TRAUMA IN SANTA CRUZ COUNTY – 2009

Kent Benedict, MD, FACEP
EMS Medical Director, Santa Cruz County EMS

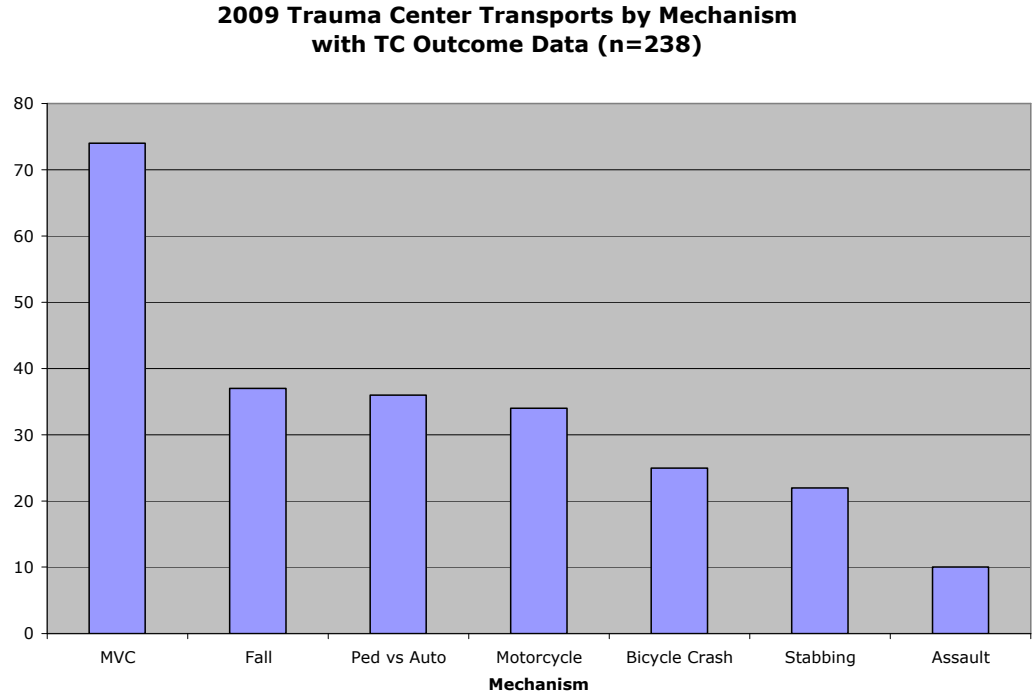
November 1, 2010

The Santa Cruz County Emergency Medical Services (EMS) 2009 annual comprehensive review of trauma care was completed in October 2010. Many stakeholders participated in this process including the two local hospitals, the three Santa Clara County trauma centers, both air ambulance services, the local ground ambulance provider, and local fire-based paramedics.

Overview

The prehospital system (EMS) responded to 3,880 trauma victims which included victims of minor wounds and fractures up to major multiple trauma from motor vehicle crashes, assaults, stabbings, gunshot wounds, falls, etc. 2,945 trauma victims were transported to local Santa Cruz hospitals or Santa Clara County trauma centers.

Mechanisms of Injury



These mechanisms account for 87% of transports to the trauma centers: Motor Vehicle Crashes (30%), followed by Falls (16%), Pedestrian vs. Auto (15%), Motorcycle Crashes (14%), Bicycle Crashes (11%), Stabbings (9%), and Assaults (4%).

Trauma Triage

In Santa Cruz County we follow the guidance of the American College of Surgeons, i.e. that all Major Trauma Victims need to be rapidly transported to the most appropriate hospital

capable of managing the needs of the victim. To accomplish this, we use a trauma triage tool that guides medics to classify patients as victims of Major Trauma (MTV) or minor trauma. For some minor trauma victims, the Base Hospital physician, during the paramedic's call-in, may categorize the victim as having sustained Major Trauma.

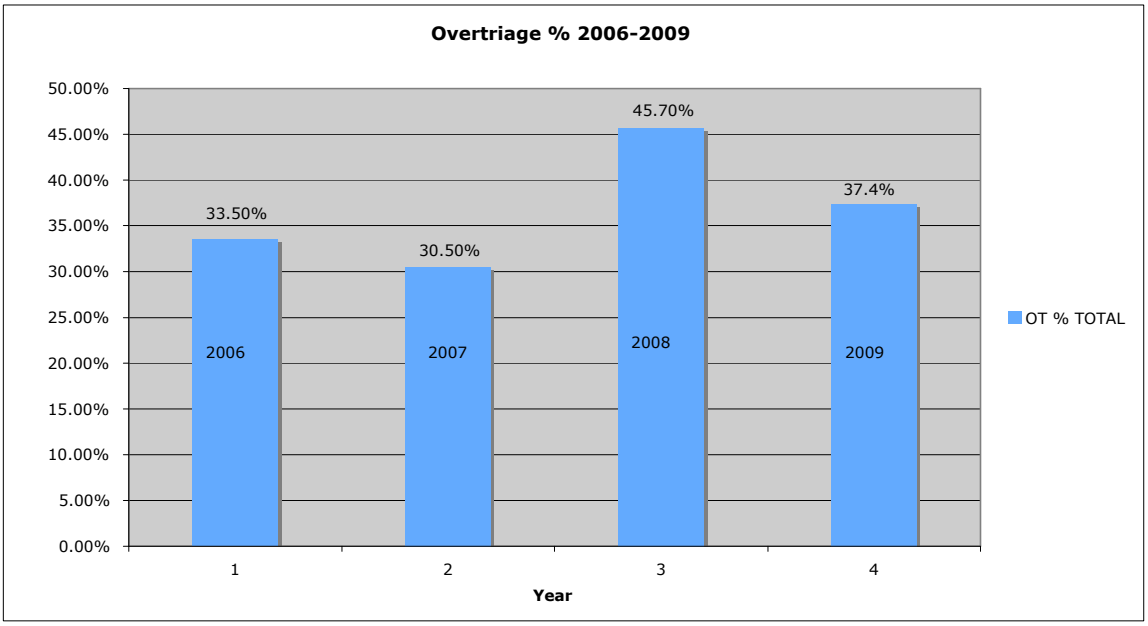
Analysis of Trauma Data for 2009

In 2009, 2,945 trauma victims were transported to acute care hospitals by the EMS system. **2,605 of these patients (88.5%) stayed in Santa Cruz County, and 340 (11.5%) were transported to Santa Clara County trauma centers by air ambulance.** (See appendix for specific information related to each hospital.)

Triage Accuracy

In December 2008, the *Journal of Trauma* published a study of our medic triage tool, *Validation of a Prehospital Trauma Triage Tool: A 10-Year Perspective*. The study found that the triage process used in Santa Cruz County did determine *"the need for air-medical transport out of a rural environment into an established trauma system with 90% accuracy."*

Trauma systems focus on the rates of over-triage and under-triage. Over-triage measures the rate of Major Trauma Victims (MTVs) later found to have only minor trauma. In order to catch nearly all cases of significant trauma, some over-triage is necessary. The acceptable over-triage rate is 30-50%. The lowest over-triage rate possible is always the goal, but if the over-triage rate is too low, then there maybe be an unacceptably high rate of under-triage, meaning that the medics did not identify trauma victims who later proved to have major injuries. For the year 2009, our over-triage rate was 37.4%.



Major Trauma Victims and Hospital Destinations

Major Trauma Victims (MTVs) are directly transported to trauma centers. Base physician direction is not required for direct field transports of Major Trauma Victims to trauma centers.

In 2009, 78% of MTVs were transported to trauma centers. 18% were transported to our local community hospitals. An additional 4% were transported by ground to unspecified hospitals. The following three reasons were citied for keeping Major Trauma Victims in Santa Cruz County:
(1)Weather prohibited air ambulance transport.
(2)The Major Trauma Victim was so critical that it was likely he/she would not survive transport directly to a trauma center and needed to be taken to the nearest local hospital for additional care prior to possible transport to a trauma center.
(3)When paramedics contacted the local Base Hospital for medical advice or direction, the emergency physician ordered the paramedics to transport the Major Trauma Victim directly to the local hospital.

Minor Trauma Victims:

Minor Trauma Victims and are to be transported to local hospitals except when the local Base Hospital physician requests a direct transport to a trauma center. In 2009, there were 2,612 Minor Trauma Victims and nearly all (97.2%) stayed in Santa Cruz County and were managed at local community hospitals.

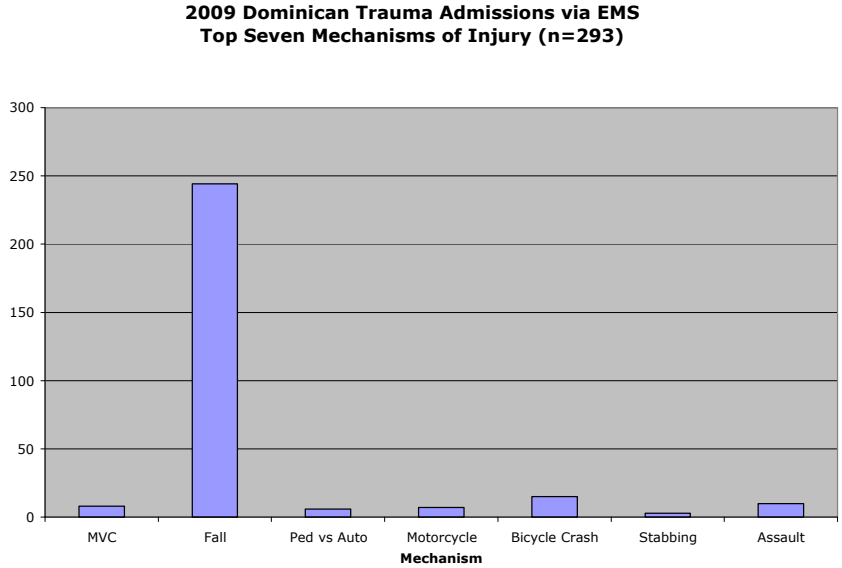
Dispatch of Air Ambulances
Santa Cruz dispatches air ambulances using geographic and call criteria. Air ambulances may be activated and dispatched in Santa Cruz County one of two ways:

1) Automatic Dispatch is a simultaneous dispatch of air and ground ambulances on specific calls in a geographical remote zone.
2) On-Request Dispatch is a request by anyone in public safety including dispatchers.

Two air ambulance providers service Santa Cruz County, depending on the location of the call: Lifeflight is the primary responder for calls north of Highway 17 and CalStar is the provider for areas south of Highway 17.

EMS Transports and Admissions to Dominican Hospital
[Note – Dominican Hospital takes approximately 70% of all EMS transports in Santa Cruz County and was able to provide data about trauma victims for analysis.]
For the year 2009 there were 2,038 EMS trauma transports to Dominican, of which 340 were admitted to the hospital (17%). These patients spent a total of 1,272 days in the hospital with an average length of stay of 3.7 days. This would seem to indicate that the tool the medics use to evaluate trauma *might* under appreciate some injuries.

Falls:
Falls accounted for **more than half (51%) of all EMS trauma transports to Dominican Hospital** (1,047 out of 2,038). And when looking at the outcome data we find that **244 out of 340 (72%) of all EMS trauma admissions to Dominican were related to falls**. It should be noted that **falls accounted for only 14% of all transports to trauma centers and 12% of the trauma center admissions**.



Our data shows **the vast majority of fall victims in Santa Cruz County receive their care within the County at local community hospitals.** The average age of EMS transported fall victims to Dominican Hospital was 66 years and the average age of admitted fall victims was 76 years. Compared with transports to trauma centers – average age of transported fall victims was 35 years, and average age of admitted fall victims was 43 years. Clearly the population of fall patients transported to trauma centers is significantly younger (by 30 years) than the population treated locally. In addition, there is a major difference in the gender – 76% of fall victims transported to trauma centers are male compared to only 40% male to Dominican.

This data raises many other questions. Is the medic trauma evaluation tool under appreciating elderly fall victims or could the medics benefit from further training about this patient population? Are there ways for the community to work together to reduce the incidence of elderly falls? Is the local hospital the right place for these patients? These questions warrant more discussion and study.

Public Education and Participation in Trauma Policy

In 2009 we identified a need to more effectively communicate to the public our trauma system in Santa Cruz County. The Santa Cruz County Emergency Medical Care Commission, composed of stakeholders and public representatives, has participated in our discussion of trauma care. One of their strongest recommendations was to explore improving public information and education.

Summary:

For the year 2009, Santa Cruz County EMS transported the vast majority of our trauma victims to our local hospitals. Our paramedics appropriately identified and called for transport of our **Major Trauma Victims** to trauma centers in Santa Clara County. We are appropriately utilizing air ambulance resources while at the same time increasing ground transport when indicated. Santa Cruz EMS continues to have a close working relationship with all three trauma centers in Santa Clara County. Still there are areas where we can improve, namely: we need to continue to monitor over-triage, we need to look carefully at the issue of field under-

triage of elderly trauma fall victims and we need to improve our public education about trauma care in general. These issues will continue to challenge us for the next years.

Specific Recommendations

1) Assign a Public Information medical person to respond to injury traffic accidents and be available to address questions from the media.
2) Schedule another meeting with the Sentinel Editorial Staff.
3) Consider a Trauma presentation to the County Board of Supervisors
4) Schedule Grand Rounds on trauma to the medical community with participation of our local surgeons and trauma specialists from trauma centers.
5) Provide real-time feedback to our local medics, Base Hospital physicians and nurses on medic-evaluated minor trauma patients who were transported to trauma centers.
6) Track ground ambulance transports to trauma centers with quarterly reports for 2011.
7) Consider some triage changes – including specific issues such as pedestrian/auto injuries, auto rollover, elderly injuries.
8) Consider a collaboration project with Stanford in injury prevention and trauma management of the frail/elderly.
9) Request local surgeon perspective on locally managed trauma.

APPENDIX

In November 2008, the State of Maryland convened an Expert Panel to review helicopter utilization and protocols in their State. Their report serves as a guideline for our own evaluation.

• Helicopter Emergency Medical Services (HEMS) is an essential component of a contemporary EMS system. Its use improves outcomes in a high risk population of trauma patients.

• Both aviation and critical care medicine are high consequence endeavors (high risk, high cost, high benefit). HEMS programs must operate at the highest levels of safety practically possible. The safety of patients and of crew members must incorporate a comprehensive systems approach to risk management.

•The configuration of the HEMS system, including overall mission profile and the number and location of aircraft should be determined primarily on the distribution of the population, injury patterns, and the geography.

• HEMS programs nationally have evolved from placing an emphasis solely on rapid transport and minimizing time-to-definitive-care to placing a more balanced emphasis that includes the early delivery of critical care in the field and during transport.

• In order to minimize patient morbidity and mortality, a level of over-triage is necessary and appropriate. Established or agreed-to benchmarks defining a specific target level of over-triage do not yet exist, especially for HEMS transport.

It is clear that Santa Cruz MTVs do need the resources of trauma centers and that we depend upon helicopters to rapidly access those resources. Our field triage policy follows the guidelines suggested by the Maryland study which states that the mode of transport decisions has to be dictated by case specific objective evaluation of distance, clinical circumstances, and logistics.

Cost-effectiveness of Trauma Systems including air transport

The 2008 Maryland report did a preliminary assessment of trauma mortality and the cost effective use of air ambulance transport to trauma centers. According to the report: *"The favorable impact of air medical transport on trauma mortality is demonstrated in a wide variety of studies, from around the world. The overall picture of the data is consistent with a reduction in mortality of between 1 and 10 patients per 100 transports. This estimate is sufficiently precise to allow for exploratory calculations in cost-effectiveness…. The preponderance of available evidence suggests that Helicopter Emergency Medical Services use, in relatively mature and well-organized systems, is cost-effective."*

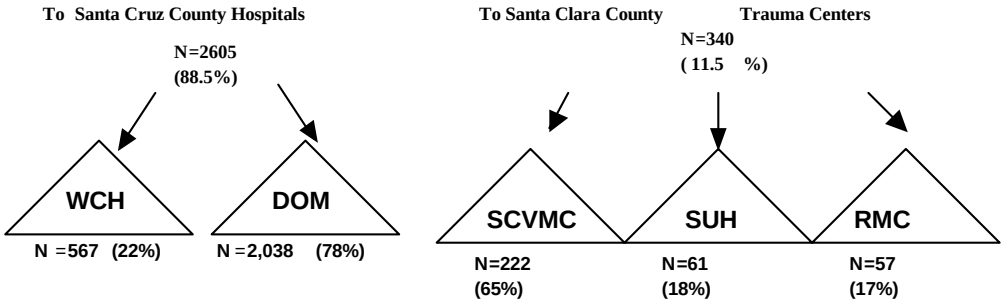
Another recent study of cost effectiveness of trauma systems, which includes the costs of air ambulance transports to trauma centers, was presented at the 2009 meeting of the American Association for the Surgery of Trauma. This study of 5,043 trauma patients concluded that treatment at a trauma center versus a nontrauma center was associated with an increase of 70 additional life-years per 100 patients, *"well within the cost-effectiveness ratios of $50,000 to $100,000 per life-year gain deemed acceptable in the literature."*

In December 2008, the Los Angeles County Department of Health Services EMS Agency (the largest EMS Agency in California) concluded that *"…trauma centers are cost-effective programs because they lower mortality rates, decrease permanent disabilities, lower morbidity rates and decrease the number of productive years lost to society."*

Distribution of 275 helicopter flights for 2009
CALSTAR – 209
LifeFlight – 66
Transport destinations
CALSTAR:
Santa Clara Valley Medical Center – 147(70%)
Regional Medical Center – 52(25%)
Stanford Medical Center – 9(5%)
LifeFlight:
Stanford Medical Center – 36(55%)
Santa Clara County Medical Center – 29(44%)
Regional Medical Center – 1(1%)

Santa Cruz EMS **Trauma Victim** **Transports** **(Jan1,2009-Dec 31, 2009**
N=2,945

Destinations



MAP Triage Criteria

- **(M)**echanism of injury
  - _____ Significant Impact ==========➔ Significant Impact Criteria:
    - _____ 1. Ejection of patient from any vehicle
    - _____ 2. Vehicle roll-over
    - _____ 3. Fatality in same vehicle
    - _____ 4. Intrusion of MV into passenger compartment
    - _____ 5. Prolonged extrication
    - _____ 6. Auto vs. pedestrian with significant impact
    - _____ 7. Other: _____
  - _____ Gunshot Wound
  - _____ Stab Type Wound
  - _____ Significant Fall
  - _____ Submersion Event

- **(A)**natomic Injury (ies)
  - _____ Significant Penetrating Injury (head, neck, chest, trunk, pelvis, thighs)
  - _____ Significant Blunt Injury (head, neck, chest, trunk, pelvis, thighs)
  - _____ Burns ========➔========➔========➔ Specific Burn Criteria
    - _____ 1. >10% TBSA 2°/3° burns
    - _____ 2. >2% 3° burns
    - _____ 3. Evidence of respiratory burns
    - _____ 4. Circumferential burns
    - _____ 5. Burns that cross joints
    - _____ 6. Significant electrical burns
    - _____ 7. Burns involving face, hands, feet, perineum
  - _____ Neuro Injury==➔Specific Neuro Injury
    - _____ 1. Sensory loss
    - _____ 2. Motor deficit
    - _____ 3. Paralysis

- **(P)**hysiologic Criteria
  - _____ Altered level of consciousness (at time of evaluation)
  - _____ Respiratory distress
  - _____ Inadequate perfusion

- Other Criteria For Determining Patient Destination
  - _____ Base Hospital Physician Judgment (may choose a local or regional destination regardless of MAP hits)
  - _____ Patient "In-extremis" (transport to closest facility)
  - _____ Co-morbidities (the following criteria may be used to increase the index of suspicion that a patient has significant injuries):
    ==========➔
    - _____ 1. Pediatric patients
    - _____ 2. Elderly patients
    - _____ 3. 2nd/3rd trimester pregnancy
    - _____ 4. Significant environmental exposure
    - _____ 5. Significant pre-existing medical problems
    - _____ 6. Inability to adequately assess patient due to:
      - developmental impairment
      - patient compliance
      - communication barriers
      - drug or alcohol intoxication

MAP Scoring – The EMS Tool For Determining Minor vs Major Trauma

Santa Cruz County EMS has used a tool called "MAP Scoring" to evaluate trauma victims since May 1996. MAP refers to the use of Mechanism of injury, Anatomical findings, and Physiologic findings. Over 500 EMT-I and EMT-Paramedic responders have been trained in the use of this tool. In late 2003, updated MAP training was provided to all Santa Cruz County paramedics and EMTs. We continue to have updated training annually. MAP changes made in 2009 included the addition of co-morbidities such as advanced age, pregnancy, pediatric – all of which can increase the index of suspicion for major trauma. This tool has been designed to guide field personnel in their assessment of trauma victims so that the victim's injuries can be sorted into Major or Minor trauma. In general terms, any patient with 2 or 3 'hits' on the MAP score is considered a Major Trauma Victim (MTV). However, in the case of a "minor" trauma

victim who has only 1 ‘hit’ on the MAP score, the Base Hospital physician, during the paramedic’s call to the Base Hospital, may use his/her judgment to override the field MAP score and categorize the victim as having sustained Major Trauma based upon the paramedic’s description of the victim.