Jeffrey P. Harrison
Colleen G. McLane

The Importance of Level 1 Trauma Services In U.S. Hospitals

Executive Summary

- Level I trauma centers provide important community services while facing a disproportionate burden of financial pressure since the delivery of high-intensity services and a constant state of readiness require substantial overhead costs.
- In comparison to hospitals without Level I trauma status, hospitals with Level I trauma are "likely to be found in larger organizations with a higher occupancy rate, and higher expenses per discharge."
- Trauma I centers are also "more likely to be located in markets with higher per capita income, fewer elderly patients, lower unemployment, and higher managed care penetration."
- In addition, they also tend to be larger in bed size, offer a wider range of clinical services, and have more managed care contracts.
- The authors outline the need for careful financial management of Level I trauma centers and public policy advocacy for better reimbursement rates in order to preserve this valuable community resource.
- In addition to efforts promoting other tertiary care services to increase volume, efforts to manage cost are also indicated such as interdisciplinary collaboration around clinical protocols and case management services to maximize patient outcomes and minimize the costs associated with complications and prolonged lengths of stay.

Traumatic injury is the fifth leading cause of death in the United States and creates a substantial burden on society in terms of lost productivity, increased disability, as well as the consumption of health care resources (Centers for Disease Control, 2004). As a result, trauma services are an area of personal, organizational, and public policy concern. According to Leikin and Lipsky (2003), trauma is defined by the American Medical Association as a physical injury caused by external force or violence. The two types of trauma include blunt trauma or falls and penetrating trauma caused by gun shots and knife wounds.

According to Finkelstein, Fiebelkom, Corso, and Binder (2004), U.S. medical expenditures attributed to trauma cost $117 billion in 2000, which is approximately 10% of the total U.S. medical expenditures. Further, trauma kills approximately 150,000 U.S. citizens and more than 400,000 develop permanent disabilities annually. In the United States, trauma is the leading cause of death for people under age 45. In addition, a disproportionate number of patients seen in trauma centers are young males aged 15 to 30 years. Trauma patients are identified by physiological measures using Trauma Score and Revised Trauma Score and anatomic injuries using Abbreviated Injury Scale and Injury Severity Scale (ISS). For example, an ISS of greater than 16 is a severely injured person (Abernathy, McGwin, Acker, & Rue, 2002). Individuals with a higher ISS score are more appropriately treated at a Level 1 trauma center.

In the United States, a regional trauma center located in a clinically complex hospital is most capable of providing care for critically injured patients. Trauma centers are not the same as emergency rooms because trauma centers care for injuries forcefully impacting the body. The American College of Surgeons classifies five levels of trauma centers. The scope of this article is limited to assessing the impact of the highest intensity trauma services provided in Level 1 trauma centers. A Level 1 trauma center is required to have immediate availability of trauma surgeons, anesthesiologists, physician specialists, nurs-

JEFFREY P. HARRISON, MBA, MHA, PhD, FACHE, is an Assistant Professor, Department of Public Health, University of North Florida, Jacksonville, FL.

COLLEEN G. McLANE, MHA, BSN, RN, is a Practice Manager, Ponte Vedra Medical Center, Ponte Vedra Beach, FL.

es, and resuscitation equipment. Its goals include providing comprehensive trauma care, serving as a regional resource, and providing education as well as research (MacKenzie et al., 2003).

In addition, Level 1 trauma centers must treat at least 1,200 admissions a year or 240 major trauma patients per year or an average of 35 major trauma patients per surgeon to maintain ideal proficiency (MacKenzie et al., 2003). Level 1 trauma centers must be staffed 24 hours a day, 7 days a week with surgeons and support staff, and be supplied with a wide range of diagnostic testing equipment. As stated previously, the requirements of Level 1 trauma centers involve significant investment in highly skilled clinical personnel as well as facilities and equipment. Since the presence of a Level 1 trauma center dramatically improves the chances of survival of a patient with serious injuries, public welfare dictates that these facilities remain accessible (MacKenzie et al., 2003).

The United States has more than 5,000 acute care hospitals. The 2002 national inventory of hospital trauma centers counted 1,154 trauma centers, of which 190 provided the highest intensity of trauma services (MacKenzie et al., 2003). These 190 Level 1 trauma centers have more than doubled since 1991. The report shows that 90% of Level 1 trauma centers are located in urban areas and have a physician residency program. Every state in the United States has at least one Level 1 or 2 trauma center with the exception of Arkansas. Based upon their unique mission, 64% of Level 1 trauma centers are located in not-for-profit hospitals while 34% are under public ownership.

Health Care Regulation

The positive impact of trauma centers on reducing death and disability has been well established (Mackenzie et al., 2003). However, there is a concern that some trauma centers may close because of high costs, thus jeopardizing lives within the local community. Although the true economic viability of trauma care remains unknown, trauma centers are required by law to accept severely injured patients regardless of health insurance status. The Emergency Medical Treatment and Active Labor Act (EMTALA), commonly referred to as the "anti-dumping" law, requires hospital emergency departments to medically evaluate all patients who are in active labor or in an emergency medical condition (Showalter, 2004). With private insurers and government programs cutting back their health care payments and the number of U.S. citizens without health insurance rising, the profitability of trauma centers may be at risk. As a result, the prompt delivery of trauma care in an efficient trauma center is vital to reducing costs while improving morbidity and mortality.

In most health care organizations the Level 1 trauma center functions as a profit center where revenue and expense are captured to track profitability. As a result, the health care costs attributed to the trauma care can be categorized into the following areas:

- *Fixed direct costs* — costs not related to a specific patient but identified as overhead in the trauma unit. These fixed costs are difficult to control because the building and equipment are an organizational investment.
- *Variable direct costs* — costs directly related to the cost of a patient include lab tests, medications, supplies, and are affected by physician practice patterns.
- *Indirect costs* — costs that cover the entire institution and are allocated to revenue-producing departments. High indirect costs reflect the broad spectrum of services the institution is required to have available to satisfy the diverse needs of patients in a Level 1 trauma center. It is estimated that these indirect costs are responsible for half the cost associated with trauma care (Taheri, Butz, Watts, Griffes, & Greenfield, 1999a).

In the health care industry, the charge is the amount billed to the patient or third-party insurance company which results in the hospital payment. Therefore, hospitals which provide Level 1 trauma care assume significant financial risk and should evaluate the profitability of these programs.

As part of this analysis, the key factors driving revenue are patient mix and volume of care provided. Additionally, factors driving increased health care costs are advances in medical technology, increased cost of prescription drugs, and higher spending for inpatient care. However, a Level 1 trauma center may have a positive impact on hospital profitability due to the types of injuries received and population treated.

This is supported by Fath, Ammon, and Cohen (1999) who found that the financial viability of trauma centers is dependent on the types and frequency of injuries. For example, burn victims may have a greater requirement for additional services such as pain management, physical therapy, and plastic surgery. Additionally, such highly complex cases may result in increased LOS and higher cost per patient. As a result, hospitals treating less severely injured patients may produce higher profit margins (Ordog, Wasserberger, & Ackroyd, 1995).

As the population ages, the elderly will continue to consume a growing percentage of health care resources. By the year 2030, the number of individuals 65 and older will reach 64.5 million Americans for an increase greater than 100% (Satorelli et al., 1999). Since Medicare insures the elderly, the inadequate reimbursement for a growing number of Medicare patients may decrease a trauma

center's profitability (Sartorelli et al., 1999). Additionally, Medicare payment reductions caused by the Balanced Budget Act of 1997 place trauma centers in a situation where reimbursement may not meet actual cost (Fath et al., 1999). However, Sartorelli et al. (1999) found pediatric trauma care costs less to deliver and can be profitable to the trauma center.

Complications are important indicators of cost with the six major complications being adult respiratory distress syndrome, acute renal failure, sepsis, pneumonia, decubitus ulcers, and wound infections. According to O'Keefe et al. (1997), a single complication can result in $7,000 in additional costs. More importantly, a patient with three or more complications averaged $10,000 in additional costs. This provides significant opportunities for hospitals that provide high-intensity trauma services to more efficiently manage patients with multiple complications through the use of protocols and evidenced-based medicine, therefore reducing overall health care costs. However, from a policy perspective it is critical that reimbursement methods adequately compensate these high-intensity trauma centers for treating these life-threatening complications.

According to Taheri et al. (1999a), poor reimbursement is the most pressing problem facing Level 1 trauma centers. Reduced reimbursement rates are caused by uninsured patients not paying their bills as well as insurance companies making fixed payment based on the type and severity of the injury regardless of cost.

As stated previously, trauma center profitability depends on the patient mix as well as the number of uninsured or underinsured patients. According to Fath et al. (1999), the problem of inadequate reimbursement is greater for severely injured patients who frequently lack health care insurance. Additionally, the introduction of diagnosis-related groups (DRG) in the 1980s provided an economic incentive to reduce the cost of care by capping the payment for each DRG. This shifted the burden of increasing costs away from the insurer to the health care provider. According to Joy, Lichtig, Knauf, Martin, and Yurt (1994), DRG payments have resulted in reduced hospital profitability, jeopardizing the operation of some trauma centers.

According to Taheri et al. (1999b), even the most severely injured patients, who consume the greatest percentage of resources, may be profitable when treated with the appropriate clinical protocols. Such clinical protocols have been developed for a wide range of clinical diagnoses and can be modified by Level 1 trauma centers to better meet their patients' needs. Therefore, Level 1 trauma centers may be in a position to manage the treatment of patients who require high-intensity services in the most efficient manner. This balance of trauma patient mix combined with organizational efficiency may allow trauma centers to remain financially viable (Mackersie, 1990). However, if the patient mix shifts to less-profitable DRGs or efficiency drops, the trauma center's profit margin will decrease. More importantly, if the number of uninsured patients increases, the trauma center may accrue large deficits.

According to Rogers, Osler, Shackford, Cohen, and Camp (1997), profitable trauma centers are frequently located in non-urban areas with fewer uninsured patients. This favorable patient mix, combined with blunt trauma associated with motor vehicle accidents and automobile insurance reimbursement, provides higher compensation for hospital costs.

As discussed by Taheri et al. (1999a), regionalization of trauma planning has improved clinical treatment as well as reduced morbidity and mortality. Unfortunately, reduced reimbursement has had a negative impact on the financial condition of many hospitals that provide trauma care. Mackersie (1990) also found the concentration of large numbers of critically injured patients at urban Level 1 trauma centers reduces profitability. From a policy perspective, regional planning for trauma care should minimize the negative financial impact of providing trauma care on any single hospital. While the requirements for regional health planning vary by state, the process frequently requires approval for expensive new services such as the implementation of a Level 1 trauma center. Such planning will minimize adverse selection and equally distribute the economic burden for trauma care. On a more positive note, Nathens et al. (2001) found larger volumes of trauma patients lead to greater efficiency and improved patient outcomes. As a result, regional trauma care planning can improve efficiency and reduce costs while improving patient outcomes.

Research Questions

The purpose of this study was to evaluate the characteristics of hospitals that provide high-intensity trauma services. Based upon the categorization of trauma care, hospitals that operate a Level 1 trauma center are compared to hospitals without such a service. Research questions sought to evaluate whether hospitals with a Level 1 trauma center have unique market characteristics, are more efficiently managed, or are more profitable. The following questions were proposed:

1. Do hospitals with a Level 1 trauma center operate in markets with higher per capita income, higher unemployment rate, more elderly Medicare patients, and higher HMO penetration?
2. Do hospitals with a Level 1 trauma center operate larger facilities and provide a wider

Table 1.
Constructs, Variables, Measures, and Data Sources

Variable	Measure	Source
Dependent Variable: **Construct, Level I Trauma Center**		
Hospitals with Level I Trauma Center	1, Hospitals with Level I trauma centers 0, Hospitals without Level I trauma centers	2001 AHA
Independent Variables: **Construct, Organizational Factors**		
Size staffed beds	Total number of staffed beds	2001 AHA
Facility age	Accumulated depreciation/depreciation expense	2001 CMS
Clinical services	Total number of services	2001 AHA
Managed care contracts	Total number of HMO and PPO contracts	2001 AHA
Construct, Operating Performance		
Return on assets	Total revenue/Total assets	2001 CMS
Occupancy rate	Total inpatient days/(Total beds x 365)	2001 AHA
Operating expense per discharge	Operating expense/discharges	2001 CMS
Long-term debt to equity	Long-term debt/equity	2001 CMS
Average length of stay	Total inpatient days/discharges	2001 AHA
Construct, Market		
Unemployment rate	Unemployment rate in the county	2001 ARF
Percentage of elderly	Population age 65 and older in the county	2001 ARF
Per capita income	Per capita income in the county	2001 ARF
HMO penetration	HMO penetration in the county	2001 ARF

AHA = American Hospital Association
CMS = Center for Medicare and Medicaid Services
ARF = Area Resource File

range of clinical services?

3. Are hospitals with a Level 1 trauma center more efficiently managed as represented by lower operating expenses per discharge and lower average LOS?
4. Do hospitals with a Level 1 trauma center show greater profitability than those without a Level 1 trauma center?

Data and Methods

Data on hospitals with Level 1 trauma centers for the year 2001 were examined. Data were obtained and analyzed from the American Hospital Association (AHA) annual survey, the Area Resource File (ARF), and the Center for Medicare and Medicaid Services (CMS) Minimum Data Set. The AHA survey provides extensive organizational data including bed size, hospital services, and utilization. The ARF from the U.S. Bureau of Health Professions has extensive information on market structure, including demographics, economics, and other measures of the hospital environment. The CMS Minimum Data Set provides information from hospital financial statements and includes data on all non-federal acute care hospitals (Harrison, Nolin, & Suero, 2004).

Dependent Variable

The dependent variable of interest is hospitals that provide the highest intensity of trauma services as evidenced by operating a Level I trauma center. As defined in Table 1, this variable is operationalized by a binary measure with 1 representing those hospitals with Level 1 trauma centers and 0 representing those hospitals without Level 1 trauma centers.

Independent Variables

This study used independent variables identified by previous researchers as associated with hospital organizational performance (Alexander & Morrisey, 1988; Harrison, McCue, Wang, & Wolfe, 2003). The organizational variables evaluated were size, facility age, number of clinical services, and managed care contracts.

The number of staffed beds is a measure of the size and complexity of acute care hospitals. Since larger hospitals have more resources, they are more likely to have Level 1 trauma centers. The number of staffed beds is positively associated with revenue, expenses, and cash flow (Clement et al., 1997).

The number of hospital clinical services is measured by the sum of all the services provided by the hospital, as listed in the AHA survey, and is an indicator of organizational complexity. Since a broad range of clinical services increases market potential, the number of clinical services has a positive correlation with hospital performance (Friedman & Shortell, 1988). Age of physical plant is defined as accumulated depreciation divided by depreciation expense (Levitz & Brooke, 1985). The age of physical plant is a measure of the physical stature of the hospital with a modern facility representing higher quality of clinical care. It is also an indicator of an organization's capital needs, with higher values indicating an older facility.

Managed care contracts are the measure of the total number of HMO and PPO contracts held by each hospital. More managed care contracts lead to fewer hospital admissions and shorter LOS (Weinick & Cohen, 2000).

Operating performance is measured at the individual hospital level and includes return on assets (ROA), occupancy rate, operating expenses per discharge, long-term debt to equity, and average LOS. A negative ROA is an indicator of poor financial performance and potential facility closure.

Operating expenses per discharge are a measure of organizational efficiency and are key factors of hospital performance. According to Harrison et al. (2004), organizations that implement case management programs and other clinical practice guidelines are able to reduce operating expenses.

Hospital occupancy is defined as the total number of inpatient days divided by the beds in service. Occupancy has been dropping as care shifts away from inpatient acute care to outpatient services, with approximately 50% of all hospital beds occupied (Yafchak, 2000). Hospitals with high occupancy rates indicate a strong market demand for services and increase the likelihood of hospital profitability. Hospitals with occupancy rates lower than the national average have an increased likelihood of acquisition or closure (Burns, Bazzoli, Dyan, & Wholey, 2000).

Long-term debt to equity is the total liabilities or debt divided by the total equity. This ratio indicates the amount of assets being provided by creditors for each dollar of assets being provided by the institution's shareholders or owners. As this ratio increases so does the creditor's risk. The lower the ratio, the greater the amount of assets being provided by the owners of the institution and the greater the protection to the creditors (Gapenski, 1999).

Average LOS is directly related to health care costs and reimbursements for trauma care (Selzer et al., 2001). Hospitals have positive net revenue for patients with a LOS of 7 days or less, but are unable to recoup costs for patients with a longer stay (Fath et al., 1999).

The market variables represent the demand for the hospital's services and include per capita income, percent of the population over 65, unemployment rate, and HMO penetration. Since the market is external to the hospital, it is measured at the county level. The use of county data to measure hospital markets has been used extensively in hospital research (Alexander & Morrisey, 1988; Harrison et al., 2003).

High per capita income reflects a sound economic community where individuals hold well-paying jobs. This is expected to increase demand for hospital services and have a positive effect on hospital profitability. Improved profitability is caused by greater health insurance coverage, an increased ability to pay for care, and reduced indigent care. Thus, higher income per capita should reduce environmental uncertainty and lower the rate of acquisition or hospital closure (Alexander & Morrisey, 1988; Friedman & Shortell, 1988; McCue, Thompson, & Dodd-McCue, 2000/2001).

Managed care penetration is a measure of managed care within the community. High managed care penetration leads to fewer hospital admissions and shorter LOS, thereby reducing hospital profitability (Weinick & Cohen, 2000). The unemployment rate serves as a measure of a community's financial ability to purchase health insurance and pay for health care services (McCue et al., 2000/2001). Reduced unemployment should generate additional demand for hospital services. The final market variable is the percentage of elderly, which represents the level of Medicare

Table 2.
Descriptive Statistics of Continuous Variables

Variable	Hospitals with Level 1 Trauma Center (N=195)		Hospitals without Level 1 Trauma Center (N=585)	
	Mean	Standard Deviation	Mean	Standard Deviation
Market				
Per capita income	$30,554 ***	9,342	$25,112 ***	6,657
Percentage of elderly	12.4% ***	2.6	14.0% ***	4.0
Unemployment rate	3.8% ***	1.6	4.6% ***	2.54
HMO penetration	30% ***	17.1	18.4% ***	17.2
Operating Performance				
Return on assets	2.5%	9.6	1.3%	12.0
Occupancy rate	70% ***	14	54% ***	19
Operating expenses per discharge	$14,792 ***	$5,479	$11,585 ***	$5,691
Long-term debt to equity	51.9%	39.4%	50.4%	38.1%
Average length of stay	7.8 **	8.4	10.3 **	15.9
Organizational Factors				
Size (Beds)	451 ***	263	154 ***	145
Number of services	38 ***	11	21 ***	10
Facility age	11.2	13.3	10.4	9.6
Managed care contracts	33 ***	42	17 ***	34

*** Significant at $p = 0.001$
** Significant at $p = 0.01$

patients within the community. As discussed by Harrison et al. (2003), the Balanced Budget Act of 1997 resulted in reduced reimbursement rates for Medicare patients, which resulted in lower profitability for hospitals serving populations with a high number of elderly patients.

Data Selection

After eliminating hospitals with incomplete data, the 2001 AHA database identified approximately 4,000 non-federal acute care hospitals. Since such a large control group creates a problem in estimation efficiency, a choice-based sampling strategy was used that drew all hospitals with a Level 1 trauma center and, as the control group, a random sample of hospitals without a Level 1 trauma center numbering three times the number of Level 1 trauma center hospitals. Since 195 hospitals had a Level 1 trauma center, a random sample of three times the number of hospitals without a Level 1 trauma center yielded a control group of 585. This sampling approach is supported in the United States hospital literature (Alexander & Morrisey, 1988; Harrison et al., 2003).

Analytic Methods

Differences in the means of the descriptive data were investigated to discover significant differences between hospitals with and without Level 1 trauma centers. Correlation analysis was completed to identify potential multicollinearity among the independent variables (problems with multicollinearity caused clinical services to be dropped from the analysis). A multivariate logistic regression model was developed to identify significant relationships between market factors, operating performance, and organizational characteristics among those hospitals with Level 1 trauma centers.

Results

Table 2 shows statistically significant descriptive statistics.

From a market perspective, hospitals with Level 1 trauma centers are more likely to be located in markets with higher per capita income, fewer elderly patients, lower unemployment rate, and higher managed care penetration. From an operating performance perspective, hospitals with Level 1 trauma centers have higher occupancy rates, higher operating expenses per discharge, and shorter average LOS. From an organizational perspective, hospitals with Level 1 trauma centers are larger, have more clinical services, and have more managed care contracts.

Table 3 presents the logistic regression analysis for hospitals with Level 1 trauma centers. Four independent variables are statistically significant. None of the market variables are related to hospitals with Level 1 trauma centers.

Three of the operating performance variables are statistically significant to Level 1 trauma centers. Since occupancy rate has a positive coefficient, hospitals with higher occupancy rates are more likely to have a Level 1 trauma center. Since the coefficient of operating expenses per discharge is also positive, then hospitals with Level 1 trauma centers are more likely to have higher operating expenses per discharge.

Finally, one organizational variable, size, is statistically significant for hospitals with Level 1 trauma centers. Since size has a positive coefficient, this indicates hospitals with a Level 1 trauma center will be larger in size. Therefore, the study indicates hospitals with Level 1 trauma centers are likely to be found in larger organizations with a higher occupancy rate and higher expenses per discharge.

Table 3.
Logistic Analysis of Hospital Level I Trauma Center

Dependent variable: 1 = Level 1 Trauma Center, 0 = not Level 1 Trauma Center (N=780)

Variable	Parameter Estimate	Standard Error	Probability
Market			
Per capita income	0.000	0.000	0.395
Percentage of elderly	-0.92	3.51	0.793
Unemployment rate	-0.005	0.062	0.934
HMO penetration	0.546	0.722	0.449
Operating Performance			
Return on assets	-0.223	1.018	0.826
Occupancy rate	1.97	0.743	0.008 **
Operating expenses per discharge	0.000	0.000	0.000 ***
Long-term debt to equity	-0.613	0.302	0.042*
Average length of stay	-0.02	0.011	0.077
Organizational Factors			
Size: Staffed beds	0.005	0.001	0.000 ***
Facility age	-0.003	0.010	0.772
Managed care contracts	-0.004	0.003	0.232

* Significant at $p = 0.05$
** Significant at $p = 0.01$
*** Significant at $p = 0.001$

Model chi-square = 297.41
-2 Log likelihood = 579.833
Pseudo R square = 0.469

Discussion

Trzeciak and Rivers (2003) found that the hospital emergency department is a vital component of the U.S. health care safety net. Our research supported this premise and showed that Level 1 trauma centers are located in communities with higher per capita income, higher HMO penetration rates, and lower unemployment. These market characteristics imply that Level 1 trauma centers are located in large urban communities. Our data also showed that Level 1 trauma centers are likely to be in markets with a lower elderly population. One possible explanation is that elderly populations in the United States are frequently located in rural communities with smaller hospitals that lack the resources or clinical expertise to support a Level 1 trauma center. This was supported by Harrison et al. (2004) who found an increased use of case management programs in markets with fewer elderly patients and greater HMO penetration. Similarly, our research shows Level 1 trauma centers are located in these more sophisticated urban markets where they provide a competitive advantage in marketing hospital services to HMOs. Another possible explanation is that a higher volume of traumatic injuries occur

among younger populations located in urban markets.

According to MacKenzie et al. (2003), a hospital with a Level 1 trauma center provides a wide variety of clinical services, research, education, and system-wide health planning. This is consistent with our research which found hospitals with Level 1 trauma centers are larger and have a wider range of clinical services. Trauma care in this setting is enhanced by coordination of care across multiple clinical service areas, a situation that is not necessary in smaller rural hospitals.

According to Mackersie (1990), Level 1 trauma centers are regional referral centers which results in higher occupancy rates. This is consistent with our study which found hospitals with a Level 1 trauma center have 70% occupancy rates, significantly higher than the industry norm.

From an efficiency perspective, Kania (1993) found that Level 1 trauma centers have higher operating expenses per discharge because of the high cost of trauma care and high percentage of uninsured trauma patients. Our research supports their work and found hospitals with Level 1 trauma centers have higher operating expenses per discharge. Based on our results, Level 1 trauma centers should aggressively attempt to improve efficiency and maximize reimbursement for trauma care. Should these efforts be unsuccessful, organizations with Level 1 trauma centers should pursue external funding for trauma care from federal, state, and local governments.

Harrison et al. (2004) identified the positive impact of clinical protocols in reducing average LOS. Our study supported their work and found that Level 1 trauma centers have lower average LOS. This shorter average LOS for hospitals with a Level 1 trauma center implies that their investments in high technologic equipment improve efficiency. The increased use of clinical protocols supports the use of treatment identified through evidenced-based research. Additionally, the use of high-tech equipment common in the treatment of trauma patients may improve overall hospital profitability.

Managerial Implications

These results have important managerial implications, as the hospital industry faces a more competitive environment and communities attempt to meet the demand for high-intensity trauma services. Low profits combined with increased competition for managed care patients may place hospitals providing high-intensity trauma services in a precarious financial position. As discussed by Harrison et al. (2004), hospital managers who wish to improve efficiency and profitability are challenged to implement meaningful programs and services that can positively affect the hospital's financial status. This study clearly demonstrates that hospitals operating Level 1 trauma centers can use their status as a regional referral center to widen their geographic market and increase overall market share. According to Laskowski-Jones (1993) and Trzeciak and Rivers (2003), hospital consolidation through merger and acquisition has led to the closure of many trauma centers. However, this study clearly demonstrates that trauma centers add prestige, market power, and widen the range of available clinical services. Additionally, designation as a Level 1 trauma center improves hospital workload by increased patient volume, greater utilization of ancillary services, and more hospital admissions. While a Level 1 trauma center may not be a stand-alone profit center, it can enhance nurse and physician recruitment, support hospital affiliation agreements, and fund capital investment in health care technology. In situations where a Level 1 trauma center is not profitable, the hospital should explore new opportunities in funding for trauma services through federal, state, and local governments. Effective trauma care frequently involves the use of clinical protocols to improve the quality of health care services. These clinical protocols also provide a strategy for cost containment through improved utilization of diagnostic and therapeutic procedures. The development of clinical protocols decreases resource consumption and therefore reduces the cost of trauma care. Moreover, high-intensity trauma care may prevent avoidable complications resulting in significant savings through lower complication rates and more efficient management of adverse occurrences.

Since trauma centers historically have faced inadequate reimbursement and high costs, hospitals must continue to improve their cost structure so they can negotiate contracts that ensure adequate reimbursement. More importantly, they must convince insurers that access to trauma care is a community responsibility (Fath et al., 1999). Since adequate reimbursement is essential, management has a responsibility to quickly and accurately bill for all services in order to improve the collection rate. By more accurately identifying the initial diagnosis of trauma patients, there are opportunities to improve the coordination of care to support and enhance trauma reimbursement. The development of a comprehensive system for patient triage, smooth patient management, and accurate billing will enhance profitability.

From a marketing perspective, Level 1 trauma centers enhance community awareness and generate public support for a wide range of tertiary care services within the organization. This can be accomplished through public education about the role of high-intensity trauma services as part of

the regional emergency services plan. An informed public may be more apt to use the Level 1 trauma center and participate in fundraising activities for the organization.

This study shows that it is critical that hospitals focus on the efficiency of providing clinical services as a method of lowering overall operating expenses per discharge. This can be done by implementing clinical protocols and coordinating care across the continuum of health care services. On a positive note, our study found that Level 1 trauma centers have been successful in reducing the average LOS for their patient population. While not specifically addressed in the study, lower average LOS in organizations with Level 1 trauma centers may be due to the greater application of advanced health care technology. This highlights past successes and emphasizes the importance of ongoing initiatives to improve organizational efficiency. The remaining challenge is to continue to implement operational processes which lower costs, increase efficiency, improve quality, and enhance organizational profitability.

Implications for Nursing Leadership

Nursing leadership plays a critical role in achieving cost-effective trauma care by balancing the organizational mission of quality health care with the reality of limited health care resources. As key stakeholders in the organization and essential to the delivery of quality health care services, nursing involvement is critical to developing and implementing clinical protocols associated with providing high-intensity trauma services. Additionally, nursing leadership serves as a patient advocate and resource sponsor in organizations that operate Level 1 trauma centers.

Trauma case management can be an effective tool in re-engineering high-intensity trauma services. By serving on case management committees, nursing staff can identify duplication of services and unnecessary tests as well as monitor cost and quality. According to Holmquist, Yamamoto, DiDonna, and Sise (1996), the implementation of trauma case managers in urban trauma centers has contributed greatly to improving outcomes. Also, as demonstrated by Harrison et al. (2004), hospital case management is an effective approach to improving quality of care while ensuring the responsible use of health care resources. Case management techniques not only boost efficiencies leading to lower cost per patient, but also can demonstrate to insurance companies a hospital's commitment to efficiency.

Finally, nursing leadership has a responsibility to assist in the regional planning of critical emergency services as well as ensure the cost-efficient provision of high-intensity trauma services. Since financial management of health care resources is not routinely included in clinical training programs, it is incumbent on nursing leaders to educate the clinical staff and community on the critical role Level 1 trauma centers play in health care delivery.

Policy Implications

From a policy perspective, the viability of Level 1 trauma centers is critical to the local and regional provision of health care services. Unfortunately, the Balanced Budget Act of 1997 reduced hospital Medicare reimbursement rates significantly which resulted in an 11% reduction in Disproportionate Share Hospital (DSH) funding. According to Selzer et al. (2001), this reduction combined with the high rate of uninsured and underinsured patients has threatened the financial solvency of Level 1 trauma centers. While not statistically significant, our study found that hospitals with Level 1 trauma centers have a 2.5% overall return on assets which is slightly higher than the industry average.

Additionally, Level 1 trauma centers are more likely to be found in larger hospitals with high clinical complexity. This study also suggests that a Level 1 trauma center can establish the organization as a regional referral network, which, when combined with efficient operations, may improve the organization's financial performance. Unfortunately, hospitals in rural communities lack the market demographics to operate a Level 1 trauma center, as well as the size and clinical complexity to provide these services. Further study should examine the impact of the absence of Level 1 trauma centers within these rural communities.

From a policy perspective, directing additional resources into hospitals operating a Level 1 trauma center is warranted where those actions can be supported by quantifiable data that support a positive impact on cost and quality. According to Trzeciak and Rivers (2003), overcrowding in emergency departments throughout the United States is jeopardizing the safety and public health of local communities. The rapid growth of the elderly population also supports the commitment of additional resources to adequately meet the challenges of providing cost-effective care for this population. Further research should be conducted to identify clinical protocols for trauma care which can be utilized across the health care industry.

There are also opportunities at the local and regional levels to coordinate high-intensity trauma services. These opportunities include more effective response by emergency personnel, improved clinical care for traumatic injuries, and better disaster readiness. Additionally, Level 1 trauma centers facilitate care across the continuum of outpatient and inpatient health services. Successful

coordination in this area may be one of the keys to maintaining or improving the number of Level 1 trauma centers while protecting the financial viability of these organizations. Proposed legislation titled *The Trauma Care Systems Planning and Development Act of 2005* (S.265) requires the National Institute of Health to implement an interagency program for trauma research. It will also provide grants through the Health Resources and Service Administration for the purpose of planning, implementing, and developing statewide trauma care centers (U.S. Senate, 2003). On state and local levels, there are initiatives to support trauma care by surcharges on motor vehicles, motor vehicle licenses, and taxes on cigarettes and alcohol.

Trauma care is also important as it relates to disaster response as well as chemical and biological warfare. Level 1 trauma centers play a critical role in responding to casualties resulting from terrorists' attacks. By functioning as a liaison with emergency medical personnel, fire, and police, Level 1 trauma centers share data and provide life saving care to disaster victims. As a result, the rapid mobilization of Level 1 trauma center resources and personnel is necessary in response to any disaster or emergency. If Level 1 trauma centers close due to lack of financial resources, it will have a negative impact on regional disaster response.**$**

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