

COASTAL VALLEYS EMS AGENCY ACUTE CARE FACILITIES & THE REGIONAL TRAUMA SYSTEM

INTRODUCTION

One of the greatest challenges to any trauma system is structuring a configuration of acute care hospitals that meets the needs of the population and geography of a given region. Variations in population density, geographical barriers to transport, and the location, capabilities and commitment of existing hospitals and physician staff are among the determinants, (and limitations), of 'system' design. The Coastal Valleys EMS region, comprising the counties of Napa, Sonoma, and Mendocino, combines the challenges of serving sub-urban and extremely rural areas, geographical barriers, variable weather patterns, and a changing physician demographic.

The purpose of this report is not to provide a comprehensive review of the Coastal Valley's trauma system, but to focus on the current configuration of acute trauma hospitals within the system, and to provide recommendations and alternatives for how the configuration of acute care centers might be modified to better ensure timely access to trauma receiving facilities for the region.

CONFIGURATION OF THE CURRENT SYSTEM



The reliability, 'accuracy' and optimal timeliness of access to specific trauma receiving facilities are outcome metrics that, by definition, will be imperfectly achieved in any trauma system. These outcome metrics can however, provide performance targets for a system as it adjusts its number and type of receiving facilities to serve the population in need. Coupled with an effective triage process, the location, capabilities, and availability of the set of designated acute care facilities within a

trauma system will be key determinants of these performance measures. Based on the

concepts promoted in the 1992 federal document “Model Trauma Care System Plan”, the ideal trauma system is ‘inclusive’, that is it incorporates a large number of acute care facilities as participants in the trauma system. An ‘exclusive’ trauma system relies on a single or very few designated facilities. There is now credible evidence from national studies that the degree of inclusivity of a trauma system may be an important determinant of patient outcomes (Utter et.al. J. Trauma 2006) validating the goal of ‘inclusiveness’ espoused by most trauma system experts.

The Coastal Valley service area consists of three counties, Sonoma, Napa and Mendocino, with a populations of 466,891, 133,522, and 88,109 respectively (2006 U.S. Census estimate). The population distribution is weighted more heavily to the southern end of the region with Santa Rosa, with a municipal population of approximately 157,000 being the largest center of the population in the area. The approximate population of other regional cities and towns are listed in table 1. The population density within the region ranges from a high of 3,913 persons/sq.mi. in the City of Santa Rosa to a low of approximately 25 persons/sq. mi. in Mendocino county. By comparison, the City &

City / Town	Approximate population	Distance to Santa Rosa
Santa Rosa	157,985	---
Rohnert Park	41,083	7.0 mi.
Windsor	25,294	10 mi.
Sonoma	9,897	29 mi.
Petaluma	54,660	17 mi.
Healdsburg	10,722	15 mi.
Cloverdale	8,129	33 mi.
Cotati	7,170	8.3 mi.
Sebastopol	7,557	7.3 mi.
Napa	74,247	41 mi.
Ukiah	15,385	61 mi.
Ft. Bragg	7,026	118 mi.

Table 1: Population of cities in Sonoma, Napa, & Mendocino counties.

County of San Francisco has a population density of roughly 15,000 persons/sq.mi., and the States of Nebraska and Utah have population densities similar to that of Mendocino County of 22 and 27person/sq. mi. respectively.

Population growth rates for Napa, Sonoma and Mendocino counties are estimated to be 8.6% through the year 2010 and 11.3% through the year 2020. Catchment population for the region is predicted to expand from 732,000 in the year 2000 to almost 800,000 by 2010 and an estimated 892,000 by 2020, reflecting an average annual growth rate of close to one percent.

Geography features prominently in the region, with the coastal mountains providing barriers to both traffic and air transportation, particularly in the setting of dense

coastal fog. The relative paucity of east/west highways, in addition to mountainous terrain, tends to direct traffic and ground transportation in the north/south direction.

The current roster of acute care facilities within the tri-county area is listed in Table 2 along with approximate driving times (normal, non-emergent travel) between these centers and Santa Rosa Memorial Hospital in Santa Rosa.

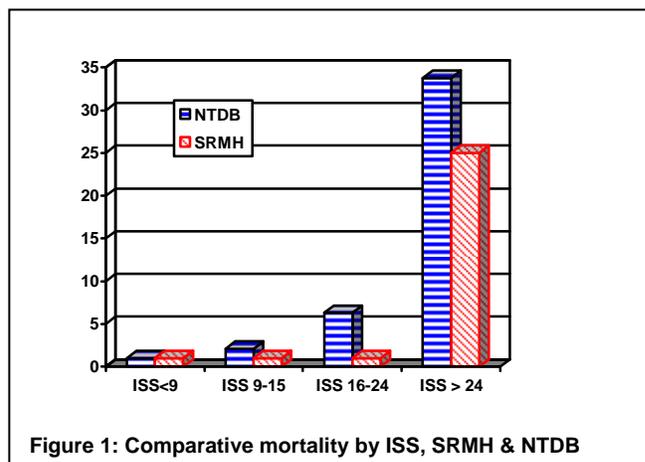


Figure 1: Comparative mortality by ISS, SRMH & NTDB

The principal trauma receiving facility in the tri-county area is Santa Rosa Memorial Hospital, an American College of Surgeons (ACS) verified, high volume, level II center. The hospital recently underwent its most recent ACS survey in January of 2006, and was verified in August 2006. Santa Rosa Memorial (SRMH) at that time

reported 1,380 trauma admissions with 356 high acuity patients (injury severity score (ISS) >15). This volume places SRMH at the high end of volume and acuity for Level II trauma centers in the United States, exceeding that even of many level I centers (for which the

Hospital	Location	Distance from SRMH*	Classification	Licensed beds**	Patient-days**
Acute care hospitals in Sonoma, Napa & Mendocino counties:					
Santa Rosa Memorial	Santa Rosa	0	ACS verified Level II	318	81,401
Healdsburg District Hos.	Healdsburg	17.8 mi., 23 min.	NTC	43	n/a
Kaiser-Permanente	Santa Rosa	3.4 mi., 8 min	NTC	117	32,925
Palm Drive	Sebastopol	8.9 mi., 17 min.	NTC	72	10,143
Petaluma Valley	Petaluma	17.4 mi., 24 min	NTC	67	14,315
Sonoma Valley	Sonoma	20.8 mi., 40 min.	NTC	83	12,414
Sutter	Santa Rosa	2.6 mi., 10 min.	NTC	162	41,349
Queen of the Valley	Napa	42 mi., 60 min.	Non-ACS verified Level III	191	47,986
St. Helena	St. Helena	30 mi., 48 min.	NTC	181	22,624
Howard Memorial	Willits, CA	82.8 mi., 1 hr., 26 min.	NTC	25	n/a
Mendocino Coast	Fort Bragg	117 mi., 2 hrs. 15 min.	NTC	49	n/a
Ukiah Valley	Ukiah	62 mi., 1 hr., 6 min.	NTC	78	13,210

Table 2. Acute care facilities in the Coastal Valley region & adjacent areas

* normal driving times **Source: American Hospital Directory

ISS>15 volume requirement is 240 patients/year). This level of volume and acuity may

also be sufficiently high as to accrue significant volumes-performance benefits typical of Level 1 centers (ref=NSCOT). In examining the reported case fatality by ISS from SRMH, (Figure 1) the reported outcomes compare favorably to data published by the National Trauma Data Bank, an aggregate of data from level I, Level II, Level III, and otherwise unspecified centers.

Depending on resources and commitment, access to high volume Level II centers can occasionally be problematic. Patient access to Santa Rosa Memorial Hospital has been, based on trauma bypass data, largely unrestricted. The reported trauma bypass (trauma center closed to ambulance admissions) for 2007 for SRMH was 11 hours and 55 minutes or 0.136%. This represents a very low number for a high volume Level II center operating within this configuration. SRMH has also reported a significant and sustained trend in

reducing trauma bypass since 2004.

The second and only other designated trauma receiving facility in the tri-county area is the Queen of the Valley Hospital, a 191 bed facility located in the town of Napa, approximately 42 miles from Santa Rosa Memorial. This facility serves as a Level III facility, but has not been verified by the ACS. As a level III

Designated Trauma Facilities in adjacent counties:			
Marin General	Greenbrae	41.7 mi. 48 min	Non-ACS verified Level III +
Enloe Med Cent	Chico, CA	157 mi. 3 hrs, 9 min	Non-ACS verified Level II
St. Elizabeth Community Hosp	Red Bluff, CA	166 mi. 3 hrs., 4 min	Non- ACS verified Level III
Oroville Med Cen	Oroville, CA	169 mi. 2 hrs. 57 min	Non- ACS verified Level III
Table 3. Designated trauma centers in adjacent areas			

center, neurosurgical services are not available (or not consistently available), and patients with more severe traumatic brain injuries require transfer, either to Santa Rosa Memorial or another level II or Level I facility.

In addition to the two (2) designated trauma centers within the Coastal Valleys EMS region, there are several centers in adjacent regions (Table 3). Marin General Hospital (MGH), located in Greenbrae California, is 42 miles from Santa Rosa Memorial. It is a 235 bed non-ACS verified level III, but offers 24/7 neurosurgical coverage. Sutter Health has provided operational oversight of Marin General, but is withdrawing from this role, rendering the long term commitment MGH to participating as a designated trauma center uncertain.

Other trauma receiving facilities adjacent to, but outside the tri-county catchment area include Enloe Medical Center in Chico California, a non-ACS verified level II center located 157 miles from Santa Rosa, St. Elizabeth Community Hospital in Red Bluff California, a non-ACS verified level III center located 166 miles from Santa Rosa, and Oroville Medical Center in Oroville California, a non-ACS verified level III center located 169 miles from Santa Rosa. Given the geography and transport distances, the functional utilization of these centers remains very limited.

The degree of access to trauma care, given the current configuration, was recently studied in the 2007 Coastal Valley Trauma Triage Performance Study. While unable to provide detailed data for all injuries, this report demonstrated that 89 and 97% of non-survivors with high ISS trauma were treated at a trauma center in Sonoma and Napa counties respectively. Non-trauma center deaths in these regions, when more carefully analyzed, were found to largely be elderly victims of minor mechanism trauma, predominantly falls. The reported triage performance is typical of systems with relatively high triage effectiveness and/or participation in re-triage. This triage performance study was not able to address the extent of secondary triage (re-triage) nor was it able to determine the time to the definitive care for the more seriously injured patients. The results of the report suggest that the triage performance within the tri-county area appears to be consistent with that of a more mature trauma system.

FUTURE CHANGES IN THE CONFIGURATION OF ACUTE CARE FACILITIES

The challenges in the tri-county region have previously been outlined. Based on the results of the Trauma Triage Performance Study, the extremely low bypass percentage for Santa Rosa Memorial, and a population distribution heavily weighted to the Santa Rosa area, there do not appear to be any exceptional deficiencies in either access to care or the triage performance of the current system. The population growth in the three county areas is projected to be a modest 1% for the next 12 years, and as such, are unlikely to make large or unpredictable demands on the current healthcare system, assuming current facilities remain active.

The issue of whether population increases will outstrip current trauma center resources may be addressed in part by examining service coverage ratios (population

served by a given trauma center). While there is considerable variability, service coverage ratios for the majority of level I and level II centers in the state of California fall in the range of one center for a population base of between 600,000 and 1,000,000. Although there are notable outliers on either side of these figures, the current ratio in the Coastal Valleys region appears to fall comfortably within this range, and should remain in this range for a number of years. These figures do not, however, take into account the “decompressive” effect of regional Level III hospitals. While the level of commitment for Queen of the Valley to remain a LIII facility is very good, a change in this status, or the abrupt closure of Marin General Hospital from service as a trauma receiving facility could place additional burdens on Santa Rosa Memorial.

Possible alternatives:

As the Coastal Valleys trauma system continues to mature over the next several years, several alternative configurations for the number and type of designated acute care facilities exists. It will be essential for the CV trauma systems to continue to collect data and track system-wide outcome measures such as access to trauma care, bypass times, time-to-definitive-care for patients in outlying regions, transfer patterns, and re-triage efficacy. Questions as to how and where and with what type of trauma center to expand an existing trauma system are among the most difficult to address. Although there is no formulaic approach to trauma system design, factors mentioned in this report, including patient volume and acuity, catchment population ratios, population growth & location, trauma center availability, performance, and outcomes, and need for regional surge capacity are all determinants of need. Medical staff commitment, particularly among specialty surgeons, and financial viability will determine feasibility. Some of these alternative configurations for acute care facilities are as follows:

1) Maintain the current system configuration:

Assuming that both Marin General and Queen of the Valley remain designated trauma receiving facilities, this is feasible, although perhaps not optimal. The current configuration, largely due to SRMH, appears to meet the needs of the vast majority of the population in the tri-county areas, but the system is not very ‘inclusive’, with only two out of twelve hospitals designated as trauma facilities. In addition, growth to the

north in Ukiah and along the coastal corridor may increasingly put some of these patients out of reach of timely access to trauma care given. Consideration should be given to increasing the inclusivity of the existing configuration by the recruitment of additional centers.(see below)

2) *Upgrade one facility to become an additional Level II Trauma Center:*

Given the virtually unrestricted access to Santa Rosa Memorial Hospital, the likely volume's performance impact on patient outcomes that will accrue to a center with this volume and acuity, and the level of commitment demonstrated by both the physicians in the hospital to maintain unrestricted access, there is no indication for the creation of or upgrade to a second Level II trauma center within the current system in the foreseeable future. Doing so would dilute the higher acuity volumes performance benefit and reduce the service coverage ratios below those typical in the State.

3) *Upgrade one facility to become an additional Level III Trauma Center:*

The purpose of level III centers is to act as definitive care facilities for the provision of basic general surgery and orthopedic services to a given population. Patients in need of subspecialty services, most notably neurosurgery, will typically require transfer to a level I or II facility. These centers are highly dependent on the commitment of the panel of general and orthopedic surgeons on staff, and the greatest challenge for recruiting participation of a given facility as a level III center is this same commitment. The expectations of level III centers to provide these services is high and creates relatively uncompromising demands for 24/7 coverage.

While there are larger facilities within the Coastal Valleys system that might be capable of providing Level III trauma services such as Kaiser Permanente Santa Rosa or Sutter Santa Rosa, these hospitals are located 3.4 and 2.6 miles respectively from the existing Level II center, duplicating, in effect, the catchment area for Santa Rosa Memorial. If there were a perceived need to "decompress" Santa Rosa Memorial Hospital based on limited access increasing bypass times, inappropriate transfers out or lack of commitment from the physician and hospital staff, the additional recruitment of an adjacent level III center in Santa Rosa Hospital might be warranted. Under the current circumstances, however, this does not appear to be the case, and the

recruitment of an additional level III near Santa Rosa Memorial would only serve to dilute out the current volume and could have an impact on volumes performance.

As the regional population grows slowly over the next 5 years, there will be an increasing need to establish a trauma facility to the north, serving the more remote population. The most promising candidate facility for recruitment as level III facility in this area, given the current volume and services, would be Ukiah Valley Hospital, located approximately 62 miles, 1 hour and 6 minutes north of Santa Rosa Memorial. This facility would serve the local Ukiah population of 15-16,000, as well as provide access along the I-101 corridor. The interest and potential commitment for this hospital and its staff, however, are uncertain.

4) *Upgrade one or more facilities to become additional Level IV Trauma Centers:*

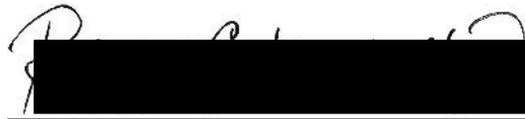
Under Title 22 of the California Code of Regulations, a level IV trauma center must have a trauma medical director, a trauma program manager, a “trauma service”, a multidisciplinary “trauma team”, and provide outreach and prevention for the community. These requirements may be perceived as burdensome by non-trauma center facilities and their staff and close collaboration with the LEMSA may be needed to ‘cultivate’ participation.

A critical function of a level IV center is the participation in the regional trauma system of care including the submission of detailed patient data, participation in system-wide performance improvement, and the establishment of protocols for managed re-triage in conjunction with receiving regional level III and level II facilities. The recruitment of these centers, in creating a more inclusive system, may act to initiate definitive life-saving treatment earlier in the patient’s hospital course, expedite transfer, prevent unnecessary diagnostic delay, and potentially improve outcomes. In the current configuration, the recruitment of Ukiah Valley Hospital as a level IV if not a Level III, and possibly Mendocino Coast District Hospital in Fort Bragg as a level IV, could act to improve early trauma care and expedite transfer of patients from these facilities. Depending on patient volume, the participation of other facilities in the region, such as Healdsburg District Hospital, Petaluma Valley Hospital, Sonoma Valley Hospital, and possibly others should be considered.

CONCLUSIONS

The current configuration of acute care hospitals in the Coastal Valleys region has as its anchor a high volume, high acuity level II facility that allows largely unrestricted access and delivers reported patient outcomes that are consistent with or better than national aggregate results. The system has some vulnerabilities including the uncertain future of Marin General Hospital (Marin County) to the south and an unpredictable level of physician staff commitment to maintain Queen of the Valley as a level III receiving facility over the long term. Based on the patient volume, catchment population ratios, and the reported performance of Santa Rosa Memorial Hospital, there is no current need to recruit an additional trauma center within the Santa Rosa municipal area. Efforts should be made to recruit additional level IV or possibly level III facilities in currently underserved regions to the north. More detailed analysis of current patient transfer and re-triage patterns should be undertaken to better define these needs.

Respectfully submitted,




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Dr. Mackersie is the Director of Trauma Services at San Francisco General Hospital, a Professor of Surgery at the University of California, and the immediate past Chairman of the Trauma Systems Planning and Evaluation Committee for the American College of Surgeons. He is an actively practicing trauma and general surgeon with an interest in surgical critical care and post-traumatic inflammatory lung injury.

Dr. Mackersie received his undergraduate degree in Mechanical Engineering from the University of California, Berkeley; his medical degree from Michigan State University, and completed his residency in General surgery at the University of California San Francisco, including a two year NIH sponsored lab fellowship. He previously served on the faculty of the University of California, San Diego, and is board certified in General Surgery and Surgical Critical Care.

Dr. Mackersie has lectured extensively in the United States as well as internationally. He has had a long involvement in the educational aspects of trauma, and has supervised fellowship programs in trauma, critical care, and violence prevention. He has led and/or participated in ACS Trauma Systems Consultations in several states including Rhode Island, Wyoming, Nevada, North Carolina, and Hawaii, and has also participated in NHTSA State EMS Assessments. He has served as a Trauma Center re-verification surveyor for the American College of Surgeons, for the State of Washington, and for the State of Pennsylvania. He has consulted on trauma systems development in Marin, Napa, Santa Barbara, Santa Clara, and Sacramento counties in California. He currently serves as a Commissioner for the State of California EMS Authority.

Dr. Mackersie has authored or co-authored over 100 publications, mostly on trauma-related topics, and is a contributing author to the 2006 Federal Document "Model Trauma System Planning and Evaluation", and the 2006 ACS trauma center guidelines: "Resources for Optimal Care of the Injured Patient". He has had a long involvement in academic and professional aspects of trauma and surgical care. His other related activities include:

1. Immediate past Chair, ACS Committee on Trauma Systems Planning & Evaluation
2. Co-author: "Model Trauma System Planning & Evaluation" document (HRSA, 2006)
3. Member: CDC Task Force on Trauma Field Triage
4. Co-author: "Resources for Optimal Care of the Injured Patient 2006" (American College of Surgeons standards for American trauma centers)
5. Chairman City/County of San Francisco Trauma Systems Medical Audit Committee (current)
6. Surveyor, ACS-COT Trauma Verification & Review Committee
7. Trauma & Surgical Leadership positions:
 - Past President, Northern California Chapter, American College of Surgeons
 - Current President: HC Naffziger Surgical Society (UCSF)
 - President-elect: Western Trauma Association
 - Secretary-Treasurer: American Association for the Surgery of Trauma (AAST)
8. Chief of Staff, San Francisco General Hospital (past)
9. State of California EMS Commissioner (current)
10. Chairman, COT Committee on Education, American College of Surgeons (past)
11. Involvement with professional & Academic societies including: American Association for the Surgery of Trauma, Western Trauma Association, Society of Critical Care Medicine, Society of University Surgeons, Pacific Coast Surgical Association, Southwestern Surgical Association, PanAmerican Trauma Society.