</td>
<td>9.53 (9.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Score on Glasgow Coma Scale, mean (SD)</td>
<td>13.60 (9.5)</td>
<td>13.52 (3.6)</td>
<td>13.75 (3.4)</td>
<td>13.92 (3.2)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Physiological complications, mean (SD)</td>
<td>0.36 (1.1)</td>
<td>0.33 (1.1)</td>
<td>0.42 (1.2)</td>
<td>0.45 (1.3)</td>
<td>.004</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>6053 (61.9)</td>
<td>4468 (64.2)</td>
<td>1382 (59.3)</td>
<td>203 (41.9)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Female</td>
<td>3718 (38.1)</td>
<td>2490 (35.8)</td>
<td>947 (40.7)</td>
<td>281 (58.1)</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.32</td>
</tr>
<tr>
<td>White</td>
<td>8655 (89.1)</td>
<td>6148 (88.9)</td>
<td>2080 (90.0)</td>
<td>427 (88.6)</td>
<td></td>
</tr>
<tr>
<td>Nonwhite</td>
<td>1056 (10.9)</td>
<td>769 (11.1)</td>
<td>232 (10.0)</td>
<td>55 (11.4)</td>
<td></td>
</tr>
<tr>
<td>Score on Glasgow Coma Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Severe (3-8)</td>
<td>1000 (10.2)</td>
<td>740 (10.6)</td>
<td>218 (9.4)</td>
<td>42 (8.7)</td>
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</tr>
<tr>
<td>Moderate (9-13)</td>
<td>453 (4.6)</td>
<td>368 (5.3)</td>
<td>77 (3.3)</td>
<td>8 (1.7)</td>
<td></td>
</tr>
<tr>
<td>Mild (14-15)</td>
<td>8312 (85.1)</td>
<td>5845 (84.1)</td>
<td>2033 (87.3)</td>
<td>434 (89.7)</td>
<td></td>
</tr>
<tr>
<td>Trauma type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.14</td>
</tr>
<tr>
<td>Blunt</td>
<td>9064 (93.0)</td>
<td>6438 (92.8)</td>
<td>2168 (93.3)</td>
<td>458 (95.0)</td>
<td></td>
</tr>
<tr>
<td>Penetrating</td>
<td>683 (7.0)</td>
<td>503 (7.2)</td>
<td>156 (6.7)</td>
<td>24 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Mechanism of injury</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Motor vehicle crash</td>
<td>3289 (33.8)</td>
<td>2193 (31.7)</td>
<td>879 (37.9)</td>
<td>217 (45.0)</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>3221 (33.1)</td>
<td>2375 (34.3)</td>
<td>702 (30.3)</td>
<td>144 (29.9)</td>
<td></td>
</tr>
<tr>
<td>Otherd</td>
<td>3214 (33.1)</td>
<td>2355 (34.0)</td>
<td>738 (31.8)</td>
<td>121 (25.1)</td>
<td></td>
</tr>
</tbody>
</table>

*Data are presented as number (percentage) unless otherwise specified. Percentages may not total 100 because of incomplete data, missing data, or rounding. Kruskal-Wallis and Mann-Whitney tests completed for means testing. χ² test completed for frequency analysis.


c Physiological complications include but are not limited to pulmonary, cardiovascular, gastrointestinal, hepatic/pancreatic/biliary/splenic, hematologic, infections, renal/gentourinary, musculoskeletal/integumentary, neurological, and vascular.

d Other: animal, assault, bicycle crash, drowning, electrical injury, fall, farm/heavy equipment, gunshot wound, motorcycle crash, off-road vehicle, other mechanism, pedestrian injury, plane crash, power equipment/machinery, railway injury, sports injury, stab wound, unspecified, watercraft injury.

nonobese patients. However, we found that within all populations (nonobese, obese, and morbidly obese), the number of physiological complications influenced ICU length of stay and number of procedures. In contrast to many researchers who investigated hospital resource usage as a single outcome (eg, total hospital length of stay, ICU length of stay), we used canonical correlation analyses to examine the complex relationship between patient/injury characteristics and the multifaceted nature of hospital resources.

In our study, nonobese patients differed slightly from the obese and morbidly obese patients; the GCS score was significantly associated with resource utilization in the nonobese group. These results are not surprising, because obese patients sustain fewer head injuries than do lean trauma patients. We were unable to use GCS scores as a significant differentiating variable for the obese and morbidly obese patients because of the rarity of head injury within those populations.

**Clinical Implications**

Although the morbidly obese patients in our study did not use more resources than did the other groups, this population potentially requires different resources than do the nonobese and obese. Morbidly obese patients require changes in practice that entail increased individual cost for care (eg, nursing equipment such as beds, toilets, and lifting devices). Further, because of airway complications, some procedures, such as percutaneous placement of a tracheostomy tube, typically done at the bedside are moved to the operating room for the patient’s safety.

From the perspective of hospital management, identifying populations of patients who use more resources than do other populations is essential. Appropriate planning and identification of at-risk populations contribute to reduced cost for patients, hospitals, and health care systems by decreasing ICU and hospital lengths of stay. Length of stay is a useful indicator of resource usage in trauma patients, and because the trauma system is a dynamic one,
According to our results, the burden of resource usage falls on the critical care team because ICU length of stay, not hospital length of stay, was affected by injury factors in terms of ISS, GCS scores, and physiological complications regardless of BMI classification. Although only 3% to 5% of beds are located within the ICU, up to 30% of hospital budgets are spent on ICU resources.47-49 The reduction in ICU length of stay is an important aim of the critical care unit because longer stays increase risk for infection and are associated with a higher risk for in-hospital death.50

Strengths and Limitations

Strengths of our study include use of a large sample size reflective of US trends in overweight, obese, and morbidly obese patients: 64% of the patients cared for at our facility and 69% of the US population, respectively.4 The trauma registry is a clinical database that provides an in-depth collection of patient information. However, because the trauma registry was not designed specifically for research purposes, incomplete and missing data might have led to a potential bias in our study sample. Facility-specific guidelines and protocols for procedures and consultations also limit the generalizability of our findings.

Knowledge of demographic data contributes to the ability to plan resources.40 In addition, resources must be used effectively and efficiently to promote maximal opportunity for optimal recovery.46

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### Table 2

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Total (9771 (100))</th>
<th>Nonobese (6958 (71.2))</th>
<th>Obese (2329 (23.8))</th>
<th>Morbidly obese (484 (5.0))</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedures, mean (SD)</td>
<td>4.72 (5.0)</td>
<td>4.54 (4.7)</td>
<td>5.12 (5.5)</td>
<td>5.37 (5.9)</td>
<td>.01</td>
</tr>
<tr>
<td>Medical consultations, mean (SD)</td>
<td>1.07 (0.8)</td>
<td>1.06 (0.9)</td>
<td>1.09 (0.9)</td>
<td>1.13 (0.9)</td>
<td>.20</td>
</tr>
<tr>
<td>Days in intensive care unit, mean (SD)</td>
<td>1.47 (3.6)</td>
<td>1.4 (3.3)</td>
<td>1.7 (4.1)</td>
<td>1.9 (4.4)</td>
<td>.34</td>
</tr>
<tr>
<td>Days in hospital, mean (SD)</td>
<td>3.12 (4.9)</td>
<td>3.08 (4.9)</td>
<td>3.14 (4.4)</td>
<td>3.7 (7.1)</td>
<td>.73</td>
</tr>
</tbody>
</table>

**Injury location**

- Head and neck | 3652 (55.7) | 2698 (58.3) | 807 (50.7) | 147 (43.2) | <.001 |
- Face | 888 (13.5) | 691 (14.9) | 164 (10.3) | 33 (9.7) | <.001 |
- Chest | 1610 (24.6) | 1131 (24.4) | 397 (24.9) | 82 (24.1) | .90 |
- Abdomen or pelvic | 969 (14.8) | 640 (13.8) | 272 (17.1) | 57 (16.8) | .004 |
- Extremity or pelvic girdle | 2467 (37.6) | 1646 (35.6) | 652 (41.0) | 169 (49.7) | <.001 |
- External | 3498 (53.3) | 2462 (53.2) | 848 (53.3) | 188 (55.3) | .75 |

**Hospital disposition (nondeceased)**

- Home | 7173 (77.3) | 5133 (77.9) | 1716 (77.1) | 324 (70.9) | <.001 |
- Continued care | 1788 (19.3) | 1212 (18.4) | 453 (20.4) | 123 (26.9) |
- Nonhome | 314 (3.4) | 247 (3.7) | 57 (2.6) | 10 (2.2) |

**Mortality**

- Survived | 9314 (95.3) | 6614 (95.1) | 2238 (96.1) | 462 (95.5) |
- Died | 457 (4.7) | 9314 (95.3) | 2238 (96.1) | 462 (95.5) |

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### Table 3

**Canonical function loadings comparison**

<table>
<thead>
<tr>
<th>Canonical function 1</th>
<th>Nonobese (n = 6958)</th>
<th>Obese (n = 2329)</th>
<th>Morbidly obese (n = 484)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient/injury characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.13</td>
<td>-0.11</td>
<td>-0.12</td>
</tr>
<tr>
<td>Injury Severity Score</td>
<td>0.61</td>
<td>0.37</td>
<td>0.30</td>
</tr>
<tr>
<td>Score on Glasgow Coma Scale</td>
<td>-0.45</td>
<td>-0.2</td>
<td>0.21</td>
</tr>
<tr>
<td>Physiological complications</td>
<td>0.94</td>
<td>0.70</td>
<td>0.74</td>
</tr>
<tr>
<td><strong>Hospital resource use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days in intensive care unit</td>
<td>0.50</td>
<td>0.56</td>
<td>0.35</td>
</tr>
<tr>
<td>Days in hospital</td>
<td>0.06</td>
<td>-0.05</td>
<td>0.09</td>
</tr>
<tr>
<td>Medical consultations</td>
<td>0.07</td>
<td>0.03</td>
<td>0.06</td>
</tr>
<tr>
<td>Procedures</td>
<td>0.54</td>
<td>0.55</td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Canonical correlation</strong></td>
<td>0.76</td>
<td>0.77</td>
<td>0.76</td>
</tr>
<tr>
<td><strong>Variance accounted for,</strong> %</td>
<td>58%</td>
<td>59%</td>
<td>58%</td>
</tr>
</tbody>
</table>

a Denotes significant factor.42
b Squared canonical correlation.
In addition, comorbid conditions could not be accounted for in our analysis because of the incomplete data in the registry.

The statistical analysis we used has some limitations. Canonical correlation maximizes the correlation between sets of variables; however, the combination may not make sense theoretically.42 Findings must be interpreted with caution; both statistical and clinical significance should be taken into account. Canonical correlation is also especially sensitive to data involved in analysis. Outliers and which variables are included in analysis can dramatically affect results.42 Variables included in our analysis are frequently noted in trauma literature.

Future Research

Future research should include assessment of additional resources “consumed” in the hospital and after discharge, including care provided by caregivers, rehabilitation, and medical needs. In addition, further exploration of the multivariate approach to understanding hospital resource usage in terms of length of stay, procedures, complications, comorbid conditions, days of mechanical ventilation, hospital equipment/materials, and human resources is needed. Development of a composite weighted variable for assessing and standardizing hospital resource utilization would be ideal to accurately gauge hospital resource usage for a critically ill trauma population. Moreover, the inclusion of injury patterns, injury type (blunt vs penetrating), mechanism of injury (eg, falls vs motor vehicle crash), and measures of injury severity (Abbreviated Injury Scale, trauma activation) in the patient/injury characteristics variable set may potentially produce different results when hospital resources are reviewed as a composite variable. Cost should also be included in future analysis, to take into account financial resource utilization.

Conclusions

Our review of a level I trauma registry in a predominantly rural area revealed that injury factors, as assessed in terms of ISS and physiological complications, were associated with hospital resource usage across BMI categories, specifically an increase in ICU length of stay and number of procedures. Results for the nonobese population differed slightly from those for the other 2 groups in the study. Among nonobese patients, GCS score was also associated with outcomes. In the evolving health care environment, rather than assessing patient/injury characteristics and hospital resource usage independently, a composite approach should be used to accurately assess patient resource needs. Our findings provide a new perspective for evaluating the complex relationship between patient/injury characteristics and hospital resource usage.

ACKNOWLEDGMENTS

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FINANCIAL DISCLOSURES

None reported.

eLetters

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