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A STUDY TO DETERMINE  
THE FEASIBILITY OF ESTABLISHING  
DAVID GRANT USAF MEDICAL CENTER  
AS A REGIONAL TRAUMA CENTER  
FOR SOLANO COUNTY, CALIFORNIA

A Graduate Research Project  
Submitted to the Faculty of  
Baylor University  
In Partial Fulfillment of the  
Requirements for the Degree  
of  
Master of Health Care Administration  
by  
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August, 1987

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SECURITY CLASSIFICATION OF THIS PAGE

## REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION N/A		1b. RESTRICTIVE MARKINGS N/A	
2a. SECURITY CLASSIFICATION AUTHORITY N/A		3. DISTRIBUTION/AVAILABILITY OF REPORT  Unclassified/Unlimited	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A		5. MONITORING ORGANIZATION REPORT NUMBER(S)	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)  71-89		7a. NAME OF MONITORING ORGANIZATION US ARMY-BAYLOR UNIVERSITY GRADUATE PROGRAM IN HEALTH CARE ADMINISTRATION	
6a. NAME OF PERFORMING ORGANIZATION DAVID GRANT, USAF, MED. CTR.	6b. OFFICE SYMBOL (if applicable) N/A	7b. ADDRESS (City, State, and ZIP Code) AHS SAN ANTONIO, TX 78234-6100	
6c. ADDRESS (City, State, and ZIP Code) DAVID GRANT, USAF, MED CTR. SOLANO COUNTY, CA.		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER  N/A	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION N/A	8b. OFFICE SYMBOL (if applicable) N/A	10. SOURCE OF FUNDING NUMBERS	
8c. ADDRESS (City, State, and ZIP Code)  N/A		PROGRAM ELEMENT NO.	PROJECT NO.
		TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) A STUDY TO DETERMINE THE FEASIBILITY OF ESTABLISHING DAVID GRANT USAF MEDICAL CENTER AS A REGIONAL TRAUMA CENTER FOR SOLANO COUNTY, CALIFORNIA			
12. PERSONAL AUTHOR(S) MCGAW, HELEN G.			
13a. TYPE OF REPORT FINAL	13b. TIME COVERED FROM 7-86 TO 7-87	14. DATE OF REPORT (Year, Month, Day) 87/8	15. PAGE COUNT 112
16. SUPPLEMENTARY NOTATION			
17. COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	SUB-GROUP	
		California Hospitals, Medical Services, Trauma, accidents, wounds and injuries, theses, etc.	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) The intent of this study was to determine if the new David Grant USAF Medical Center could/ should be designated as a Solano County Trauma Center. Through careful consideration of the outside influences on such a decision this paper is based,			
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS		21. ABSTRACT SECURITY CLASSIFICATION N/A	
22a. NAME OF RESPONSIBLE INDIVIDUAL Major Leahy		22b. TELEPHONE (Include Area Code) (512) 221-2324/6345	22c. OFFICE SYMBOL N/A

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## CHAPTER I

### INTRODUCTION

In the United States, physical trauma from accidents and intentional injuries are the principal cause of death for people between the ages of 1 and 38 (Traska, 1986). Statistics from the National Safety Council show the total cost for accidents alone in 1984 was about \$96.9 billion. Other studies on trauma care indicate that 11% of trauma related deaths could have been prevented (Hospitals, 1986).

The preventable death rate in Solano County, California, has been reported to be as high as 60%. In a 1982 study by Dr. Donald Trunkey, 20 of 31 Solano County traffic deaths were rated as preventable or possibly preventable. The neighboring counties of Napa and Contra Costa have well developed trauma care systems. Napa County's 44% death rate among trauma cases has dropped to 5% since the establishment in 1984 of Queen of the Valley Hospital as a regional trauma center (Malich, 1987). Within the past year John Muir Hospital has been designated as Contra Costa County's regional trauma center. Although accurate statistics

are not yet available, a similar decrease in the trauma death rate is expected in that county as well.

Defined as injuries that occur from a harmful application of force to the body, trauma is a nocturnal weekend disease (Champion & Garner, 1986). It does not occur by appointment, and it rarely occurs during the workweek. Although most hospital emergency rooms are open around the clock, few hospitals have the sophisticated equipment and highly trained professional staff necessary to treat major trauma at all times. When trauma occurs, the mere fact that the injured have been taken to a hospital does not assure that the services they need will be available.

A trauma care system is an organized approach to treating acutely injured patients that provides personnel, facilities, and equipment for effective and coordinated trauma care in an appropriate geographical area (Maull, et al., 1986). The trauma center is the focal point of the system, providing prehospital, emergency department, and inhospital care. Trauma centers are distinguished from emergency departments (ED) not only by the level of care provided, but also by an institutional commitment to excellence in trauma care.

The term trauma center is a designation made within the local Emergency Medical Services (EMS) plan. It is a political process, inseparable from the enhancement of medical services. In California, each county is responsible for developing its own EMS plan. The pivotal element of that plan is the designation of a particular hospital's ED as the system's trauma center. Once a comprehensive EMS plan has been developed by the county it is submitted to the state for approval. The hospital seeking designation undergoes rigorous on-site verification and licensure visits by the state. Once designated, the hospital then becomes the focal point of the EMS system and assumes responsibility for the administrative oversight of the EMS program.

Competition within the health care industry has become a major factor in trauma center designation. As competition becomes more vociferous, hospitals seek innovative ways to draw patients into their facilities. In trauma care, the objective is to draw the high dollar, high reimbursement, trauma patient without decreasing the overall volume of ED visits. Although serious trauma cases require more intensive professional management efforts and resources, they

represent only a fraction of overall ED visits. Serious injury accounts for 1 in 250 ED visits, 1 of 20 ambulance transports, and 1 of 100 hospital days. Yet, less than 1 in 1000 ED patients require the level of care (Level 1) unique to a trauma center (Cales, Anderson & Heilig, 1985). In actual practice, designation as a trauma center has been associated with only minimal changes in overall utilization of medical care.

Trauma centers are considered glamorous, representing the quintessence of the medical profession. The publicity that accompanies the designation of a hospital as a trauma center can be a valuable tool in marketing the hospital to the medical community and the public at large. Financial incentives are especially strong for those suburban centers where middle-class trauma patients are usually covered by health insurance. Trauma centers are, by and large, money making entities.

Solano County, California houses six acute care hospitals: four public, one state, and one federal. Vallejo, in the southwestern corner of the county hosts Sutter Solano Hospital, a 97 bed facility with Level



III emergency services, and Kaiser Permanente Hospital with 231 beds and a Level III emergency department. North Bay Medical Center (NBMC) is centrally located in the county. This Fairfield facility offers 108 beds and Level III emergency services. Ten miles northeast of Fairfield, a fourth public hospital has recently opened in Vacaville. The 52-bed Vaca Valley Hospital, a subsidiary of NBMC, likewise offers Level III services. The California Medical Facility, also in Vacaville, provides 500 beds for state prisoners only and is not available for use by the general public. A federal hospital is located on Travis Air Base, midway between Fairfield and Vacaville.

David Grant United States Air Force Medical Center (DGMC) was originally built in 1948 as a 150-bed acute care facility. The organization has grown to become the third largest medical center in the Air Force, supporting the second largest training program. Currently operating as a 285-bed tertiary care facility, DGMC serves as the local health care facility for Travis Air Force Base beneficiaries, a regional referral center for eight western states plus Alaska and the Pacific theater, the west coast aeromedical evacuation staging facility (ASF), and a casualty

receiving center during natural disasters or contingency operations.

DGMC is operating in a severely space-deficient, obsolete, and inefficient plant. Facility shortcomings have existed for over two decades and have been well documented in reports of the Joint Commission on Accreditation of Hospitals (JCAH) and Air Force Health Services Management Inspection (HSMI) teams. Facility studies were completed in 1979 and 1980 to identify and quantify the numerous deficiencies that exist. Following those facility studies, an economic analysis was conducted to determine the most feasible and cost-effective plan for providing health care services in the future. Based primarily on life cycle costs analysis, the optimal solution was determined to be complete replacement of the existing DGMC.

On August 22, 1984, ground was broken for the new medical center. Programmed as a \$206.2 million project, the four-story structure will house 298 inpatient beds. Advanced diagnostic and treatment capabilities will include magnetic resonance imaging, linear accelerators, and hyperbaric medicine. To date, the project is 71% complete. The government expects to take occupancy of the building in October, 1988.

### Conditions Which Prompted this Study

Situated midway between the metropolitan areas of Sacramento and San Francisco, Solano County is one of the fastest growing counties in the state. The primary economic base of the region is government employment, retail trade, agriculture, and light-to-medium industry. An extensive network of interstate highways provides easy access to either city and also serves as the conduit to mountain and coastal recreation areas.

The Solano County emergency medical system (EMS) is in its infancy. No coordinated plan exists for providing emergency services within the county. Since the appointment of an EMS coordinator in 1987, several public meetings have been held to discuss the formation of an EMS plan. At these meetings representatives from NBMC have expressed their interest in seeking designation of their hospital as a regional trauma center.

In the late fall of 1986, Mr. Gary Passama, Chief Executive Officer of NBMC, and several members of his staff met with Col (Dr.) Gary Romberg, Director of Hospital Services at DGMC, to discuss the issue of establishing a regional trauma center within Solano County. Mr. Passama wanted to know if the Air Force

intended to seek designation of the new DGMC as a regional trauma center. Based on the teaching role of DGMC and the enhanced capabilities to be available in the replacement medical center, the facility gives the appearance of being a competitor for that designation. Dr. Romberg commented that while DGMC is accredited by the Joint Commission on Accreditation of Hospitals (JCAH) as a Level II emergency department, physical, fiscal, political and personnel constraints could preclude DGMC from pursuing trauma center designation.

Subsequent to that meeting, Dr. Brown, President of the NBMC Medical Staff, met with the DGMC Commander, Director of Hospital Services, Associate Administrator, and Chief of Surgery for further discussion of trauma center designation. Dr. Brown felt that the replacement DGMC would be the more appropriate facility for providing trauma care, citing the trauma care system in San Antonio, Texas, as an example. There, Brooke Army Medical Center and Wilford Hall USAF Medical Center serve as two of the four trauma centers for the city and Bexar County. Dr. Brown stated that the NBMC medical staff was not in full agreement on pursuing trauma center designation for NBMC.

This study is an outgrowth of those meetings. As the Administrative Resident, I was asked to investigate the feasibility of establishing the replacement DGMC as a regional trauma center.

#### Statement of the Problem

The problem was to determine the feasibility of establishing the new David Grant United States Air Force Medical Center as a regional trauma center for Solano County California.

#### Objectives

The development of this feasibility study was predicated upon sequentially completing the following objectives:

1. Complete review of current and past literature.
2. Describe the current system of providing trauma care in Solano County.
3. Review and report the locally established criteria for trauma center designation.

4. Project the need for trauma care in Solano County based upon projections of population and industrial growth.

5. Assess the facility adequacy, availability of support services, and scope of professional services projected for the new DGMC.

6. Matching trauma center criteria against DGMC capabilities.

7. Identify shortfalls between criteria and capabilities.

8. Determine the cost of resources needed to overcome shortfalls.

9. Describe the organizational advantages and disadvantages of trauma center designation for DGMC.

10. Conclude the feasibility of designating DGMC as a trauma center.

#### Criteria

Feasibility was measured by the following:

1. Demonstrated need for a trauma center in Solano County based upon incidence of trauma and population statistics.

2. The ability of DGMC to meet, by 1990, the

criteria (per California state law) for designation as a Level II emergency department and trauma center.

3. The ability of DGMC to absorb the additional workload generated by providing regional Level II trauma care.

#### Assumptions

The following assumptions were made for this study:

1. The calendar year 1990 is used as the target year for trauma center designation.
2. Demographic data and descriptive statistics contained in the literature are valid and reliable.
3. Current criteria for trauma center designation will remain valid over the next five years.
4. The stated mission of DGMC will remain the same over the next five years.
5. The organization and structure of the Air Force Medical Service will remain unchanged over the next five years.
6. There will be no war or outbreak of major hostilities for the next five years.

### Research Methodology

The future need for trauma care in Solano County was determined by describing the current population of Solano County, reporting the incidence of violent crime in the county, and applying Trunkey's model for estimating trauma occurrences to the area's highway injury statistics. Statistics used in this assessment were taken from the calendar year 1985.

Facility capabilities of DGMC were assessed by detailed review of the functional design, expanded and new services to be available, and medical-functional relationships within the new DGMC.

Professional capabilities have been assessed by blending the current manpower document with known projected losses and expected future authorizations.

Shortfalls were identified by matching capabilities against criteria.

Personnel shortfalls are measured as full time equivalents (FTE).

Feasibility was concluded by matching capabilities and correctable shortfalls against the established trauma center criteria.



### Literature Review

A review of the current and past literature in the broad area of trauma care was performed.

The majority of definitive writing appears in the medical journals. The literature is replete with statistical evidence to support the need for trauma care. The dominant authors, Champion, Cales, Cooper, and Trunkey are renown in the medical community as leaders in the movement for an organized comprehensive approach to trauma care nationwide.

Falling into a few general categories, the literature speaks primarily to the need for regionalized trauma care and the potential to decrease death and disability from major injury. Lesser, although significant, attention is also given to trauma center utilization, including future population demographics and their impact on trauma injuries, the political process of designation and verification of trauma centers, and the economic factors of trauma care. Together, these topics form a conceptual framework for the discussion of trauma care systems and trauma center designation.

### Trauma Care and Regionalized Centers

Studies conducted by the Medical University of South Carolina and the University of Utah, College of Medicine concluded that injury patients treated at trauma centers had significantly enhanced probabilities of survival compared to patients treated at nontrauma centers (Champion & Gainer, 1986). For example, the Utah study found that 78% of critical trauma patients who were treated at community hospitals died versus 44% for trauma patients treated at a trauma center.

Orange County, CA was the site of the first published investigation of mortality due to trauma prior to and after implementation of a regional trauma system. Cales (1984) found that the trauma care system had a significant impact on the quality of trauma care in this county; the proportion of deaths judged potentially salvageable dropped by 15%. In his study Cales was able to demonstrate that the trauma victim's best chance for survival occurs when treatment is within a regionalized trauma system.

Time is a critical factor in trauma treatment. Champion and Gainer (1986) point out that half of the deaths that result from trauma occur before the patient even reaches the hospital. Of the remaining deaths,

60% occur in the first four hours after the accident. Further defining the criticality of timely care, studies done by Trunkey (1982) suggest that death from trauma has a trimodal distribution. The first peak of deaths occur at or very near the time of the injury; few of these patients could be saved in any setting. The second peak of death occurs within the first hour or two after injury. Some refer to this as the "golden hour", when resuscitation and definitive care can make a dramatic difference. The third peak occurs days or weeks after the injury, usually from sepsis and organ failure.

Champion and Gainer (1986) feel that the real tragedy lies in the fact that many critical patients never reach the type of hospital that can successfully handle their injuries. The reason is twofold: critical patients must be matched with the appropriate treatment resources, and the match must be made quickly enough to prevent death or permanent disability. The idea that the nearest hospital is the proper place for a trauma victim is outmoded.

Throughout the literature there is unanimous agreement on the need for regionalization of trauma care for the severely injured. A panel of trauma

experts convened in 1984 by the Scripps Foundation concluded that all seriously injured trauma patients in the United States could be effectively handled by about 250 strategically placed Level I and II trauma centers (Champion & Gainer, 1986). Each Level I trauma center should treat about 1000 patients per year; each Level II trauma center should treat no less than 500 patients per year. Teufel and Trunkey (1982) feel that for a community hospital trauma program to be effective approximately 400 critically injured trauma victims should be seen per year.

Regionalization of trauma centers is intentionally restrictive in that it limits the number of hospitals and physicians who provide care to a select group of patients. This restriction is justified. Not every facility that treats emergency patients can provide the high technology resources and trained specialists needed of a trauma center, nor should they. A 1979 study conducted at Stanford University showed that hospitals and surgical teams that perform operations requiring complex techniques and multiple medical discipline involvement do better, in terms of patient outcomes, when they perform a higher volume of these procedures. Limiting the number of hospitals that

treat major trauma guarantees trauma centers enough seriously injured patients to maintain the skill level of the professionals performing the procedures needed to save lives.

Unfortunately, it is not always possible to achieve the political support to restrict the number of trauma centers. While trauma regionalization should result in redistribution of only seriously injured patients, economic fears persist that it might also redistribute the minor injury patients and those with nontraumatic conditions; and their associated revenues.

#### Trauma Center Designation

Trauma is a surgical malady. The body of knowledge relevant to trauma has generally been gleaned by surgical research (Thompson, 1983). The American College of Surgeons (ACS) has played the major role in attempting to improve the lot of the injured patient and has developed standards for the care of the injured. Optimal Hospital Resources for Care of the Injured Patient (1976) was an initial attempt to define those resources necessary for excellence in trauma care. The 1979 revision was titled Hospital Resources for Optimal Care of the Injured Patient, changing the

focus to commitment of the institution and its medical staff for the special demands of the severely injured. The 1983 revision was entitled Hospital and Prehospital Resources for Optimal Care of the Injured Patient. The changes in the document titles are not simply semantics. They reflect a redirection from initial concern with providing hospital resources to providing optimal care for the patient and then extending that optimal care into the prehospital phase of the treatment.

Unfortunately, there is no one method for designating trauma centers and no methodology of assuring quality care for injury victims. Although the ACS has set High standards, those standards serve only as guidelines. The ACS has no way of insisting that these standards be used by state or local agencies to designate and evaluate trauma centers. As a result, both the process and the criteria for designating trauma centers vary widely among jurisdictions.

The power to regulate health care and license hospitals is a responsibility normally reserved for state government. A 1983 survey conducted by the American Trauma Society revealed some type of trauma center designation activity in 23 states. Although the

responsibility for designating trauma centers varied from state to state, in only 16 of the 23 respondent states was the process sanctioned at the state level.

For political reasons, state and local jurisdictions may use designation standards that are a weakened version of those promulgated by the ACS. Furthermore, when local agencies designate trauma centers, the designation process often is diluted when those who serve as the designation inspectors have no trauma care experience or have political axes to grind (Champion, 1986). Problems arise when the designating body lacks validity or authority to control the emergency service system in a given region. For these reasons the designation process generates a significant amount of controversy within the medical community.

#### Trauma Center Verification

Verification is defined as the act or process of establishing truth or accuracy. It is critical that on-site verification be completed before the official designation of any trauma center. Maull et al. (1986) state that trauma center verification, when utilized as part of the designation process, serves three primary functions. First, and most importantly, it measures

commitment. The actual application of a hospital's resources to the treatment of an injured patient is the measure of the institution's commitment to trauma care. Second, verification is an organized and objective method of assessing deficiencies in an institution's capability and utilization, and to provide advice and encouragement for improvement in the overall function of the trauma care system. Last, verification is a valid form of peer review, a phenomenon of increasing importance as federal funding sources attempt to adjust reimbursement to compensate those hospitals that appropriately manage the more severely injured patients.

In Maull's experience, a trauma center review team was appointed to critically examine each institution seeking Level I or Level II trauma center designation and to confirm the capabilities and commitment of both the hospital and its staff. The review team found only one out of ten hospitals claiming to have Level I capabilities actually met the designation criteria. Maull stresses the importance of using a disinterested, multidisciplinary party to eliminate bias and depoliticize the process.



Mitchell (1986) reported on the Missouri trauma center program application process. Strictly a paper application process, hospitals reported on the level of services they thought they were able to provide. When on-site verification reviews were conducted, over 50% of the hospitals failed to fulfill their claimed capability. Most disturbing was a lack of commitment to a trauma care by the medical staff, particularly the prompt availability of trauma surgeons to the emergency department. Mitchell reports that two claims are pending in Missouri courts concerning the failure of the surgeon to be promptly present in the emergency department when a critical patient arrived. A serious liability potential exists if the designated trauma center does not fulfill its criteria commitment to a patient.

### Trauma Care Statistics

#### Trauma Center Utilization

Cooper (1985) and his associates cite many commonly held assumptions about trauma centers and their patients: 1) patients tend to be young men; 2) penetrating (violent) injuries predominate; 3) reimbursement for trauma patients is worse than for

general patients; 4) reimbursement for penetrating (violent) trauma is worse than for blunt or nonviolent trauma; 5) patients transferred to a trauma center tend to be the so-called insurance dumps (those who are less likely to have insurance and are more likely to be socially or financially undesirable) with violent or penetrating trauma. Their detailed study of trauma center utilization and reimbursement corroborated only the first of these assumption. They found that young men do indeed make up the majority of cases. Although male patients did have a higher proportion of penetrating versus blunt injuries, they found an overall ratio of three to one blunt to penetrating injury cases and almost two to one nonviolent to violent injury cases. Other assumptions, especially the third and fourth points, remain unsupported. At the time of the study, reimbursement for general patients at their hospital averaged 34%, compared to trauma patient reimbursement at 77%. They found no difference between reimbursement for penetrating (violent) versus nonpenetrating (nonviolent) injuries. However, the nonviolent group was more likely to have insurance.

In their analysis of patterns of patient transfer, almost half the patients requested transfer to private institutions, often within the same medical center area. Those who transferred were typically patients with nonviolent injuries and insurance. Those patients who transferred had higher charges per day, which the researchers felt was artificially weighted by proportionately more intensive care unit (ICU) time. They also had higher ICU charges and total bills than the nontransfer patients. The less severely injured from within the primary drawing area of the trauma center remained at university hospital for their entire length of stay, proportionately diluting their cost per day with less severe recovery days.

Cales (1985) studied the utilization of ambulances, emergency departments, and hospitals before and after implementation of a regional trauma system. In his findings, serious injury accounted for approximately one of every 250 ED visits and one of every 20 ambulance transports. Serious injury accounted for approximately only one of every 100 hospital days.

In North Carolina, Proctor and Harmelink (1986) retrospectively studied trauma injuries in an attempt

to determine how many trauma centers were necessary, where they should be located and what level of capability they should possess. Consistent with the findings of Cooper, their study found that men represented 74% of the injuries. The leading causes of major injury were motor vehicle accidents (47%), homicide (13%), accidents and falls (18%), injuries other than by accident (7%), accidents by fire and flame (4%), suicide (3%), all other causes (8%).

As an interesting aside, their study included analysis of burn victims; showing that the frequency distribution of burns was noted to be entirely different from other trauma. Burns were documented in all age groups in approximately the same proportion.

Teufel and Trunkey, (1977) suggest that a region can estimate the number of critically injured trauma victims as 5% of the yearly total motor vehicle injuries and fatalities reported by the respective state highway patrol.

#### Population Demographics

A detailed and timely projection of trauma care statistics based upon national population trends is provided by Fischer (1986). He projects that the

population of the United States will increase by 21 million (8.7%) and age dramatically in the next ten years. By 1995 almost all of the baby boomers will reach age 35 and the national median age will increase to 35 years. Along with this, the high-risk trauma cohort (14 to 35 years) will decrease by 6.9 million (-8.2%). Of this decrease, 77% will be the 18 to 24 year group which has vehicular and assault injury rates 2.2 and 2.8 times greater respectively than the national average of other age groups.

Personal violence will decrease in proportion to the 14 to 34 year age group decrease. But the minorities clustered in the inner cities, who have a median age 5 years younger and birth rates more than twice the national average, are unlikely to experience respite from personal violence.

Many of the 14 states with a drinking age under 21, the 35 states without seat-belt laws, and the 33 states without child restraint laws are likely to legislate such standards by 1995. It is probable that the net effect of these factors plus aging will be a 10-20% decrease in major blunt injuries nationally. Fischer foresees this decrease to be greatest in the Northeast. The receptors of the Northeast

outmigration, the South, Southwest, and California, which have lower median ages, will be least affected.

More elderly trauma victims will be treated as the number of people over age 65 will increase by 6.7 million (+21.4%). According to Fisher, the elderly require hospitalization four times more frequently following injury, require more care, longer hospitalization and rehabilitation, and less frequently return to independence.

Fischer concludes that despite a population increase of 21 million, aging and other factors will largely eliminate the need for additional trauma facilities during this decade. In fact, he feels that retrenchment will be needed in many locales to keep patient loads adequate enough to maintain the clinical and educational excellence requisite of trauma facilities.

#### Economics

The emergency department is the admitting door for 15 to 20% of the inpatient population in most general hospitals (Thompson, 1981). As the competition for patients intensifies, emergency departments are experiencing increasing pressure from both primary care

alternatives such as freestanding emergency clinics and from tertiary care systems such as trauma systems. The hospital's emergency department is an economic lifeline which cannot be ignored.

Hospitals have come to realize that trauma centers can be, by and large, money making entities. The financial incentive is especially appealing to suburban centers whose middle class residents are more likely to have private or corporate insurance. However, inner city hospitals, whose patients are often indigent and have no insurance, also seek trauma center designation, in an attempt to increase their revenues by expanding their referral area into the affluent suburbs.

ACS has estimated that at least 10,000 multiple injury admissions per year are necessary for a Level I center to be cost effective and for its personnel to maintain necessary skills. Much of the cost associated with a trauma center operation represents fixed costs that exist whether patients are being cared for or not (Proctor & Harmelink, 1986). Thus, a large organization that sees 10,000 or so cases annually can typically provide care at a lower cost per case than a smaller or rural center seeing fewer patients.

As competition for patients increases, facilities have turned to the implementation of air ambulance services to secure an adequate patient load. The cost of operating a helicopter has been estimated to be three to five times that of conventional emergency medical transport (Schwab et al., 1985). The potential for increased revenue at first glance seems excellent, but remains to be proven.

Designation as a trauma center lends prestige to a hospital, yet such a commitment involves a substantial dedication of financial resources. Teufel & Trunkey (1977) estimated the cost for optimal staffing of a trauma center (as recommended by the ACS Committee on Trauma) to be nearly \$3.7 million (125 FTE). They state that only a few large university teaching hospitals approach these staffing patterns. In presenting a more pragmatic approach to staffing that better suits the professional resource constraints of the community hospital, they propose utilizing a general surgeon, anesthesiologist, and emergency physician as the primary team, with other physician specialists on backup call. In this scheme, the estimated costs are lowered to \$1.7 million (57 FTE). However, the figures presented by Teufel & Trunkey fail



to address the resources needed to maintain the transportation, communications and other hospital support services of a comprehensive trauma system.

Dunn, Berry, Cross (1986) review in detail the steps taken to transform a community hospital into a trauma center. Initially, \$350,000 was invested in space modifications and state of the art surgical equipment, instruments, and backup supplies in the hospital's existing operating suite. A sophisticated, versatile 24-hour communication center was established in the emergency department (\$85,000). A Bell Longranger Helicopter, configured for aeromedical service, cost approximately \$1.4 million, inclusive of \$125,000 worth of movable medical-related equipment and supplies. They do not address the maintenance, operational and pilot costs of this service. A total of 30.7 FTE were added in hospital support services to include blood banking, nursing, operating room, and EMS dispatcher staffs. Training hours were described for the flight nurses (215 hours) but not addressed for the remainder of the multidisciplinary trauma team.

Some researchers feel that there are financial disincentives to accepting patients with severe multisystem injuries. When the prospective payment

scheme went into effect in Connecticut in 1983, Jacobs and Schwartz (1985) initiated a study to assess the impact of prospective payment on trauma care reimbursement. They analyzed hospital charges versus the Diagnostic Related Group (DRG) prospective reimbursement per variables of trauma score, injury severity score, and age. In their findings, the DRG reimbursement system did not adequately compensate for the severity of an injury. They maintain that inadequacies of the DRG prospective payment system could have a devastating impact on the care of trauma patients.

A major flaw in the study by Jacobs and Schwartz is their comparison of billed hospital charges, rather than hospital costs, with DRG reimbursements. They failed to distinguish between hospital costs and hospital charges for trauma care. Champion (1986) points out that actual hospital costs are, on average, about 60% of charges. Reflecting back to Cooper's experience with an overall 77% reimbursement for trauma care, reimbursement is still higher than costs, with the marginal profit being 17% of charges.

A strong point is made for early social work contact as part of every trauma admission. This

interaction has been shown to be effective in maximizing reimbursement and minimizing negative financial impact on the patient, the family, and the trauma center (Silverston & Carey, 1985).

Cooper (1985) suggests a method for improving trauma reimbursement. He feels that many inner-city hospitals lack an aesthetically appealing architecture and stimulating, acceptable roommates as company. Consequently, patients or their families request transfer after stabilization, leaving the trauma center to recoup the more expensive portions of the patient's treatment while the transfer receiving hospital reap the profits from the less expensive recovery and rehabilitative stay. He promotes making the trauma center attractive to the patients and their families, stimulating them to spend their entire hospital stay there.

Cooper (1985) also suggests that it may be less costly to maintain a tiered level of care in which a subsidized trauma center cares for the patient during the most unstable initial days, after which the patient is transferred to a less costly general or specialty care hospital and later to a rehabilitation or chronic care facility as indicated.

### Summary

The dominant theme that prevails throughout the literature is that death and disability from traumatic injury is a major national health problem. However, it is a problem that can be better managed.

Experts in the field call for a regionalized system of trauma care in which an accident victim's needs are quickly matched to a medical facility that has the demonstrated resources, training and commitment to providing trauma care. The process of trauma center designation and verification are key elements in the assurance of excellence in trauma care.

There are strong political, economic, egoistic, and moral incentives for hospitals to seek trauma center designation. Cales (1985) aptly stated that the ultimate decision in designation of a hospital as a trauma center must rise above those motives. Only the facility that best provides for the patients needs must be the trauma center.

## CHAPTER II

### DISCUSSION

The following sections present a profile of Solano County and the current trauma care system. Discussion of the services and programs required by the State of California for trauma center designation is followed by an assessment of DGMC's ability to meet those requirements.

#### Solano County Profile

Since 1960, Solano County's population has expanded exponentially. The cities of Vacaville and Fairfield have quadrupled in size, while Vallejo has increased over 40%. In 1987 the Solano County population was estimated at 291,264, an increase of 18% over the 1980 census. The Association of Bay Area Governments (1985) estimates that over the next 20 years the population is expected to increase by 151,000 people. The county's projected population is shown in Table 1.

Two population subgroups contribute to Solano's high risk trauma cohort. The large military centers at Mare Island Naval Shipyard and Travis Air Force Base

Table 1.  
Solano County Population

Year	Population Projection
1980	235,203
1985	270,500
1990	308,650
1995	351,700
2000	390,200
2005	421,800

Note: Population Research Unit, State of California, 1985.

distribute a high risk trauma population throughout the county. Unlike the civilian population, this age distribution is unaffected by population migration. As military members leave they are replaced by others within the same age range, usually 18 - 44 years. The county's population distribution by age group is shown in Table 2.

Table 2.  
Population Distribution by Age

<1	1%
1-5	4%
5-15	7%
15-25	16%
25-35	23%
35-45	17%
45-55	13%
55-65	11%
>65	8%

Note: Population Research Unit, State of California, 1985.

The leading causes of trauma are motor vehicle accidents, personal violence, homicide, industrial accidents and falls. The large industrial sites along Interstate Highways 80, 680, 780, 505, and the shores of Carquinez Straights along with multiple rail, air and automobile transportation avenues pose potentially high risk areas for major injury and trauma.

The county Sheriff's office reports that the area crime rate is considerably lower than the national average. In 1986, Solano County reported 6 murders, 15 alleged rapes, and 461 assaults, approximately 12% of which resulted in serious injury (D. Warhover, personal conversation, July 1987).

Rail and air transportation, both freight and passenger, has an impressive safety record. Despite the abundant small agricultural airfields, a commercial airport, and a very active military airfield, there have been only seven injury related accidents over the past five years; four of which occurred on Travis Air Force Base.

The 1512.6 miles of city, county and state maintained roads are the major source of traumatic injury. The California Highway Patrol (CHP) reported

1,948 highway accidents, resulting in 2,785 injuries and 46 fatalities in 1985; 335 of these accidents were considered to be alcohol related (CHP, 1987).

Statistics are not yet available to show the impact of the mandatory seat belt law which went into effect in 1986. The county encompasses roughly ten miles of interstate highway with the new 65 mile per hour speed limit. The CHP feels that this will have only a small impact on the overall accident rate in Solano County (D. Meyer, personal conversation, July 1987).

Trunkey's method for predicting the incidence of major trauma for a region takes 5% of the number of reported motor vehicle injuries and fatalities. Applying this method, Solano County could expect approximately 142 major trauma victims per year.

#### Current System of Trauma Care

Solano County Department of Emergency Services is the local EMS agency, and the State of California is the EMS authority. The county office is tasked to develop policies and procedures that ensure compliance of the local trauma system with established criteria of the state. The required components of that plan are listed in Table 3. To date, no such plan exists.



Table 3.  
Trauma Center Policy Requirements

- Multidisciplinary nature of systematized trauma care
- Public information and education about trauma system
- Marketing/advertising as relates to trauma system
- Established service area for trauma hospitals
- EMS dispatching
- Communication system usage
- Transportation
  - Inter trauma center transfer
  - Transfer from receiving hospital to trauma center
  - Integration of pediatric hospitals into system
- Training of prehospital EMS personnel
- EMS and trauma care coordination
  - Mutual aid between neighboring jurisdictions
  - Integration with nonmedical emergency services
- Appropriate fees
  - Application
  - Designation
  - Monitoring
  - Evaluation
- Medical controls and accountability
  - Triage
  - Treatment protocols
- System organization and management
- Data collection and management
- Quality control and system evaluation
- Assuring availability of trauma team personnel
- Trauma center designation process
- Written agreements

Note: California Administrative Code, Title 22, 1986.

### Pre-Hospital Phase

Currently, community emergency services are provided by a combination of private ambulance services, the California Highway Patrol, municipal police and fire services, and, for a limited region, DGMC. There is an area wide "911" emergency telephone system which refers calls for assistance to the service having jurisdiction over the area of the incident. The procedures and methods used for notification, response, and transportation are fragmented. Trauma victims are generally transported to the nearest hospital or, to DGMC when a victim is known to be military.

Ambulance services throughout the county use several different methods in assessing and reporting essential data. No standardized method is used for patient assessment, severity of injury assessment, or recording of vital patient data. An effort is underway to standardize the assessment tool but uniformity is not expected for at least a year (T. Scheidel, personal conversation, July 1987).

### Hospital Phase

There is no generalized community understanding of the extent of services available at each hospital. As a result, ambulance services lack the protocols

necessary to route the injured patient to the facility that can best serve their needs. There are no plans for bypassing particular hospitals when their services are known to be limited or unavailable. Several areas within the county rely on the services of the Napa and Contra Costa County trauma centers. The monitoring of the quality of care falls within the purview of each facilities quality assurance plan, without any system wide exchange of information. Likewise, there is no comprehensive organized plan for training.

#### Trauma Center Criteria

The State of California is the licensing and regulating agency for all public and private health care services. The statutes governing trauma care systems are contained in the California Administrative Code, Title 22, Chapter 7 (Appendix).

A hospital seeking trauma center designation must be licensed by the state. A facility with an emergency department licensed as a Level I, II or III may seek designation, within a regional trauma plan, as a trauma center. The California designation of levels of emergency services is consistent with those of the JCAH and the ACS. No health care agency can advertise

itself as a trauma center until it has been so designated by the local EMS agency and is in compliance with state statutes.

#### Population and Patient Volume

The trauma center eligibility requirements in California limits one trauma center for an area population of 350,000 and a major trauma case load of 350 patients for the defined catchment area. When this requirement cannot be met, the state stipulates that written agreements be made with neighboring EMS agencies for the purpose of developing a regional trauma system. Two areas in rural northern California have petitioned for exception to this population stipulation. So far, the state has refused to grant any waivers and it is unlikely that it will modify its stance (C. Jezycki, personal communication May 1987)

#### Facility Requirements

Titles 22 and 24 of the California Administrative Code detail the construction specifications and codes for health care facilities. A review of titles 22 and 24 revealed no evidence of facility design, construction or structural codes specific for trauma centers vis a vis emergency departments.

The facility problem most often encountered is the lack of a dedicated operating room and sufficient ICU beds. This can usually be resolved with internal management and scheduling controls. Generally, facilities that meet the rigorous requirements for state licensure need no other physical modifications when they seek trauma center designation (C. Jezycki, personal conversation, May 1987).

### Hospital Services Requirements

#### Physician Requirements

All physicians must be California licensed and physician specialists must become board certified within three years of qualifying for certification, or within three years of joining the trauma team. The state has taken a realistic approach to meeting the ACS' strict 24 hour in-house criteria for physician specialties.

California allows that the physician requirements may be filled with senior residents who have completed two years of their residency, are licensed in California and are capable of initiating immediate care for the trauma patient. Residents in general surgery must have completed three years of their residency. When residents are utilized in this

manner, the attending physicians must be in-house and immediately available, the designated physician specialists must be promptly available, either in-house or on call. The Level II trauma center physician staff requirements, per California statutes, are summarized in Table 4.

Table 4.  
Level II Trauma Center Criteria  
Physician Requirements

In-house immediately available 24 hours per day:

- Anesthesiology
- Emergency Medicine
- General Surgery

On call and promptly available:

- Surgical Specialties
  - Cardio-thoracic Surgery
  - Neurosurgery
  - Oral/Plastic Surgery
  - Otorhinolaryngology
  - Orthopedic Surgery
  - Urology

- Medical Specialties
  - Cardiology
  - Hematology
  - Internal Medicine
  - Nephrology
  - Pathology
  - Pediatrics
  - Radiology

Note: From California Administrative Code, Title 22, 1986.

Applying Trunkey's (1977) model for community hospital staffing of a trauma service, manpower

requirements are matched to the Level II physician criteria (Table 5). While Trunkey determined that four positions were needed to provide 24 hour on call coverage, rotating on call duties among three individuals can provide an effective schedule for round

Table 5.  
Level II Trauma Center Criteria  
Physician Requirements

	# For 24 hr. Coverage	Total Needed
In-house 24 hours per day:		
Anesthesiology	1 x 5	5
Emergency Medicine	1 x 5	5
General Surgery	1 x 5	5
Promptly Available:		
Surgical Specialties		
Cardio-thoracic Surgery	1 x 3	3
Neurosurgery	1 x 3	3
Ophthalmic	1 x 3	3
Oral/Plastic Surgery	1 x 3	3
Otorhinolaryngology	1 x 3	3
Orthopedic Surgery	1 x 3	3
Urology	1 x 3	3
Medical Specialties		
Cardiology	1 x 3	3
Hematology	1 x 3	3
Internal Medicine	1 x 3	3
Nephrology	1 x 3	3
Pathology	1 x 3	3
Pediatrics	1 x 3	3
Radiology	1 x 3	3
TOTAL		57

Note: Teufel & Trunkey, 1977.

the clock coverage. This is a more realistic pattern for smaller facilities. Any number less than three is unrealistic as it would require a person to be on call 50% of the time.

#### Hospital Support Services Requirements

The physician and the quality of care that is provided can only be as good as the training and availability of the other support services. Those allied health personnel and support services required by the state are shown in Tables 6 and 7, respectively.

The hospital designated as a trauma center becomes the hub of the EMS system and assumes administrative management. The major programs to be managed are quality assurance and community outreach training. The

Table 6.  
Level II Trauma Center Criteria  
Allied Health Personnel

In-house and immediately available 24 hours  
Certified radiological technician  
Computerized Tomography (CT) Technician  
Laboratory technologist  
OR staff

On call and promptly available  
Angiography technician  
Back-up OR staff

Note: From California Administrative Code, Title 22, 1986.



**Table 7**  
**Level II Trauma Center Criteria**  
**Hospital Services Requirements**

**Clinical Lab**

- Alcohol and drug screening
- Blood bank (or access)
- Blood gas and pH determinations
- Coagulation studies
- Serum and urine osmolarity

**Emergency Services**

- Backboards/spinal immobilization boards
- Drugs and supplies for initial resuscitation
- Peritoneal Lavage
- Pneumatic anti-shock trousers
- Skeletal tongs
- Two-way radio linked with EMS
- X-Ray capability

**Radiology**

- Angiography
- General radiological procedures
- Imaging services to include CT

**Surgical Services**

- OR suite available/in use for trauma patients
- Craniotome
- Endoscopes
  - Bronchoscope
  - Esophagoscope
  - Gastrosopes
- Operating Microscope
- Thermal control equipment: patients and blood
- X-Ray capability

**Supplemental Services**

- Immediate access to clinical lab
- Cardiac output monitoring
- Electronic blood pressure monitoring
- Patient weighing devices
- Intracranial pressure monitoring
- Burn Care \*
- Pediatric Care \*
- Physical therapy /Rehabilitation center \*
- Acute hemodialysis \*
- Acute spinal cord injury management \*

**Note:** \* May be provided through a transfer agreement.  
From California Administrative Code, Title 22, 1986.

scope of the quality assurance program must include detailed audits of all trauma-related deaths, major complications, and transfers; and monthly multidisciplinary trauma conferences to critique selected trauma cases. A system must be in place to provide telephone and on-site consultation with physicians in the community and outlying areas. The trauma center becomes the focal point for providing formal continuing medical education in trauma care for physicians, nurses, allied health personnel, local EMS personnel, (EMT-I, EMT-II and EMT-P), and all affiliated Level II and III trauma receiving hospitals (California Administrative Code, 1986).

#### DGMC Profile

DGMC services a primary beneficiary population of 59,700 people in northern California and Nevada as well as a large referral population. Over the past calendar year the hospital maintained an average daily occupancy of 188 patients, with an average length of stay of 8.0 days, for a 72% average occupancy rate. The ambulatory care services provided over 350,000 outpatient visits for the same period. Of the beneficiary population serviced at DGMC 21.5% are retirees, 23.5% are dependents of retirees and deceased members, 32% are

dependents of active duty military members, 22% are active duty military, and the remaining 1% is a composite of other authorized beneficiaries and civilian emergencies (DGMC/SGM, 1987).

The Chairman, Department of Emergency Services is board certified in emergency medicine, and has over 12 years of experience in emergency medicine. The department is accredited by the JCAH as a Level II emergency room. The most recent accreditation visit was completed in March of 1987.

For the past calendar year the emergency room averaged 1,972 visits per month. Similar to those in the private sector the DGMC emergency room also serves as an after hours convenience clinic for minor ailments and health problems. The Charge Nurse of Emergency Services, estimates that 80% of emergency room visits are convenience visits, 20% are emergent problems and only .5% of the cases are true trauma patients ( V. Kennedy, personal conversation, July 1987).

The existing emergency room is a prefabricated building connected to the main facility by an enclosed walkway. The emergency suite houses three treatment rooms, one waiting room, two offices and one restroom.

Supporting the emergency room is a five operatory surgical suite that averages 323 cases per month.

Adjoining the surgical suite is an eight bed Intensive Care Unit (ICU). Only six of the ICU beds are operational, the limited number of nurses and trained technicians has forced the "closure" of two ICU beds.

Facility Capabilities: Physical Profile  
of Planned Emergency Department

Construction of the new DGMC is 71% complete. The government expects to take possession of the building in October of 1988. During an intensive two month transition period the building and it's staff will be readied for the opening of full patient services. The state-of-the-art medical center will be the second largest in the Air Force and the largest structure in Solano County.

The new facility is situated one mile west of the main gate to Travis Air Force Base. Access to the medical center campus is segregated from the traffic flow of the main base by a separate entrance and security gate.

The emergency department is located at street level on the south side of the facility. Emergency vehicles enter through a dedicated drive, separating emergency traffic from visitor and staff traffic. The covered ambulance reception point will be easily

recognizable by a well developed signage system. The ambulatory patient entrance and waiting area are separate from the ambulance entrance.

Within the facility the department is strategically placed to provide an excellent functional adjacency to the surgery suite, ICU, laboratory and radiology functions. The design of the emergency suite provides for the location of trauma beds separate from the treatment and exam areas. Waiting areas are designed to be spacious, quiet, and out of sight of the trauma beds.

#### Physician Staff Profile

Based upon the January 1987 manpower authorizations and assigned physician reports, the physician staff specialties currently available at DGMC are shown in Table 8. The current combination of specialty and subspecialty services available at DGMC is impressive. While the number of positions filled matches the authorizations, the number of actual authorizations is a source of concern when considering the need to provide round-the-clock immediate response to the trauma patient.

The professional staff of a military medical center is relatively unstable. Physicians, nurses, and

Table 8.  
Physician Specialty Services at DGMC  
As of 1 July 1987

Emergency Medicine	Pathology
Family Practice	Pediatrics
Internal Medicine	Allergy
Allergy	Cardiology
Cardiology	Endocrinology
Dermatology	Gastroenterology
Endocrinology	Hematology-Oncology
Gastroenterology	Neonatology
Hematology	Neurology
Nephrology	Radiology
Neurology	Diagnostic Imagery
Oncology	Radiotherapy
Primary Care	Nuclear Medicine
Pulmonology	Surgery
Rheumatology	Anesthesiology
Mental Health	General Surgery
Obstetrics-Gynecology	Neurosurgery
Endocrinology	Ophthalmology
Pathology	Maxillofacial
Oncology	Otolaryngology
Orthopedics	Plastic Surgery
Orthopedic Surgery	Thoracic Surgery
Hand Surgery	Urology
Podiatry	Vascular Surgery

Note: DGMC Management Information Summary, 1987.

technicians are frequently sent to provide critical manning assistance to other facilities. Cyclic assignment rotations, lag time between the departure of one staff member and arrival of a replacement, and required military training obligations often compromises the availability of what appears on paper to be a well rounded staff.

### Hospital Support Services

Currently DGMC does not meet the state criteria for the essential physician (Table 9) and allied health (Table 10) staffing patterns.

Table 9.  
Level II Trauma Center Criteria  
Available Physician Resources

	Total Needed	DGMC Auth	DGMC Assign	Shortage
In-house 24 hours per day:				
Anesthesiology	5	4	4	1
Emergency Medicine	5	5	6	
General Surgery	5	3	3	2
Promptly Available:				
Surgical Specialties				
Cardio-thoracic	3	1	1	2
Neurosurgery	3	2	2	1
Ophthalmic	3	2	2	1
Oral/Plastic Surgery	3	2	2	1
Otorhinolaryngology	3	2	2	1
Orthopedic Surgery	3	4	4	
Urology	3	2	2	1
Medical Specialties				
Cardiology	3	2	1	2
Hematology	3	1	2	1
Internal Medicine	3	6	8	
Nephrology	3	1	1	2
Pathology	3	5	5	
Pediatrics	3	7	7	
Radiology	3	8	9	
TOTAL	57	57	61	15

Note: Does not include residents.

Table 10.  
Level II Trauma Center Criteria  
Available Allied Health Resources

Service	Availability	
	Yes	No
In-house 24 hours per day:		
Emergency Room:		
Nurse	X	
Technician	X	
Surgical Suite:		
Nurse		X On Call
Technician		X On Call
Radiology		
General Technician	X	
CT Technician		X On Call
Laboratory		
General Technician		X
Promptly Available:		
Surgical Suite		
Back-up Nurse	X	
Back-up Technician	X	
Radiology		
Angiography Technician	X	

Likewise, the hospital support services fall short of the state criteria. The surgical staff is available in-house until midnight and then remains on call. A back-up surgical team is available, on call, round-the-clock. Likewise, after normal duty hours the CT technician is available on call. Generally, there is a nurse on duty in the Emergency Room at all times.

Historically, DGMC has had difficulty obtaining both the civilian and military specialized support



staff that it needs. For the past ten months the Department of Nursing has had seven vacant positions for civilian nurses. The Air Force Medical Service has traditionally added additional administrative requirements and clinical programs without providing the additional manpower resources to manage them.

### Shortfalls

Matching the California criteria for trauma center designation with the current system of trauma care in Solano County and the profile of physician and hospital services to be available at the new DGMC, the following shortfalls are identified:

A comprehensive trauma care plan addressing the specifically required policies does not exist.

Administrative programs to monitor the quality of trauma care do not exist.

System wide training and professional out-reach programs do not exist.

Based upon a staffing pattern that utilizes an in-house emergency physician, anesthetist, and general surgeon, with specialists on call, 15 additional physician FTE's are required to provide staffing for for immediate round- the-clock trauma care.

An additional five FTEs are needed in nursing to provide round-the-clock registered nurse coverage for the emergency room and surgical suite.

Radiology services require two additional FTEs for CT technicians.

Three FTEs are identified for dedicated radio dispatch staff.

Administrative support of the quality assurance program, processing of insurance and workmans' compensation claims, and maintenance of the trauma registry demand 2 FTEs (C. Jezycki, personal conversation, May 1987).

Given a full effort between all agencies, DGMC would need to contribute one person, full-time for three months (.25 FTE) to work with the county on policy development (T. Scheidel, personal conversation, July 1987).

The requirement for additional personnel totals to 27.25 FTEs. This total does not include the hours dedicated to the initial and recurring training required of all members of the trauma team.

The basic annual personnel costs, exclusive of training costs, moving expenses and other basic allowances for these 27.25 FTEs are shown in Table 11.

Table 11.  
Basic Personnel Costs

Position	FTE Needed	Military Pay Grade	Annual Salary	Total Salary
Physician	15	0-3*	21,504	322,560
Nurse	5	0-2	19,037	95,184
Radiology	2	E-4	11,523	23,064
Dispatcher	3	E-4	11,532	34,596
Program Administration	2	0-2	19,037	38,074
Policy Development	.25	0-3**	27,940	6,884
TOTAL	27.25			\$530,362

Note: 1987 Military Pay Scale

\* Physician 0-3 with <2 years service.

\*\* Administrator 0-3 with >4 years service.

#### Organizational Implications

Any hospital that commits to a trauma program must be ready to deal with changes in the character of its organization:

The availability requirements and the preemptive nature of the trauma patient are not always comfortable. The trauma patient preempts the blood available in the bank for elective surgery; gets the arteriogram ahead of the barium enema; displaces the CT scan patient with severe headaches; preempts the patient who has undergone lengthy preparation for surgery, and takes that scarce intensive care bed for prolonged periods of time. The special needs of the trauma patient can be very disruptive to an otherwise tranquil physician and support staff.

### Physician Staff Concerns

The definition of roles in the emergency department is a frequent problem. Since trauma is a surgical specialty, the potential conflict between the emergency medicine and surgical specialists must be addressed.

Although the surgeon is the linchpin of the trauma care team, the anesthesiologist and the emergency physician play such integral roles that there can be no second class members of the team. In a facility where the surgeon is on call, the emergency physician will play different role than he would in a trauma center with immediate surgical staff availability. The institution must establish ground rules and defined roles for each member of the trauma team. The success of the trauma system relies on the ability of the emergency physician and the trauma surgeons to work together. When patient welfare is placed as the top priority, "turf" problems become irrelevant.

Physician services throughout the organization must be absolutely committed to providing trauma care. Reluctance to dedicate anything less than full resources at any link in the chain compromises the success of the program and the welfare of the patient.

### Fiscal Concerns

Generally, trauma care is considered to be a revenue generating enterprise. If DGMC were to provide regional trauma care it would be a direct financial drain on the organization.

The first financial obligation would payment of an application fee. This payment to the local EMS agency has been estimated by NBMC to be as high as \$250,000, and is in addition to other state licensure fees. The next financial obligation would be in funding the 27.25 full time positions that would be required to bring essential services up to the level specified in the state criteria.

California law prohibits the transfer of patients from one medical facility to another for economic reasons. Often referred to as an "anti dumping" law, it establishes that patients can only be transferred for valid medical reasons or upon the patient's request. In contrast, federal guidelines for providing emergency care to civilians in a military hospital stipulates that the patient be transferred to a civilian hospital once medically stabilized. Under either proviso, DGMC would be providing direct patient

care for the more costly and resource intensive portion of the hospitalization. Transfers to the surrounding community hospitals would then be for the less costly, recuperative days of care.

Cooper's (1985) study reported on the average billed charges for trauma care (Table 12). In comparison, Queen of the Valley hospital reports an average minimum daily charge of \$1,100 for each trauma patient (C. Jezycki, personal conversation, May 1987).

Table 12.  
Billed Hospital Charges

Average basic charge per day	\$ 743 (range 210 - 4600)
Average OR charges	\$ 668
Average ICU charges	\$1353
Average length of stay	5.8 (range 1 - 35 days)

Note: Does not include physician fees or diagnostic procedures.  
Cooper, 1985

Multiplying this basic charge by the average length of stay at Queen of the Valley (7.5 days), the estimated basic charge for a trauma patient would be \$8,520.

At Queen of the Valley, additional charges are accrued for diagnostic and laboratory procedures, physician fees, operating room charges and other specialty services provided.

DGMC would be billing civilian emergency care at the DOD fixed rate of \$48 for each outpatient (Emergency Room) visit and \$446 for each inpatient day, regardless of the extent of diagnostic procedures, services, supplies and equipment used to treat the patient. Based on an average length of stay of 8 days, total billed charges, inclusive of physician care, for a trauma patient at DGMC would be \$3,616.

Assuming that a given trauma patient would consume the same resources no matter which trauma center provided the care, this cursory comparison of charges clearly shows that DGMC would be providing trauma care at a financial loss. Currently, there are no fiscal advantages, and significant fiscal disadvantages to be recognized from providing regional trauma care.

#### Organizational Advantages and Disadvantages

The following discussion serves to highlight the major advantages and cautions of designating DGMC as the regional trauma center.

### Medical Readiness

The primary mission of DGMC is to "operate a tertiary care medical center providing the highest possible degree of wartime readiness and combat capability" (DGMC/SGM, 1987). In the event of a wartime mobilization, 851 of DGMC's 1240 military personnel would leave the facility and deploy to a predesignated site; where their mission would then be to provide definitive care and treatment of wartime casualties. The skeleton staff remaining at DGMC would be augmented with ready reserve units. In this scenario, DGMC's tasking then becomes one of providing primary care to the remaining military population and preparing to receive returning wartime casualties for recuperative and rehabilitative care.

There is an obvious enhancement of readiness training to be recognized through providing regional trauma care. The medical profile of a trauma casualty closely parallels that of a wartime casualty. In both cases, the victim is usually an otherwise healthy young adult, and although the nature of the injury is different, the actual types of injuries are usually



similar. In both cases the wounds are dirty, the casualty has been exposed to a range of environmental factors and has received some level of organized prehospital care. The similarities of case management extends from prehospital assessment and initial care through rehabilitation and discharge. For the emergency physician, surgeon, anesthesiologist, nurse, medical technician, and dietician the trauma patient provides an excellent experiential model for preparing to treat wartime casualties.

The decision to seek trauma center designation implies a promise to the community that the service will be available every time it is needed. Augmenting reserve units would be unfamiliar and untrained in the established regional plans and protocols for trauma care. The augmenting reserve forces are unlikely to provide the mix of skills and specialty services required to maintain the trauma service and hospital support services would be extremely limited.

In the event of a wartime mobilization or extended exercise DGMC would have to terminate it's commitment to the community of providing regional trauma care.

### Medical Education Program

An additional part of the DGMC mission is to "conduct professional education and training" (DGMC/SGM, 1987). The medical center supports six physician, two dental and an administrative residency programs; a nurse intern program, three technician training programs, and an extensive on-the-job training (OJT) program.

There can be no doubt as to the learning opportunity provided by caring for the trauma patient. The potential enhancement to training extends throughout the organization. Technicians from multiple departments (nursing, laboratory, radiology, surgery, emergency, cardio-pulmonary medicine, ICU) all gain valuable experience from recognizing, assessing, and meeting the special demands of the trauma patient.

One of the administrative programs required of the trauma center is the maintenance of a trauma registry. Maintenance of and access to such a data repository would certainly enhance the medical education and research program.

Currently the physician residency programs utilize several inner-city medical centers for their trauma

care experience. Based upon the projected number of trauma cases for the county (142), it is not likely that there would be a sufficient trauma patient volume to provide a creditable stand-alone trauma rotation at DGMC. While some limited experience could be gained at DGMC it would be myopic to expect that DGMC could provide the same depth and breadth of experience available at the Sacramento or San Francisco sites currently used.

#### Recruitment and Retention

An obvious advantage to being designated as a trauma center is the ability to recruit and retain those health care professionals who are interested in and motivated to become part of a trauma team.

On the surface it would appear that the greatest advantages would be recognized for physician recruitment. However, the Air Force Medical Corps does not have a recruitment problem. For fiscal year (FY) 1986 the Recruiting Service exceeded its goal of 156 physicians and had met its 1987 goal by the tenth months of the fiscal year (S. Gregory, personal conversation, July 1987).

Retention is an issue however. Based upon the wartime role of the Medical Corps, the greatest demand exists for anesthesia, surgery, and emergency physician specialists. Designation as a trauma center could provide a stimulating work environment for these specialists and aid in physician retention.

Retention is becoming a major concern for other health professionals also. The national nursing shortage has not yet created a retention problem for the Nurse Corps. However, as the private sector becomes more competitive in pay and benefits for nurses, the Air Force is likely to experience an exodus of nurses and medical technicians seeking nursing degrees. The critical skills currently sought by the Nurse Corps are operating room nurses, emergency room nurses, and nurse anesthetists (Korach, 1987). The promise of working in a trauma center may increase the potential to recruit and retain those critical skills.

#### Commitment to Community Service

Travis Air Force Base is an integral part of the community. Many programs have been developed that nurture the excellent rapport between the base and the

surrounding communities. Great strides have been made in joint disaster planning and training.

DGMC stands in a position to provide a much needed community service. There are certainly positive goodwill overtures to be enjoyed. Providing trauma care affords the opportunity to project a positive image of both the Air Force and its Medical Service.

On the other side of the coin, however, if designated as the regional trauma center, DGMC is placing itself in direct competition with the private sector. This is a major concern. In the words of one local hospital administrator, "I would have you in court so fast, you wouldn't know what hit you" (confidential conversation, May 1987).

Aside from the legal controversy, the issue of direct competition can serve to undermine two important DOD health care reform initiatives. The aim of the first program is to increase access to primary care services for military dependents and retired beneficiaries. In this program the government contracts with private providers for services not available at the federal facility. The second program is the National Defense Medical System. This program

asks for a voluntary commitment of civilian hospital beds in the event of a national emergency.

It seems a dichotomy of principle to expect the civilian health care industry to contract primary care services and national emergency beds to a federal agency that is in direct competition with them for the high reimbursement trauma patient.

#### Potential Obstacles

Beyond the basic concept of feasibility, there are other significant issues that may pose as obstacles to trauma center designation for DGMC.

#### Resolution of State Licensure Requirements

Repeatedly, throughout the discussion of trauma center criteria the requirement of state licensure for the facility and physicians is stipulated. The state cannot license a federal agency. Likewise, physicians and nurses working within a federal hospital are not subject to state licensure requirements.

The state's criteria for trauma center designation parallel closely and are no more stringent than the Air Force Inspector General's Health Services Management

Inspection (HSMI) criteria. In lieu of licensure the state would have to be willing to accept the current criteria used by the HSMI and the JCAH as a measure of DGMC's ability to provide Level II trauma care.

A reasonable alternative to facility licensure by the state would be a courtesy verification and evaluation survey by the state. In this way California can be assured that DGMC meets or exceeds all of the state's necessary criteria. It would also be necessary to negotiate with the state on the issue of professional licensure for nurses and physicians.

While this issue could be resolved, the negotiating process may prove too long, arduous and potentially damaging to DGMC. If an attempt were initiated to either waiver or modify the licensure requirements the entire military health care system would be put on trial by the press. A tremendous potential exists for the publicity to damage the public image of the military health care system.

#### Federal Sector Competition

As mentioned previously, significant legal implications would have to be overcome to resolve the alleged issue of unfair federal sector competition. In

other areas of the country where military hospitals serve as public trauma centers (San Antonio, San Diego, District of Columbia) they serve as one of many hospitals within the regional plan. In those cities the patient's destination is based on the geographic location of the incident or a specific care need. DGMC would be the sole center for Solano County and thus a singular provider of the service, to the exclusion of the private hospitals.

#### Litigation

An additional concern to be evaluated is the potential legal risk imposed upon the medical technicians from DGMC.

Presently, DGMC ambulances respond off-base to accidents, but very infrequently. As part of a regional trauma plan it is reasonable to expect that DGMC ambulances would be called upon more frequently to respond to accidents outside the confines of Travis Air Force Base. The accident victim being treated would be billed by DGMC for the services provided. As a sanctioned extension of the trauma center, the medical



technicians would also be providing their services for a fee. By doing so, the medical technician loses immunity under the Good Samaritan proviso and is held accountable to the local standard of care (S. Johnson, personal conversation, July 1987). Local civilian emergency response teams are trained at the EMT-II or EMT-P level. Thus the local standard of care is higher than the level at which DGMC technicians are trained.

The American public is a highly litigious society. It is well known that in most cases of alleged malpractice it is a mismatch between the patients expectations and their perceptions of care rather than a breach in the quality of care that precipitates a suit.

The increase in trauma cases brought to DGMC is likely to result in a significant rise in the number and dollar value of claims against the government. Public notions about military health care, right or wrong, set the tone for the expectation of care to be provided. The government, as an entity, can be seen as the "Deep Pocket". The actual dollar amount of claims along with the extensive manhours dedicated to researching, authenticating, and arbitrating claims poses a significant loss to the government.

### Financial Loss

Under the current system of manpower allocation, budgeting and financial reimbursement, designation of DGMC as a regional trauma center would be a financial drain on the medical center.

Potentially, reimbursement schemes could be developed that would partially compensate for the cost of providing trauma care. The simplest method would be to bill for care using the already established DRG system. On the surface this would appear to be a reasonable solution; however, there are significant drawbacks.

Unlike civilian health care agencies, the military does not have an accounting and billing service that can enumerate the resources that a patient consumes. Systems would have to be developed to price and verify each service and supply item used by the patient. These systems exist as "off the shelf" software packages but would require significant investment of computer hardware support. A switch to such a cost accounting and charge system would necessitate a radical change in the way care is provided, as procedures are developed to capture patient costs.

Additional manpower would be needed to provide procedural training and billing services. Finally, DGMC would still not receive the benefit of the revenues it would be generating. Any collected monies are returned into the general treasury, not credited to the Air Force Medical Service or to DGMC.

Resolution of the financial reimbursement constraints would take, literally, an act of Congress. Restructuring would be needed in the way manpower is earned, charges assessed, and reimbursements collected.

## CHAPTER III

### FINDINGS

The current system of trauma care in Solano County is disjointed and fragmented. The full spectrum of available services is not generally known and therefore not adequately utilized for the benefit of the trauma patient.

The current population and trauma incidence figures for Solano County meet the criteria for only one designated trauma center within this catchment area. The area population is expected to reach 390,200 by the year 2000. If growth continues as projected a second trauma center may not be justified until well into 2020.

The new DGMC will have the facility and the clinical support features necessary to provide Level II trauma care for Solano County, however, shortfalls exist in the availability of physicians and allied health personnel. An additional 27.25 FTEs would be required to overcome these shortfalls. With an average occupancy rate of 77%, DGMC would be able to accommodate the predicted trauma case load of 142 patients annually.

Significant political, organizational, financial and legal issues would have to be resolved, however, if DGMC were to seek designation as the regional trauma center.

## CHAPTER IV

### CONCLUSIONS

A tremendous potential exists to reduce disability and unnecessary death through the implementation of a coordinated trauma care system. Yet the medical-political-societal problems of the drinking driver, street violence, drug abuse, the spiraling costs of health care, and an ever litigious public frustrate easy solutions.

Given significant obstacles to overcome, it is feasible for David Grant Medical Center to be designated as the regional trauma center for Solano County California.

If the decision is made to pursue trauma center designation for DGMC, a full commitment to trauma care would be essential from all levels within the Medical Service. Starting at the local level, the Executive Committee and the Medical Staff must be fully informed of the impact that trauma care will have upon the resources and organizational structure at DGMC. From the top level, long term commitment of personnel and money is vital to the success of a trauma program at DGMC. Such a commitment must be resilient and

steadfast, spanning changes in leadership and administration at all levles within DOD.

If DGMC is not designated as the regional trauma center there is an important role it can fill in the trauma care system. The professional services available, and pool of experience in program development and management provides a valuable resource for the county. Likewise, the extensive medical services available can serve to supplement the services offered by the designated trauma center.

Taking the leadership position on the issue of trauma care, NBMC, has asked the five hospitals in Solano County, to come together in a unified effort to spur the county governance in moving ahead with development of an EMS plan. As the health care sector brings pressure on the county government, the need for a trauma care system in Solano County holds the potential of rapidly becoming a major political issue. While only one of the county's seven mayoral seats is up for election in 1987, the concern for a trauma care system is likely to become a future campaign issue among the five member Board of Supervisors and seven city mayors.

The designation of a singular hospital as the trauma center must be for the benefit of the patient; not to fill beds, increase revenues or build a public image. The hospital needs to take stock of its internal organizational resources and capabilities, the ability to dedicate essential resources to trauma care, the medical staff issues, and most importantly of all, the full organizational commitment to trauma care. The trauma center can only function within a system and can only be effective if there is full community support.



## CHAPTER V

### RECOMMENDATION

David Grant United States Air Force Medical Center should play an active role in the development of a regional trauma care system for Solano County, California. As an integral part of that system, DGMC should be clearly defined as a designated receiving hospital, rather than the designated trauma center. Within the county trauma plan, the professional services available at DGMC should define the types and mix of patients routed to DGMC.

## APPENDIX

## APPENDIX

### California Administrative Code

#### TITLE 22. SOCIAL SECURITY

#### DIVISION 9. PREHOSPITAL EMERGENCY MEDICAL SERVICES

#### CHAPTER 7. TRAUMA CARE SYSTEMS

##### Article 1. Definitions

##### 100236. Catchment Area

"Catchment area" means that geographic area served by a local EMS Agency for the purpose of regional trauma care system planning.

##### 100237. Emergency Department

"Emergency department" or "emergency room" means the area of a licensed general acute care hospital that customarily receives patients in need of emergency medical evaluation and/or care.

##### 100238. Immediately Available

"Immediately" or "immediately available" means (a) unencumbered by conflicting duties or responsibilities; (b) responding without delay when notified; and (c) being within the specified area of the trauma center when the patient is delivered in accordance with local EMS Agency policies and procedures.

##### 100239. Implementation

"Implementation" or "implemented" or "has implemented" means the development and activation of a trauma care system plan by a local EMS Agency, including the actual triage, transport and treatment of trauma patients in accordance with the plan.

##### 100240. Major Trauma Patient

"Major trauma patient" or "major trauma" or "critically injured patient" means a person who has sustained acute injury and by means of a standardized field triage criteria (anatomic, physiologic, and mechanism of injury) is judged to be at significant risk of mortality or major morbidity.

100241. On-Call

"On-call" means agreeing to be available to respond to the trauma center in order to provide a defined service.

100242. Pediatric Trauma Center

"Pediatric trauma center" means: (a) a licensed acute care hospital which usually treats persons fourteen (14) years of age or less, which meets all relevant criteria and has been designated as a pediatric trauma center, according to this Chapter; or (b) the pediatric component of a trauma center with pediatric specialists and a pediatric intensive care unit approved by California Children Services.

100243. Promptly Available

"Promptly" or "promptly available" means being within the trauma receiving area, emergency department, operating room, or other specified area of the trauma center within a period of time that is medically prudent and proportionate to the patient's clinical condition and such that the interval between the delivery of the patient at the trauma center and the arrival of the respondent should not have a measurably harmful effect on the course of patient management or outcome.

100244. Qualified Specialist

"Qualified specialist" or "qualified surgical specialist" or "qualified non-surgical specialist" means a physician licensed in California who has taken special postgraduate medical training, or has met other specified requirements, and has become board certified within three (3) years of qualification for board certification in the corresponding specialty, for those specialties that have board certification and are recognized by the American Board of Medical Specialties, or within three (3) years of joining a trauma team if more than three (3) years have elapsed since qualifying to take the board certification examination.

100245. Receiving Hospital

"Receiving hospital" means a licensed general acute care hospital with a special permit for basic or comprehensive emergency service, which has not been designated as a trauma center, according to this Chapter, but which has been formally assigned a role in

the trauma care system by the local EMS Agency. In rural areas, the local EMS Agency may approve standby emergency service if basic or comprehensive services are not available.

100246. Residency Program

"Residency program" means a residency program of the trauma center or a residency program formally affiliated with a trauma center, which has been approved by the appropriate Residency Review Committee of the Accreditation Council on Graduate Medical Education.

100247. Senior Resident

"Senior resident" or "senior level resident" means a physician licensed in the State of California who has completed at least two (2) years of the residency under consideration and has the capability of initiating treatment, including surgery, when the clinical situation demands, and who is in training as a member of the residency program as defined in Section 100246 of this Chapter, at the designated trauma center. Residents in general surgery shall have completed three (3) years of residency in order to be considered a senior resident.

100248. Service Area

"Service area" means that geographic area defined by the local EMS Agency in their trauma care system plan as the area served by a designated trauma center.

100249. Trauma Care System

"Trauma care system" or "trauma system" or "regional trauma care system" means a formally organized arrangement of health care resources, that has been described in writing by a local EMS Agency, by which major trauma patients are triaged, transported to, and treated at designated trauma care hospitals.

100250. Trauma Center

"Trauma center" or "designated trauma center" means a licensed general acute care hospital which has been designated as a Level I, II or III trauma center by the local EMS Agency, in accordance with this Chapter.

100251. Trauma Receiving Area

"Trauma receiving area" means a designated area within a licensed general acute care hospital or designated

trauma center that routinely receives and manages the care of trauma patients.

100252. Trauma Team

"Trauma team" means the multidisciplinary group of personnel who have been designated to collectively render care for trauma patients at a designated trauma center.

100253. Triage Criteria

"Triage criteria" means a measure or method of assessing the severity of a person's injuries that is used for patient evaluation, especially in the prehospital setting, and that utilizes anatomic considerations, physiologic and/or mechanism of injury.

100254. Application of Chapter

(a) A local EMS Agency which has implemented or plans to implement a trauma care system shall:

(1) Establish policies and/or procedures to assure compliance of the trauma system with the provisions of this Chapter, at a minimum;

(2) Submit its trauma system plan to the EMS Authority for approval.

(b) The EMS Authority shall notify the local EMS Agency submitting its trauma care system plan within seven (7) days of receiving the plan that:

(1) its plan has been received.

(2) it contains or does not contain the information requested in Section 100257 of this Chapter.

(c) A local EMS Agency which implements a trauma care system on or after the effective date of this Chapter shall submit its trauma system plan to the EMS Authority and have it approved prior to implementation.

(d) A local EMS Agency which implements a trauma care system on or after the effective date of this Chapter shall submit its trauma system plan to the EMS Authority within one (1) year of the effective date of this Chapter.

(e) The EMS Authority:

(1) Shall "notify the local EMS Agency" either "of" approval or disapproval of its trauma system plan within sixty (60) days of receipt of the plan;

(2) Shall provide written notification of approval or the reasons for disapproval of a trauma system plan.

(g) If the EMS Authority disapproves a trauma system plan, the local EMS Agency shall have one (1) year from the date of notification of the disapproval to submit a revised trauma system plan which conforms to this Chapter or to appeal the decision to the Commission on Emergency Medical Services (EMS) which shall make a determination within six (6) months of receipt of the appeal.

(1) If a revised trauma system plan is approved by the EMS Authority the local EMS Agency shall begin implementation of the plan within one (1) year of its approval.

(2) If a revised trauma system plan is disapproved by the EMS Authority, the local EMS Agency may appeal the decision the Commission on EMS, which shall make a determination within six (6) months of receipt of the appeal.

(f) If the EMS Authority determines that a local EMS Agency has failed to implement the trauma system in accordance with the approved plan, the approval of the plan may be withdrawn.

(g) After approval of a trauma system plan, the local EMS Agency shall submit to the EMS Authority for approval any significant changes to that trauma system plan prior to the implementation of the changes. In those instances where a delay in approval would adversely impact the current level of trauma care the local EMS Agency may institute the changes and then submit the changes to the EMS Authority for approval within thirty (30) days of their implementation.

(h) No health care facility shall advertise in any manner or otherwise hold themselves out to be a trauma center unless they have been so designated by the local EMS Agency, in accordance with this Chapter.

(i) No provider of prehospital care shall advertise in any manner or otherwise hold themselves out to be affiliated with the trauma system or a trauma center unless they have been so designated by the local EMS Agency, in accordance with this Chapter.

100255. Trauma System Criteria

A local or regional EMS Agency which plans to implement or modify a trauma system shall develop a plan consistent with the following criteria:

(a) Catchment areas.

(1) No more than one (1) trauma center shall be designated for each 350,000 population or for each 350 major trauma patients per year occurring within the catchment area of the local EMS Agency. This number per trauma center may be exceeded if the local EMS Agency determines that a particular trauma center is capable of handling a larger volume of patients.

(2) If the requirement of subsection (a) (1) cannot be met within the jurisdiction of the local EMS Agency, then the local EMS Agency should execute written agreements with neighboring EMS Agencies for the purposes of developing a regional trauma system.

(3) In those circumstances where geography and population density preclude compliance with subsection (a)(1) and/or the option of written agreements with neighboring EMS Agencies, subsection (a)(2) is not viable, exemptions may be granted by the EMS Authority with the concurrence of the Commission on EMS on the basis of documented local needs. Such documentation shall include relevant information on the circumstances which preclude compliance, the alternate methodologies to be utilized to assure appropriate care and other data as may be required by the EMS Authority.

(b) Service areas.

(1) Each trauma center service area shall be defined by the local EMS Agency commensurate with local conditions including locations of prehospital service providers.

(2) The local EMS Agency may authorize the



utilization of air transport within its jurisdiction to geographically expand the primary service area(s) provided that the expanded service area does not encroach upon another trauma system, or that of another trauma center, unless written agreements have been executed between the involved local EMS Agencies and/or trauma centers.

(3) Within any given service area the local EMS Agency shall designate a single trauma center of the highest level possible except that a pediatric trauma center may also be designated within the same service area. In areas where pediatric trauma centers are designated the population requirements of subsection (a)(1) shall reflect the impact of the reduced pediatric population/patients.

(c) Base hospitals.

(1) The local EMS Agency shall identify base hospitals for trauma medical control and direction of prehospital emergency medical care personnel.

(2) The identified base hospitals shall meet all relevant base hospital requirements in the EMT-II or EMT-P regulations.

(d) Prehospital providers

(1) All prehospital emergency medical care personnel rendering trauma patient care within an organized trauma system shall be trained in the local trauma triage methodology.

(2) In areas where only EMT-I personnel provide prehospital emergency medical care, subsection (c) shall be appropriately modified by the local EMS Agency with regard to medical control requirements.

(3) All trauma patient transport vehicles shall be equipped with two-way radios capable of accessing hospitals, in accordance with local EMS Agency policies regarding radio communication.

100256. Policy Development

A local EMS Agency planning to implement a trauma system shall develop policies which address at least

the following:

- (a) The multidisciplinary nature of systematized trauma care;
- (b) public information and education about the trauma system;
- (c) marketing and advertising by trauma centers and prehospital providers as it relates to trauma care system;
- (d) establishment of service areas for trauma hospitals;
- (e) EMS dispatching;
- (f) communication system usage;
- (g) transportation, including inter trauma center transfer and transfer from a receiving hospital to a trauma center;
- (h) the integration of pediatric hospitals, when applicable, into the overall trauma care system to ensure that all trauma patients receive appropriate trauma care in the most expeditious manner possible;
- (i) training of prehospital EMS personnel;
- (j) EMS and trauma care coordination and mutual aid between neighboring jurisdictions;
- (k) coordination and integration of trauma care with nonmedical emergency services;
- (l) fees, including those for application, designation, monitoring and evaluation;
- (m) medical control and accountability, including triage and treatment protocols;
- (n) system organization and management;
- (o) data collection and management;
- (p) quality control and system evaluation;

(q) assuring the availability of trauma team personnel;  
and

(r) trauma center designation process, including the  
written agreement.

#### 100257. Plan Development

(a) The initial plan for a trauma care system that is  
submitted to the EMS Authority shall contain at least  
the following:

- (1) Summary of the plan;
- (2) organizational structure;
- (3) system design;
- (4) objectives;
- (5) implementation schedule;
- (6) fiscal impact of the system,
- (7) written documentation of local approval, and

(8) table of contents identifying where the  
information in this Section and Section 100256 of this  
Chapter can be found in the plan."

(b) The system design shall address the operational  
implementation of the policies developed pursuant to  
Section 100256 and the following aspects of hospital  
service delivery:

- (1) Critical care capability including but not  
limited to burns and pediatrics;
- (2) medical organization and management; and
- (3) quality assurance.

#### 100258. Data Collection

(a) The local EMS Agency shall develop a single  
standardized data collection instrument and implement a  
data management system for trauma care. The system

shall include the collection of both prehospital and hospital patient care data, which should be readily available from patient care and related records when the data management system for trauma care has been implemented.

(b) The prehospital data shall include at least those data elements required on the EMT-II or EMT-P patient care record, as specified in Section 100129 of the EMT-II regulations and Section 100164 of the EMT-P regulations.

(c) The hospital data shall include at least the following, when applicable:

(1) Data from a trauma center:

(A) Time of arrival and patient treatment in:  
receiving  
1. Emergency department or trauma  
2. operating room.

(B) Dates for:  
1. Initial admission;  
2. intensive care; and  
3. discharge.

(C) Discharge data, including:  
1. Total hospital charges (aggregate dollars only); and  
2. patient destination.

(2) Data from an intermediary hospital.  
In the event that a patient is first transported to a receiving hospital, and subsequently transferred to a trauma center, the applicable information in subsection (c) shall be readily available from patient care and related records.

#### 100259. Trauma System Evaluation

(a) The local EMS Agency shall be responsible for periodic performance evaluation of the trauma system, which shall be conducted at least annually.

(b) The local EMS Agency shall require participating trauma hospitals to collect specific data and perform

certain audit and evaluation functions and provide this information to the local EMS Agency as requirements for designation and redesignation.

100260. Level I Trauma Centers

(a) In order to be designated as a Level I trauma center a licensed general acute care hospital shall have at least the following:

(1) A trauma service or multidisciplinary trauma committee included in their organization, which can provide for the implementation of the requirements specified in this section and provide for coordination with the local EMS Agency.

(2) Department(s), division(s), service(s) or section(s) that include at least the following surgical specialties, which are staffed by qualified specialists:

- (A) General;
- (B) cardiothoracic;
- (C) neurologic;
- (D) orthopedic;
- (E) otorhinolaryngologic;
- (F) ophthalmic;
- (G) oral;
- (H) plastic and/or maxillofacial;
- (I) urologic;
- (J) gynecologic.

Designated trauma centers shall ensure that their staff surgeons have training and experience in trauma surgery.

(3) An emergency department, division, service or section staffed so that trauma patients are assured of immediate and appropriate initial care. Such staff

shall include qualified specialists in surgery or emergency medicine who are in-house evaluating trauma patients, providing initial resuscitation and performing necessary surgical procedures not requiring general anesthesia.

(4) Qualified surgical specialist(s) or specialty availability, which shall be as follows:

(A) General surgery, in-house and immediately available at all times;

(B) On-call and promptly available from inside or outside hospital:

1. Cardiothoracic;
  2. neurologic;
  3. orthopedic;
  4. otorhinolaryngologic;
  5. ophthalmic;
  6. oral;
  7. plastic and/or maxillofacial;
  8. urologic;
  9. hand, including microsurgery
- capability;
10. pediatric; and
  11. gynecologic.

(C) Requirements may be fulfilled by senior residents as defined in Section 100247 of this Chapter who are capable of assessing emergent situations in their respective specialties. In such cases, the senior resident(s) shall:

1. Be capable of undertaking immediate surgical care;
2. be able to provide the overall

control and surgical leadership necessary for the care of the patient;

3. have staff specialists on-call, who shall be advised about the patient and make themselves promptly available, when needed; and

4. have attending physicians in-house and immediately available for all operative major trauma cases.

(5) Qualified non-surgical specialist(s) or specialty availability, which shall be as follows:

(A) In-house and immediately available at all times:

1. Emergency medicine. This requirement may be fulfilled by senior level residents, as defined in Section 100247 of this Chapter, in emergency medicine or surgery, who are assigned to the emergency department and are serving in the same capacity. In such cases, the senior resident(s) shall be capable of assessing emergency situations in trauma patients and of providing for initial resuscitation.

2. Anesthesiology. This requirement may be fulfilled by senior residents as defined in Section 100247 of this Chapter, who are capable of assessing emergency situations in trauma patients and providing any indicated emergent anesthesia treatment. In such cases, the staff anesthesiologist on-call shall be advised about the patient and make themselves promptly available, when needed.

(B) On-call and promptly available from inside or outside hospital:

1. Cardiology;
2. gastroenterology;
3. hematology;
4. infectious diseases;
5. internal medicine;
6. nephrology;

7. pathology;
8. pediatrics;
9. psychiatry;
10. pulmonary; and
11. radiology.

(b) In addition to licensure requirements, a Level I trauma center shall have the following service capabilities;

(1) Radiological service. A radiological service shall have the following:

(A) Certified radiological technician in-house and immediately available at all times for general radiologic procedures;

(B) angiography; and imaging services with a technician who is promptly available at all times; and

(C) computerized tomography, for both head and body, with an in-house technician who is immediately available at all times.

(2) Clinical laboratory service. A clinical laboratory service shall have the following:

(A) Comprehensive blood bank or access to a community central blood bank

(B) capability to perform:

1. Coagulation studies;
2. blood gas and pH determinations (this function may be performed by services other than the clinical laboratory service, when applicable);
3. serum and urine osmolality; and
4. drug and alcohol screening.

(C) clinical laboratory technologist in-house and promptly available at all times.



(3) Surgical service. A surgical service shall have an operating suite that is available or being utilized for major trauma patients and that has at least the following:

(A) In-house operating staff who are immediately available at all times unless operating on major trauma patients and back-up personnel who are on-call and promptly available when needed;

(B) operating microscope;

(C) thermal control equipment:

1. for patients; and

2. for blood.

(D) x-ray capability;

(E) endoscopes, including at least:

1. bronchoscopes;

2. esophagoscopes; and

3. gastroscopes.

(F) craniotome; and

(G) autotransfusion capability.

(c) A Level I trauma center shall also have the following supplemental services which have special permits issued pursuant to Chapter 1, Division 5 or Title 22.

(1) Basic or comprehensive emergency service. The emergency service shall:

(A) Designate a physician to be a member of the trauma team. Senior level residents as defined in Section 100247 of this Chapter in emergency medicine or surgery who are assigned to the emergency medicine service, who are capable of assessing emergency situations in trauma patients and providing for initial resuscitation may fulfill this requirement. In such cases, the staff emergency medicine specialist on-call shall be advised of the patient and make themselves promptly available, when needed.

(B) Have the following equipment:

1. peritoneal lavage equipment;
2. drugs and supplies necessary for the initial resuscitation of major trauma patients;
3. x-ray capability;
4. two-way radio capable of being accessed by ambulances in the emergency medical services system in accordance with the local EMS Agency policies and procedures;
5. pneumatic anti-shock trousers;
6. skeletal tongs; and
7. back boards/spinal boards.

(d) In addition to the special permit licensing services, a Level I Trauma Center shall have the following licensed supplemental services:

(1) Intensive Care Unit (ICU).

- times;
- (A) A physician promptly available at all times;
  - (B) immediate access to clinical laboratory;
  - (C) cardiac output monitoring;
  - (D) electronic blood pressure monitoring;
  - (E) patient weighing devices;
  - (F) pulmonary function measuring devices;
  - (G) thermal control devices; and
  - (H) intracranial pressure monitoring devices.

(2) Burn care. This service may be provided through a written transfer agreement with a Burn Center.

(3) Pediatric care. Except for pediatric trauma

centers this service may be provided through a written transfer agreement with a hospital having pediatric intensive care unit approved by California Children Services.

(4) Physical Therapy Service.

(5) Rehabilitation Center Service. In-house consultation service for immediate or acute rehabilitation, when medically prudent, shall be available, but further rehabilitation may be provided through a written transfer agreement with a Rehabilitation Center.

(e) A Level I trauma center shall have the following services or programs that do not require a license or special permit.

(1) Acute hemodialysis capability. This service may be provided through a written transfer agreement.

(2) Acute spinal cord injury management capability. This service may be provided through a written transfer agreement with a Rehabilitation Center.

(3) Programs for quality assurance, including:

(A) Detailed audit of all trauma-related deaths, major complications, and transfers;

(B) multidisciplinary trauma conferences that include all members of the trauma team; these conferences shall be held at least once a month to critique selected trauma cases; and

(C) participation in the trauma system data management system.

(4) Outreach Program, to include telephone and on-site consultations with physicians in the community and outlying areas.

(5) Trauma research program.

(6) Continuing medical education. Formal continuing medical education in trauma care shall be provided for:

- (A) Staff physicians;
- (B) staff nurses;
- (C) staff allied health personnel;
- (D) local EMS personnel including at least EMT-I EMT-IIIs, and EMT-PS;
- (E) other community physicians and health care personnel; and
- (F) affiliated Level II and III trauma centers and trauma receiving hospitals.

(f) A Level I trauma center shall have an approved and accredited postgraduate medical training programs for residents at multiple levels of training in general surgery, internal medicine and anesthesiology.

(g) All level I trauma centers shall have written transfer agreements with all affiliated trauma care hospitals.

#### 100261. Level II Trauma Centers

(a) In order to be designated as a Level II trauma center a licensed general acute care hospital shall have at least the following:

(1) A trauma service or multidisciplinary trauma committee included in their organization, which can provide for the implementation of the requirements specified in this section and provide for coordination with the local EMS Agency.

(2) Department(s), division(s), service(s) or section(s) that include at least the following surgical specialties, which are staffed by qualified specialists:

- (A) General;
- (B) cardiothoracic;
- (C) neurologic;

- (D) orthopedic;
- (E) ophthalmic;
- (F) oral, otorhinolaryngologic, maxillofacial and/or plastic; and
- (G) urologic.

Designated trauma centers shall ensure that their staff surgeons have training and experience in trauma surgery.

(3) An emergency department, division, service or section staffed so that trauma patients are assured of immediate and appropriate initial care. Such staff shall include qualified specialists in surgery or emergency medicine who are in-house and immediately available at all times and capable of evaluating trauma patients, providing initial resuscitation and performing necessary surgical procedures not requiring general anesthesia.

(4) Qualified surgical specialist(s) or specialty availability, which shall be as follows:

(A) General surgery, in-house and immediately available at all times. The in-house requirement may be fulfilled by surgeons outside the facility provided that a mechanism exists to provide for compliance with Section 100238 (Immediately Available).

(B) On-call and promptly available from inside or outside hospital:

1. Cardiothoracic;
2. neurologic;
3. orthopedic;
4. ophthalmic;
5. oral, otorhinolaryngologic, maxillofacial and/or plastic, when available in the community; and
6. urologic.

(C) Requirements may be fulfilled by senior residents as defined in Section 100247 of this Chapter who are capable of assessing emergent situations in their respective specialties. In such cases, the senior resident(s) shall:

1. Be capable of undertaking immediate surgical care;
2. be able to provide the overall control and surgical leadership necessary for the care of the patient;
3. have staff specialists on-call, who shall be advised about the patient and make themselves promptly available, when needed; and
4. have attending physicians in-house and immediately available for all operative major trauma cases.

(5) Qualified non-surgical specialist(s) or specialty availability, which shall be as follows:

(A) In-house and immediately available at all times:

1. Emergency medicine. This requirement may be fulfilled by senior level residents as defined in Section 100247 of this Chapter, in emergency medicine or surgery, who are assigned to the emergency department and are serving in the same capacity. In such cases, the senior resident(s) shall be capable of assessing emergency situations in trauma patients and of providing for initial resuscitation.

2. Anesthesiology. May be promptly available with a mechanism established to ensure that the anesthesiologist is in the operating room when the patient arrives. This requirement may be fulfilled by senior residents as defined in Section 100247 of this Chapter, who are capable of assessing emergency situations in trauma patients and providing any indicated emergent anesthesia treatment. In such cases, the staff anesthesiologist on-call shall be advised about the patient and make themselves promptly available, when needed.

(B) On-call and promptly available from inside or outside hospital:

1. Cardiology;
2. hematology;"
3. internal medicine;
4. nephrology;
5. pathology;
6. pediatrics; and
7. radiology.

(b) In addition to licensure requirements, a Level II trauma center shall have the following service capabilities;

(1) Radiological service.

A radiological service shall have the following:

(A) Certified radiological technician in-house and immediately available at all times for general radiologic procedures;

(B) angiography; and imaging services with a technician who is promptly available at all times; and

(C) computerized tomography, for both head and body, with an in-house technician who is immediately available at all times.

(2) Clinical laboratory service.

A clinical laboratory service shall have the following:

(A) Comprehensive blood bank or access to a community central blood bank

(B) capability to perform:

1. Coagulation studies;
2. blood gas and pH determinations (this function may be performed by services other than the clinical laboratory service, when applicable);

3. serum and urine osmolality; and
4. drug and alcohol screening.

(C) clinical laboratory technologist in-house and promptly available at all times.

(3) Surgical service

A surgical service shall have an operating suite that is available or being utilized for major trauma patients and that has at least the following:

(A) In-house operating staff who are immediately available at all times unless operating on major trauma patients and back-up personnel who are on-call and promptly available when needed;

(B) thermal control equipment:

1. for patients; and

2. for blood.

(C) x-ray capability;

(D) endoscopes, including at least:

1. bronchoscopes;

2. esophagoscopes; and

3. gastroscopes.

(E) craniotome.

(c) A Level II trauma center shall also have the following supplemental services which have special permits issued pursuant to Chapter 1, Division 5 or Title 22.

(1) Basic emergency service. A basic emergency service shall:

(A) Designate a physician to be a member of the trauma team. Senior level residents as defined in Section 100247 of this Chapter in emergency medicine or surgery who are assigned to the emergency medicine service, who are capable of assessing emergency



situations in trauma patients and providing for initial resuscitation may fulfill this requirement. In such cases, the staff emergency medicine specialist on-call shall be advised of the patient and make themselves promptly available, when needed.

(B) Have the following equipment:

1. peritoneal lavage equipment;
2. drugs and supplies necessary for the initial resuscitation of major trauma patients;
3. x-ray capability;
4. two-way radio capable of being accessed by ambulances in the emergency medical services system in accordance with the local EMS Agency policies and procedures;
5. pneumatic anti-shock trousers;
6. skeletal tongs; and
7. backboards/spinal boards.

(d) In addition to the special permit licensing services, a Level II trauma center shall have the following licensed supplemental services:

(A) A physician promptly available at all times. This requirement may be fulfilled by a senior resident as defined in Section 100247 of this Chapter;

- (B) immediate access to clinical laboratory
- (C) cardiac output monitoring;
- (D) electronic blood pressure monitoring;
- (E) patient weighing devices;
- (F) pulmonary function measuring devices;
- (G) thermal control devices; and
- (H) intracranial pressure monitoring devices.

(2) Burn care. Except for pediatric trauma centers this service may be provided through a written transfer agreement with a Burn Center.

(3) Pediatric care. Except for pediatric trauma centers this service may be provided through a written transfer agreement with hospital having pediatric intensive care unit approved by California Children Services.

(4) Physical Therapy Service.

(5) Rehabilitation Center Service. In-house consultation service for immediate or acute rehabilitation, when medically prudent, shall be available, but further rehabilitation may be provided through a written transfer agreement with a rehabilitation center.

(e) A Level II trauma center shall have the following services or programs that do not require a license or special permit.

(1) Acute hemodialysis capability. This service may be provided through a written transfer agreement.

(2) Acute spinal cord injury management capability. This service may be provided through a written transfer agreement with a rehabilitation center.

(3) Programs for quality assurance, including:

(A) Detailed audit of all trauma-related deaths, major complications, and transfers;

(B) multidisciplinary trauma conferences that include all members of the trauma team; these conferences shall be held at least once a month to critique selected trauma cases; and

(C) participation in the trauma system data management system.

(4) Outreach Program, to include telephone and on-site consultations with physicians in the community and outlying areas.

(5) Continuing medical education. Formal

continuing medical education in trauma care shall be provided for:

- (A) Staff physicians;
- (B) staff nurses;
- (C) staff allied health personnel;
- (D) local EMS personnel including at least EMT-I EMT-IIIs, and EMT-Ps;
- (E) other community physicians and health care personnel; and
- (F) affiliated Level II and III trauma centers and trauma receiving hospitals.

(f) All Level II trauma center shall have written transfer agreements with all affiliated trauma care facilities.

#### 100262 Level III Trauma Centers

(a) In order to be designated as a Level III trauma center a licensed general acute care hospital shall have at least the following:

- (1) A trauma service or multidisciplinary trauma committee included in their organization, which can provide for the implementation of the requirements specified in this Section and provide for coordination with the local EMS Agency.
- (2) A surgery department(s), division(s), service(s), or section(s) staffed by qualified specialists.
- (3) An emergency department, division, service, or section staffed so that trauma patients are assured of immediate and appropriate initial care.
- (4) Qualified general surgical specialist(s) shall be promptly available from inside or outside the hospital at all times.
- (5) Qualified non-surgical specialist(s) or specialty availability, which shall be as follows:

(A) Emergency medicine, in-house at all times;

(B) On call and promptly available form inside or outside hospital:

1. Anesthesiology. This requirement may be fulfilled by certified registered nurse anesthetists (CRNAs) capable of assessing emergent situations in trauma patients and of providing any indicated emergent anesthesia treatment. In such cases, the staff anesthesiologist on call shall be advised about the patient and make themselves promptly available, when needed;

2. internal medicine;

3. pathology;

4. pediatrics; and

5. radiology.

(b) A Level III trauma center shall have the following basic services which are licensed pursuant to Chapter 1, Division 5 of Title 22.

(1) Clinical laboratory service.

A clinical laboratory service shall have the following:

(A) Comprehensive blood bank or access to a community central blood bank; and

(B) capability to perform:

1. Coagulation studies;

2. blood gas and pH determinations (this function may be performed by services other than the clinical laboratory service, when applicable);

3. serum and urine osmolality; and

4. alcohol screening.

(2) Surgical service. A surgical service shall have an operating suite that is available or being utilized for trauma patients and that has at least the following:

(A) Thermal control equipment:

1. for patients; and

2. for blood

(B) X-ray capability; and

(C) endoscopes.

(c) A Level III trauma center shall also have the following supplemental services which have special permits issued pursuant to Chapter 1, Division 5 of Title 22.

(1) Basic emergency service. A basic emergency service shall:

(A) Designate a physician to be a member of the trauma team.

(B) Have the following equipment:

1. peritoneal lavage equipment;

2. drugs and supplies necessary for the initial resuscitation of major trauma patients;

3. x-ray capability with coverage by in-house technicians at all times;

4. two way radio capable of being accessed by ambulances in the emergency medical services system in accordance with the local EMS Agency policies and procedures;

5. pneumatic anti-shock trousers;

6. skeletal tongs; and

7. backboards/spinal boards.

(d) In addition to the special permit licensing services, a Level III trauma center shall have the following licensed supplemental services.

(1) Intensive Care Units (ICU).

(A) A physician promptly available at all times. This requirement may be fulfilled by a senior

resident as defined in Section 100247 of this Chapter;

- (B) immediate access to clinical laboratory
- (C) cardiac output monitoring;
- (D) electronic blood pressure monitoring;
- (E) patient weighing devices;
- (F) pulmonary function measuring devices; and
- (G) thermal control devices.

(2) Burn care. This service may be provided through a written transfer agreement with a Burn Center.

(3) Pediatric Care. Except for pediatric trauma centers, this service may be provided through a written agreement with a hospital having a pediatric intensive care unit approved by California Children Services.

(e) A Level III trauma center shall have the following services or programs that do not require a license or special permit:

(1) Acute hemodialysis capability. This service may be provided through a written transfer agreement.

(2) Acute spinal cord injury management capability. This service may be provided through a written transfer agreement with a rehabilitation center.

(3) Programs for quality assurance, including:

(A) Detailed audit of all trauma-related deaths, complications and transfers; and

(B) participation in the trauma system data management system.

(f) All Level III trauma centers shall have written transfer agreements, with Level I or II trauma centers for the immediate transfer of major trauma patients.

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