

County of Orange  
Health Care Agency  
EMERGENCY MEDICAL SERVICES  
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# Trauma Plan System Status Report

## 2017

Reviewed and updated January 2018

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*Contains Provider Data for CY 2012-16*

**2017 ORANGE COUNTY EMERGENCY MEDICAL SERVICES  
TRAUMA PLAN SYSTEM STATUS REPORT**

**December 2017**

**SUMMARY**

One of the first comprehensive systems of care in the United States, Orange County’s Trauma System is unique and inclusive with the overall delivery of emergency medical services. Evaluation of the injured patient is viewed as an entire community problem, with four designated hospitals that are committed to trauma care. The Orange County Trauma Care System (Title 22 § 100247) is fully implemented with sufficient capacity to care for all designated trauma patients and demonstrates the maturity of a well-established system that addresses all aspects of trauma care.

In January of 2015, Orange County Emergency Medical Services (OCEMS) designated Children’s Hospital of Orange County (CHOC) as a Level II Pediatric Trauma Center (PedTC), adding a fourth designated trauma center along with the three previously designated Trauma Centers (TC’s) in Orange County. University of California Irvine Medical Center (UCIMC), Orange County Global Medical Center (OCGMC) previously known as Western Medical Center Santa Ana, Mission Hospital (MH), and Children’s Hospital of Orange County (CHOC) along with one Los Angeles County designated hospital, Long Beach Memorial Medical Center (LBMMC), ensure complete county coverage. Orange County Emergency Medical Services (OCEMS) and the trauma centers have a collegial relationship and work collaboratively to provide the highest quality of care for trauma patients.

UCIMC, a Level I trauma center and OCGMC, a Level II trauma center receive trauma patients from the northern, western and portions of the central/eastern sections of the county. Mission Hospital, also a Level II trauma center, receives most of its trauma patients from the southern sections of the county (Map, Appendix 1). CHOC, a Level II pediatric trauma center receives pediatric trauma patients from all areas within the county and serves as a regional resource for pediatric trauma patients. In addition, Orange County’s Trauma system incorporates UCI, OCGMC and Mission Hospital as trauma centers with capabilities of managing pediatric trauma patients and also serve as trauma centers for pediatric traumas within the county. The following table describes the total number of trauma patients the system cared for from 2012-2016.

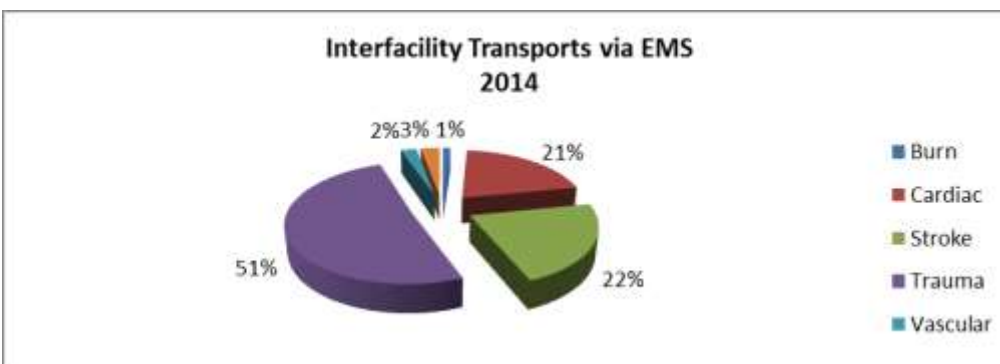
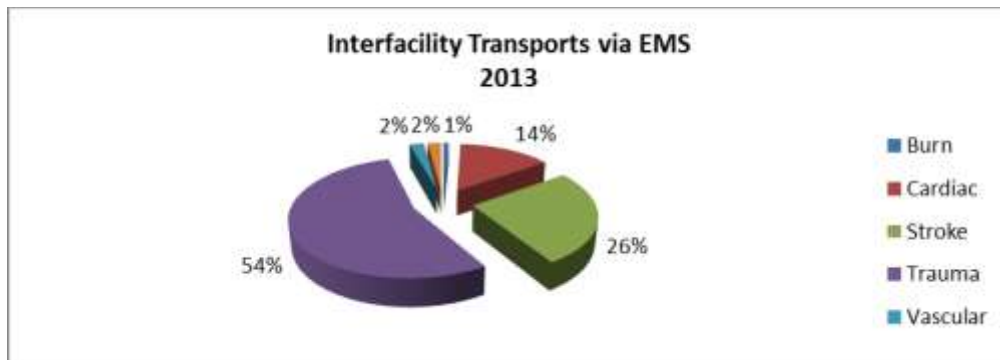
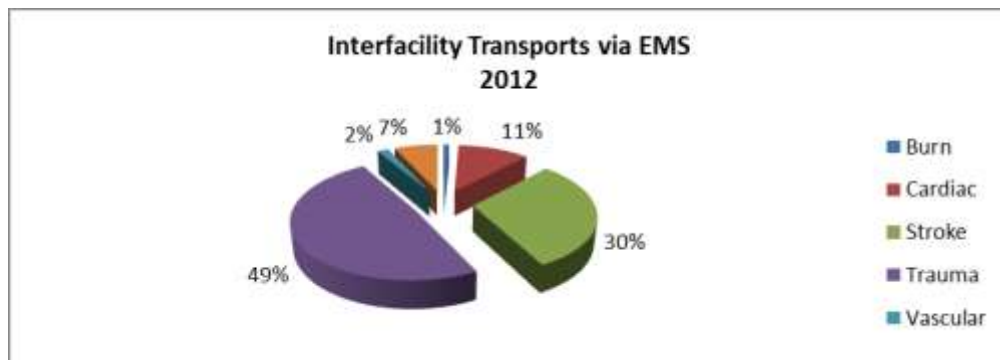
<b>Orange County Trauma</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>Adult</b>	5500	6100	6000	7250	8307
<b>Pediatric</b>	525	450	400	480	536
<b>Total</b>	6025	6500	6400	7730	8843

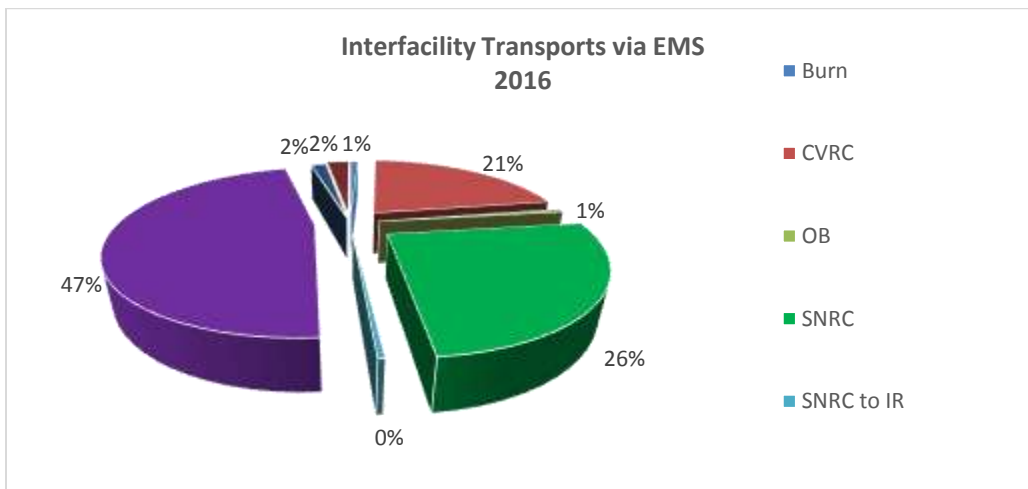
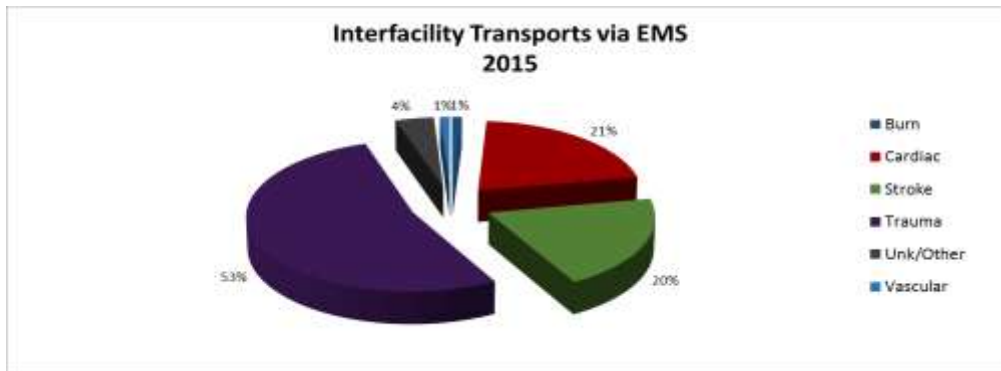
**CHANGES**

There exists in Orange County an Emergency Receiving Center (ERC) system (Title 22 §100243: Receiving Hospital) that is designed to care for the mild to moderately injured patient. Up until the spring of 2011, mild to moderately injured patients presenting in the prehospital setting could be classified as a Moderate Trauma Victim (MTV). Depending upon the paramedic responding agency, the patient could be transported to an ERC. Once transported to the ERC, the patient would be evaluated/treated and if deemed to be medically necessary, the patient could be secondarily transported to a trauma center, utilizing the 9-

1-1 re-triage policy. If the patient was severely injured, the paramedics could designate the patient as a critical trauma victim (CTV) and transport the patient to the nearest TC.

In 2011, Orange County Emergency Medical Services (OCEMS) implemented a revised Field Triage Decision Scheme in response to system-wide identification of under-triage of trauma patient subgroups. The revised Field Triage Decision Scheme fully implements the national standard guidelines developed by the American College of Surgeons and the Centers for Disease Control and Prevention. The use of this trauma triage criterion has led to the majority of patients being accurately and effectively transported to the most appropriate facility. Interfacility transport rates in the past years indicated a decrease in the number of secondary transfers for trauma care. In 2012, there were a total of 440 patients secondarily transferred to trauma centers. While the number of patients secondarily transferred to trauma centers were 353 patients for 2013, 400 patients for 2014, and 502 for 2015. The OCEMS trauma field triage decision scheme was updated in 2015 based on identified data elements to address system triage needs for the care of the injured patient.





In 2017, Mission Hospital (MH) Mission Viejo and Orange County Global Medical Center (OCGMC) underwent the American College of Surgeons (ACS) verification process for re-verification as Level II trauma centers. In addition, Mission Hospital also underwent ACS review for Level II Pediatric Trauma Center verification. In September of 2017, Orange County Emergency Medical Services granted OCGMC trauma center conditional designation for a period of one year to be reviewed in June of 2018. In September of 2017, Orange County Emergency Medical Services granted MH trauma center designation for a period of three years and a conditional designation for one year as a Pediatric Trauma Center to be reviewed in June of 2018.

In 2015, University of California Irvine Medical Center (UCIMC) underwent the American College of Surgeons (ACS) verification process for re-verification as a Level I trauma center. In September of 2015, Orange County Emergency Medical Services granted UCIMC trauma center designation for a period of one year with an additional two years added to their designation in June 2016. During the 2015 ACS trauma verification review, UCIMC submitted for and subsequently received verification as a Level II pediatric trauma center. Currently, Orange County Emergency Medical Services Trauma Center (TC) designation recognizes and allows trauma care for both adult and pediatric patient populations and Pediatric Trauma Center (PedTC) designation recognizes and allows trauma care for pediatric populations.

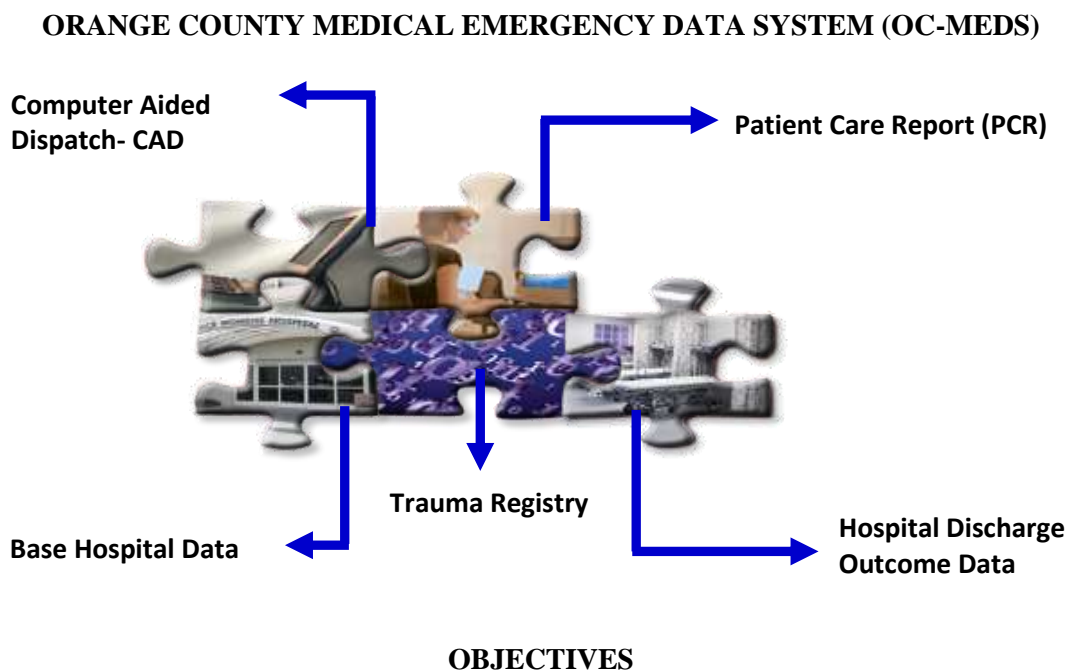
The recent addition of the Pediatric Trauma Center designation allows Orange County Emergency Medical Services to evaluate and analyze various models for the development of pediatric trauma triage protocols for trauma triage and destination decisions. OCEMS will consider three potential models for pediatric

trauma triage and destination decisions as outlined in the White Paper of 2014, “Analysis of Pediatric Utilization of Orange County Emergency Services and Secondary Health Impact Analysis of Pediatric Trauma” (Appendix #4). Once complete, Orange County Emergency Medical Services will revise the current trauma plan and system policies and procedures to operationalize a model that provides the most optimal care for the pediatric trauma patient population.

Another project affecting the trauma system is the introduction of an electronic Prehospital Care Report (ePCR) system that has been phased in over the past several years. Beginning in 2006 with a multidisciplinary EMS Data Taskforce group whose members included private and public stakeholders, an EMS Data Standards and Policies was developed in 2009 and a scope of work itemized along with a request for Urban Areas Securities Initiative (UASI) grant funding. In 2010 this culminated in a successful RFP process. In 2016, through a collaborative process among EMS stakeholders, comprehensive data standards for patient care reporting by EMS personnel and provider agencies was developed and implemented.

As of January 1, 2017 one hundred percent of 9-1-1 ALS providers were documenting within the ePCR and submitting data into the Orange County Medical Emergency Data System (OC-MEDS). All EMS system personnel and provider agencies operating in Orange County are now submitting data based on current standards as identified by the National EMS information System (NEMSIS) and California EMS Information System (CEMSIS).

Some of the major accomplishments (as shown in the image below) of the Orange County Medical Emergency Data System (OC-MEDS) hosted by ImageTrend™ are: the replacement of the paper-based PCR; an interoperable network which will provided an electronic method in which to receive PCR’s from EMS personnel; powerful web-based reporting/visual informatics and data mining to facilitate CQI; HIPPA/Health Information Technology for Economic and Clinical Health (HITECH) Act 2014 compliant; ability to perform syndromic surveillance and identify medical surge in real-time; a web-based patient registry for use by all hospitals to facilitate the reporting of Hospital Discharge Data Summaries (HDDS) and all specialty care patients (STEMI/Stroke/Pediatric/Trauma).



One of the primary goals of the Orange County trauma system is to have in place trauma guidelines that identify the trauma patient; reduce field scene time; and prevent delay in the transport of the critically injured patient to the nearest trauma center for definitive care. This focus will ensure optimal medical care in a timely fashion.

The purpose of objectives is to present annual mileposts that a program needs to achieve in order to accomplish system goals. Trauma Plan Section VI: Objectives has been recently evaluated and a **Status Update** of the seven objectives statements which have been revised to meet current system standards is provided (Appendix #2).

## **PERFORMANCE IMPROVEMENT**

Orange County Emergency Medical Services (OCEMS) maintains a system-wide continuous quality improvement program to monitor, review, evaluate and improve the delivery of prehospital and trauma care services. Region-wide efforts are ongoing to define the system through data collection, committee based review and system evaluation expectations. Orange County Emergency Medical Services has standardized performance criteria review which integrates the following elements:

- Internal quality improvement processes for each trauma center
- External quality improvement processes for regional trauma care
- Trauma center and system review

### Internal Quality Improvement

- Each trauma center must have a formal written internal quality improvement program for its trauma service.
- As part of the internal quality improvement process, each trauma center employs a trauma medical director and trauma program manager who performs case audits and reviews for their own facility.
- Specific audit topics are forwarded to the Regional Trauma Operations Committee (RTOC) for evaluation and review.

### External Quality Improvement

- Regional Trauma Operations Committee (RTOC) provides clinical practice and performance improvement discussion. The mission of the committee is to optimize the quality of care and outcomes for all EMS trauma patients including injury prevention and reducing injury severity and death.
- The RTOC performs confidential trauma case study, education, data analysis, and regional studies.
- The RTOC provides recommendations to EMS regarding the care provided within the trauma system.
- The Quality Assurance Board (QAB) monitors, investigates, studies and makes recommendations to EMS regarding the quality of care provided by the EMS providers and includes the trauma system.
- Each trauma center participates in EMS regional trauma studies and audits.

## Trauma Center/Systems Review

- Designated Trauma Center Reviews:  
Periodic review is performed by the EMS Agency to assure trauma center contract compliance. The audits may include random chart reviews, trauma registry data review, and review of other records and documents. Reviews are both announced and unannounced.
- Verification of Trauma Centers/Trauma System:  
Reviews conducted every three years by out of county trauma specialist, allow for independent evaluation for verification of trauma centers and effectiveness of the trauma system. The reviews are designated to evaluate the quality of care rendered by the trauma centers and to review the trauma centers compliance with both California regulations and local requirements of the trauma system.

Performance improvement processes allow for ongoing standardized medical review of trauma care and include, but are not limited to, trend analysis and review of:

- High risk, high volume, problem oriented calls, and calls requested to be reviewed by OCEMS.
- Specific audit topics established through the Quality Assurance Board.
- Specific audit topics established through the Regional Trauma Operations Committee.
- Evaluate medical care delivered by prehospital care providers based on information available to them with respect to protocols.
- Identify trends in the quality of medical control delivered by the base hospital MICNs and BHPs.
- Identify trends in the quality of field care delivered by EMTs and Paramedics.

## CONCLUSION

The Orange County Trauma System has been an integral component of the Orange County Emergency Medical Services Plan since its inception. Orange County Emergency Medical Services in collaboration with regionally designated trauma centers and other partners monitor factors influencing the trauma system and make accommodations to meet current system standards and needs. An updated version of the Trauma Plan Section VII: Implementation scheduled is included (Appendix 3). Upon acceptance of this status report, EMSA recommendations will be considered and the updated plan submitted for review and approval to the appropriate committees.

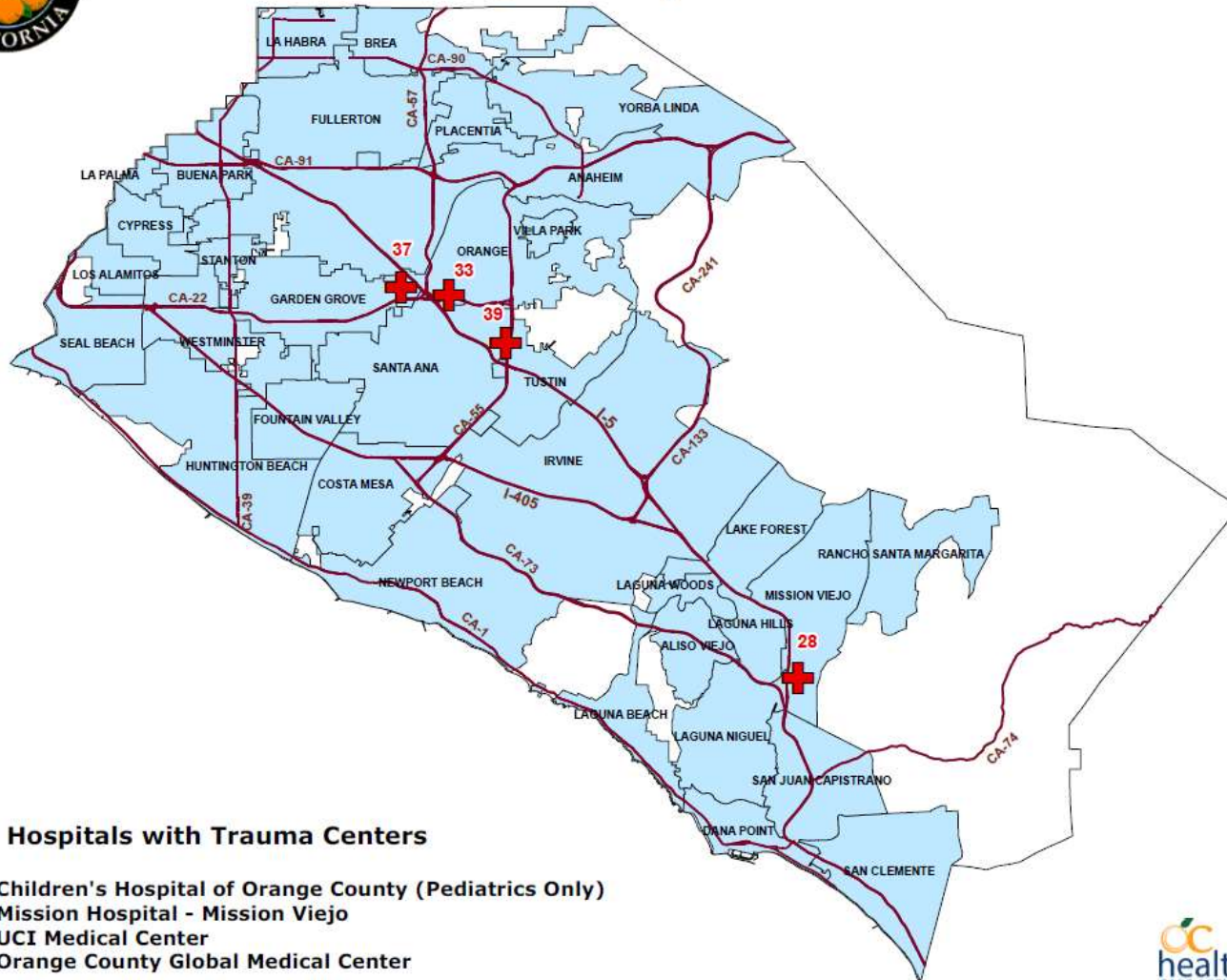
# **APPENDIX 1**

## **MAP**





## Acute Care Hospitals with Trauma Centers Orange County, California



Health Policy - Research, September 2015

## **APPENDIX 2**

### **SECTION VI: OBJECTIVES**

## OBJECTIVES

The purposes of this section is provide a status update and to put forward revised objectives that represent annual mileposts that the program will strive to achieve in order to accomplish its five year goal. One of the primary goals of the trauma guidelines is to identify the trauma patient, reduce field scene time and prevent delay in the transport of the critically injured patient to the nearest trauma center for definitive care. This will ensure optimal medical care in a timely fashion. Optimal care of Orange County trauma patients will occur by meeting of the following objectives:

### 1. *Continue trauma system coordination.*

On a quarterly basis, the OCEMS Facilities Coordinator will scheduled and commence the Regional Trauma Operations Committee (RTOC) and in keeping with the committees' mission, will publicize in a timely manner, approved meeting minutes on the county website so that the entire system is aware of trauma-related issues and activities.

*Timeline: Ongoing*

#### **STATUS UPDATE:**

Objective met. Currently Orange County EMS has a full-time Facilities Coordinator who works closely with each trauma center. The Facilities Coordinator is not a full-time dedicated Trauma Coordinator and has responsibilities for all hospital related OCEMS activities including pediatric, cardiac and stroke center programs.

The mission statement of the RTOC is to serve as a multidisciplinary forum to monitor, evaluate, and report on the operation and quality of trauma services in Orange County. The EMS Facilities Coordinator, Medical Director, Program Administrator, Trauma Program Managers and Trauma Medical Directors are members in the Regional Trauma Operations Committee. Additionally, the UCIMC Trauma Medical Director participates at the regional level (RTCC) and the EMS Medical Director serves as the lead writer for the LEMSA section of the state trauma plan.

### 2. *Assure the availability of rapid and consistent access to citizens in order to maintain short scene times and timely transportation to the nearest trauma center.*

Beginning January 2012 on a biannual basis, the EMS ALS/CQI Coordinator has and will continue, utilizing OC-MEDS, generate a report and evaluate paramedic transport and scene times of all trauma patients designated to trauma centers and advise the EMS Medical Director. The purpose of this objective is to ensure that citizens have available rapid and consistent access to the nearest trauma center. The report will be presented to the RTOC for review and discussion to identify potential care issues, develop strategies for the provision of education and to track for consistency. This monitoring of continuous quality improvement with proper reporting and analysis validates this objective.

*Timeline: Ongoing audits of prehospital response times/scene times/transport times.*

#### **STATUS UPDATE:**

Objective partially met. The inadequacies of the previous data system prevented an accurate depiction of prehospital times. Data from multiple databases sources made the reconciliation of data difficult. With the recent transition from paper to electronic patient care records and a patient registry system capable of consolidating data into one system will facilitate audit and evaluation

of prehospital response times, scene times and transport times. With 100 percent of 9-1-1 ALS providers currently documenting the patient care record within the OC-MEDS system, OCEMS is able to reconcile and evaluate data needed to evaluate prehospital response times, scene times and transport times.

**3. *Work collaboratively with each trauma center to assure quality improvement activities within each center.***

By June of 2012, OCEMS will facilitate formalizing a method for the RTOC to share trauma center specific QI processes and outcomes. The RTOC will provide the forum for addressing QI processes and presenting outcomes data among trauma centers. By October of 2015, OCEMS will facilitate a trauma data standards subcommittee to review and develop trauma data reporting standards.

*Timeline: Annual LEMSA reviews of each trauma center, a biennial system review, along with tri-annual ACS re-verification visits.*

**STATUS UPDATE:**

Objective partially met. Currently, each trauma center shares case studies within the Clinical Practice Discussion of RTOC. Additionally, as ACS-verified trauma centers, each has presented samplings of their quality improvement (QI) processes. However, an organized presentation of QI activities within the RTOC has been limited to prehospital care issues. In particular, the trauma triage guidelines were extensively evaluated by this committee and ultimately an endorsement of a customized version of the ACS/CDC trauma triage guidelines was approved. Currently, each trauma center has a trauma program manager and a trauma registrar representative on the trauma data standards subcommittee who participate in the review and development of trauma data reporting standards.

**4. *Ensure the accuracy of trauma triage guidelines and ensure trauma patients are transported to an appropriate facility.***

On a quarterly basis evaluate data and quality systems to determine the appropriateness of trauma triage guidelines and transport of patients meeting trauma criteria to trauma centers.

*Timeline: Ongoing continued assessment of in-hospital QI process.*

**STATUS UPDATE:**

OCEMS is continuing to monitor and evaluate system impacts based on field trauma triage criterion. With the majority of 9-1-1 ALS providers currently documenting the ePCR within the OC-MEDS system, OCEMS will continue to reconcile and evaluate data needed to assess the accuracy of trauma triage guidelines and ensure those patients meeting trauma triage criteria are being transported to designated trauma centers.

**5. Evaluate system function and design improvements as needed.**

By March 2012, publish findings from a well-defined study focusing on the application of the newly revised trauma triage policy (#310.30) and contrast with patient outcomes.

*Timeline: Ongoing.*

**STATUS UPDATE:**

Objective postponed. On March 28, 2011 in response to increasing rates of interfacility transports of trauma patients from non-trauma hospitals to trauma centers, OCEMS implemented a revision to filed trauma triage based upon national trauma triage guidelines developed by the American College of Surgeons and the Centers for Disease Control and Prevention. Essentially, the policy eliminated the terms Moderate Trauma Victim (MTV) and Critical Trauma Victim (CTV) and requires all victims of trauma with specific conditions be called into a base hospital for medical direction. This has been a major operational change within the trauma system and was introduced over a three-month period through mandatory educational sessions performed by the base hospital and fire EMS Coordinators. As a result of this change, the system anticipated an increase in trauma volume and we are currently evaluating the decision-making process by the base hospitals when determining destination of patients.

By mid-year 2012, program priorities and resources were re-evaluated and shifted to support implementation of electronic prehospital care record (ePCR), thereby postponing the study. By mid-year 2014, program priorities were shifted to support the implementation of a new NEMSIS 3 electronic prehospital care record and conversion to ICD-10 codes. Program priorities have continued to focus on the implementation of NEMSIS 3 compliant electronic prehospital care record systems and the development of comprehensive data standards for patient care reporting by EMS personnel and provider agencies.

**6. Reduce accidental injuries/deaths and increase community awareness regarding potential safety hazards in the home/school/office for pediatric and adult age groups through implementation of effective injury prevention programs.**

Evaluate the current injury prevention efforts on an annual basis to ensure that seasonal and annual injury prevention programs coincide with common injury patterns identified through data analysis. Current program include seasonal press releases are put out in conjunction with the trauma centers and other County agencies addressing seasonal injury patterns. The trauma center coordinators are also involved in a variety of injury prevention programs such as red light running, fall prevention, winter press releases on holiday fall prevention, and spring and summer press releases on pediatric window falls.

*Timeline: Will vary depending upon current injury prevention programs. This will be ongoing in conjunction with other County groups.*

**STATUS UPDATE:**

Currently, Mission Hospital has an active program to educate Orange County residents and visitors of the dangers for cervical (neck) spine injuries that can occur with water sports and recreation. Mission Hospital has an ongoing anti-gang program that features contact with youth at risk for gang activity with offering alternatives to gang involvement. Mission Hospital has also developed a comprehensive fall reduction program for communities with large elderly populations. Orange

County Global Medical Center provides elderly fall prevention seminars and has connected with assisted living facilities to help implement elderly prevention programs. OCGMC provides a motorcycle safe driving/safety day as well as an ongoing every fifteen minutes program targeting teen texting and drinking and driving prevention. Children's Hospital of Orange County (CHOC) provides fall prevention, drowning prevention and car seat safety program targeted at pediatric populations throughout the county. UCIMC Pediatricians, the OCEMS Medical Director and the Orange County Fire Authority conduct yearly drowning and water injury prevention fairs within the community during which water safety is encouraged, including prevention of diving and water sports injuries. The OCEMS Medical Director is a member of the Orange County School Board Student Safety Committee. This committee provides direct advice to the Superintendent of Orange County Schools on matters related to student safety in schools, including injury prevention during routine school activities and sporting events.

7. ***Develop and implement an advanced computer tracking system to better collate, collect and review data from each trauma center.***

Initiate quarterly analysis and review of trauma data within OC-MEDS. The development and implementation of OC-MEDS allows for comprehensive data management and analysis. The system also supports the ability to obtain outcome data and to corroborate data from the EMS system, trauma receiving centers and base hospitals.

***Timeline:*** Ongoing.

**STATUS UPDATE:**

Trauma centers currently input data into OC-MEDS. All of Orange County 9-1-1 ALS EMS providers are documenting patient care within the OC-MEDS ePCR. The electronic base hospital record was implemented in all six base hospitals in 2014. Implementation of the next generation Patient Care Reporting System (PCRS) that is compliant with the National EMS Information System (NEMIS) Version 3.4.0 has been fully implemented.

## **APPENDIX 3**

### **SECTION VII: IMPLEMENTATION SCHEDULE**

## IMPLEMENTATION SCHEDULE

The Orange County trauma care system plan has been fully implemented with sufficient capacity to care for all designated trauma victims since June of 1980. This well-established trauma system addresses all aspects of trauma care. Ongoing evaluation of this system occurs on a regular basis and is accomplished with the cooperation and commitment of the long-standing designated trauma centers. Trauma plan objectives with timeline are included in Section VI. Each trauma center abides with Orange County EMS Policy #660.00: Agreement to Provide Services as Trauma Center.

In order to appreciate the detailed planning and expertise that has been afforded to the Orange County Emergency Medical Data System (OC-MEDS) project, a detailed timeline is presented to itemize the progress.

The vision and design for this project has been a major undertaking for OCEMS beginning in 2006 with the formation of a multidisciplinary EMS Data Taskforce group whose members included private and public stakeholders. The purpose of this project was multi-faceted and came about as a result of the determination in 2005 that the current data system was not meeting system needs, was not compliant with NEMESIS/CEMESIS nor prepared for the intentions of the 2014 HITECH Act. Additionally, because of the dependency on the paper-based PCR, the system was unable to perform timely CQI and most importantly link patient outcomes to specific complaints.

In 2009, EMS Data Standards and Policies were developed and a scope of work itemized along with a request for Urban Areas Securities Initiative (UASI) grant funding. This culminated in 2010 with a successful RFP process.

In late 2010, Vendor negotiations began and a phased implementation was developed and distributed to system stakeholders. The phased implementation has been ongoing with significant progress being made in developing and implementing the system. Below is a status update for each of the phases previously submitted.

In 2012, the electronic patient care records system was implemented and advanced life support system providers initiated implementation of the electronic patient care record.

In 2015, OCEMS started the implementation of the NEMESIS 3 Data Standards with the expectation that all EMS System personnel and providers will be submitting NEMESIS 3 compliant data by January 1, 2017. This was successfully completed on January 1, 2017.

Phases with timeline include:

- ❖ Phase I            Development of Web-based Infrastructure  
*(October 2010-March 2011)*  
*Status: Completed*
- ❖ Phase II            Integration of Software and Base Hospital Hardware  
*(October 2011-March 2012)*  
*Status: Completed*
- ❖ Phase III           Selection Public EMS Provider Agencies Hardware with Software Integration  
*(June 2011-July 2013)*  
*Status: Completed*
- ❖ Phase IV            Integration of Mobile Web Connectivity  
*(June 2011)*  
*Status: Completed*
- ❖ Phase V            Hospital Integration  
*(To be determined)*  
*Status: In Progress*



## **APPENDIX 4**

### **White Paper – January 2018 Orange County Trauma System**



## **THE ORANGE COUNTY TRAUMA SYSTEM: 2018**

ORANGE COUNTY HEALTH CARE AGENCY

EMERGENCY MEDICAL SERVICES

January 5, 2018

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Vicki Sweet, RN, MSN  
EMS Advanced Life Support/CQI Coordinator

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EMS Information Systems Chief

## EXECUTIVE SUMMARY

The Orange County Trauma System is mature and stable. Throughout the County, both adult and pediatric trauma victims have access to specialized trauma care with transport times that are well within national standard limits. The greatest risk for trauma care in Orange County is loss of an adult trauma care center.

The Orange County Trauma System is based on emergency medical services (EMS) field identification and ambulance transport of injury victims who require specialized surgical-medical services to five County designated trauma centers:

- UC, Irvine, Medical Center
- Orange County Global Medical Center
- Mission Hospital Regional Medical Center, Mission Viejo
- Children's Hospital of Orange County (specialized pediatric trauma)
- Long Beach Memorial Medical Center

Trauma victims are transported under "real-time" direction of six Orange County Base Hospitals to any of these trauma centers by paramedics representing one of twelve 911- dispatched, fire department based advanced life support emergency medical service providers.

Pediatric trauma victims (age under 15 years-old) represent a special population in the Orange County Trauma System. Pediatric trauma victims have timely access to services throughout the County. Data collected for this report show that, at this time, Orange County has adequate pediatric trauma care resources.

Adult trauma services are accessible from throughout the County. When considering national norms and standards, adult trauma centers in Orange County are high volume service providers. Reputable research (peer-reviewed) has supported an association with higher individual trauma center volume of trauma cases and better quality care when compared to low volume centers.

Considering the current trauma system, loss of an adult trauma center would severely strain the remaining trauma system components. The loss of an adult trauma center would overwhelm remaining trauma centers and negatively alter field emergency transport times and resources. Loss of an adult trauma center is the highest risk for disruption and damaging the Orange County Trauma System.

The absorption of a new trauma center would add excess capacity to the current system yet significantly draw volume from existing trauma centers. As noted above, low trauma case volume at an existing trauma center would be a potential challenge for maintaining trauma care quality. Further, economic instability secondary to loss of trauma cases for any one of the existing centers may result in a decision to close that trauma center.

## BACKGROUND

Orange County Emergency Medical Services (OCEMS), a division of the Health Care Agency, is responsible for ("shall establish") policies and procedures to assure medical control of the local EMS system (California Health/Safety Code, Div 2.5, sec 1797.220). Included in OCEMS responsibilities are the designation of specialty care facilities to which paramedics and ambulances transport emergency patients. Designation responsibilities involve identification of trauma centers and oversight for the countywide trauma system (California Health and Safety Code Div 2.5, sec 1798.170). The Trauma System administered by the OCEMS Agency is mature and was established in 1980. It is supported by five trauma centers: Adult/Pediatric centers at UCI Medical Center, Mission Hospital Regional Medical Center- Mission Viejo, and Orange County Global Medical Center, and a pediatric trauma center at Children's Hospital of Orange County. OCEMS has also identified Long Beach Memorial Hospital Trauma Center as part of the County trauma system.

## OBJECTIVE

The objective for this report is to present an evaluation of the structure of the Orange County Trauma System.

## METHODOLOGY

Using U.S. national standards, the following information is presented in this report:

Orange County Trauma System Evaluation Data Elements:

- Population of Orange County (overall and distribution)
- Emergency (911-dispatch call) Transport Time from Scene to Trauma Center
- Trauma Patient Volume/Injury Acuity (overall and distribution)
- EMS Ambulance Diversion and Patient Offload times

Available cost data for operation of a trauma center is outdated (2003, 2005) and likely not applicable to 2018 due to recession beginning in 2008 and health economic changes related to the U.S. Affordable Care Act. Estimated average cost per trauma victim treated in Orange County is \$30,000 not including rehabilitation expenses (communication to committee in Orange County Trauma Operations Committee, 2017). Additionally, there is unrecovered cost for the County government in maintaining and over-seeing the Orange County Trauma System.

Not measured, as part of the methodology for this report is the availability of surgical specialist and medical staff required to operate local trauma centers. There is an established lack of vascular surgery and surgical replant (limb reattachment) capability within the Orange County Trauma System.

## RESULTS

### Population:

General rates of population growth or density affect decisions about location and designation of trauma centers. The projected population growth in Orange County is reflected in the following data:

- Population of OC in 2010 = 3.02 million
- Population of OC in 2017 = 3.15 million (projected)
- Population of OC in 2020 = 3.23 million (projected)
- Population of OC in 2040 = 3.56 million (projected)

These data demonstrate a rate of growth of less than 1% increase per year (Open Data Network, Orange County Community Indicators 2017 and Orange County Economic Forecast). Assuming a 1% annual growth rate for Orange County in the near future, there is minimal population increase pressure to expand trauma care capacity.

Orange County trauma centers are located in areas of higher population density (further discussed on page 6). This suggests that community access to trauma care is matched to available trauma centers. Planned building projects and available land for development are located in the Southern area of the County, which may increase demand in that area.

The OCEMS system utilizes Base Hospitals to determine trauma center destination for field EMS units that are transporting trauma victims from accident scenes. Base Hospitals are 24/7 on-line radio control points in the OCEMS system that provide immediate, real-time support to all 911-dispatch EMS units. During times of high volume demand in the OCEMS system, Base Hospitals can immediately redistribute trauma cases among the available trauma centers such that any one center is not overwhelmed.

### Transport Times

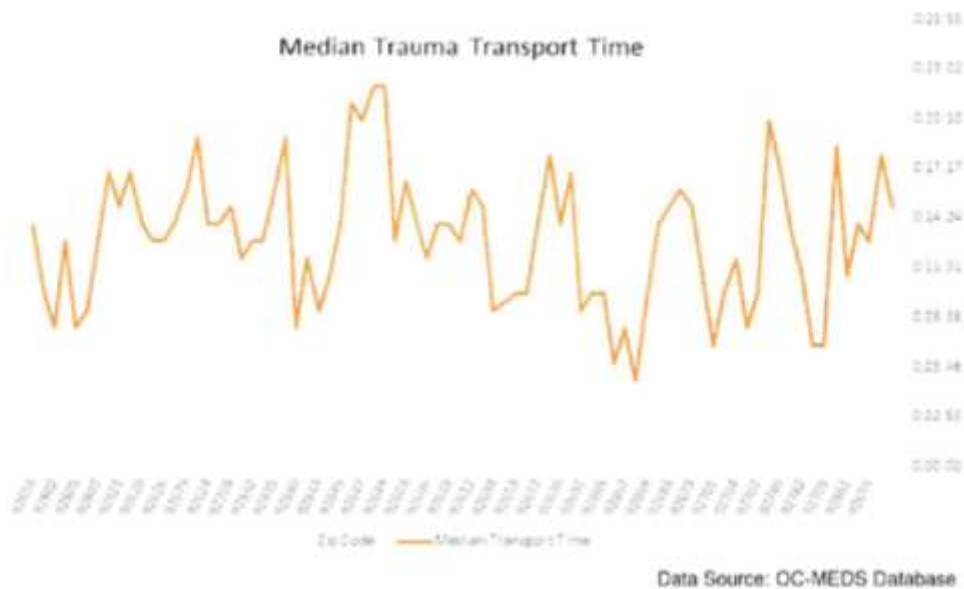
Transport time is a measure of accessibility of critical medical services within a community. Transport time is defined as the time required an ambulance to transport a critical patient from the scene of an accident to the emergency department of a receiving hospital.

Studies (McCoy et al, 2013; Newgard et al, 2010) have not found urban-area transport times of less than 30 minutes to have a significant impact on trauma victim mortality. National standards for urban-area trauma cases is that victims arrive at a trauma center within a 30-minute transport time (Resources for Optimal Care of the Injured Patient, Committee on Trauma, American College of Surgeons, 2014). Using the urban-area 30-minutes maximum transport time to a designated trauma center, none of the areas of Orange County are beyond the national standard.

## THE ORANGE COUNTY TRAUMA SYSTEM 2018

The following 2017 year-based graph shows 911-dispatch call trauma transport times in zip code areas that overall represent Orange County (see Annex 1 for data on all zip code regions). Median scene transport to a trauma center time for 911 vehicles is 13 minutes with a range of 5 minutes to 22 minutes.

minutes with a range of 5 minutes to 22 minutes.



### Volume and Injury Acuity:

A trauma patient is defined by policy in Orange County as someone with significant injury that may result in loss of life or extremity (see Annex 2: Orange County EMS Policy# 310.30). The Orange County Field Trauma Triage policy is based on standards published by the U.S. Centers for Disease Control and Prevention and the American College of Surgeons with endorsement by the American College of Emergency Physicians. In Orange County, reports of trauma patients encountered in the field are relayed to an Orange County Base Hospitals for determination of destination, which results in a "Trauma Activation" and confirmation that the case meets trauma criteria and requires trauma center care.

Research evaluating a single trauma center has suggested a bell-shaped curve exists with too small or too large a trauma case volume having a negative impact for outcomes (London JA, et al, 2002).

## THE ORANGE COUNTY TRAUMA SYSTEM 2018

Trauma center case volume is conceptualized into three major categories:

1. *Trauma Activations*: All injury patients transported under Base Hospital direction to a trauma center that require evaluation by the trauma service.
2. *Trauma admissions*: The subset of trauma activations that are serious enough to require hospitalization for observation or treatment.
3. *Injury Severity Score greater than 15 (ISS > 15)*: The subset of trauma admissions that are most severely injured with high demand for medical care resources.

The Needs-Based Assessment of Trauma Systems (NBATS) tool is suggested by the American College of Surgeons Committee on Trauma as a method for needs assessment of change in trauma system design. These guidelines state:

### Minimum Capacity:

At a minimum, a high-level adult trauma center (Level 1) should have at least 1,200 trauma admissions with 240 of those admissions having an ISS > 15.

### Maximum Capacity:

According to the NBATS tool, an adult trauma center receiving more than 4,000 to 5,000 trauma activations a year and admitting more than 500 patients with an ISS > 15 may be at maximal capacity.

Note that the volume figures provided refer to adult and adult/pediatric combined trauma centers and are not valid for pediatric trauma centers such Children's Hospital of Orange County.

The institutional volume and acuity numbers for the trauma centers located in Orange County are,

#### Orange County Global Medical Center (2017 site visit data):

Total trauma activation visits:	2887 patients
Trauma admits:	2619 patients
Trauma admits with ISS > 15:	304 patients

#### Mission Hospital Regional Medical Center (2017 site visit data):

Total trauma activation visits:	3083 patients
Trauma admits:	1967 patients
Trauma admits with ISS > 15:	262 patients

#### UC Irvine Medical Center (2015 site visit data):

Total trauma activation visits:	3786 patients
Trauma admits:	1827 patients
Trauma admits with ISS > 15:	423 patients

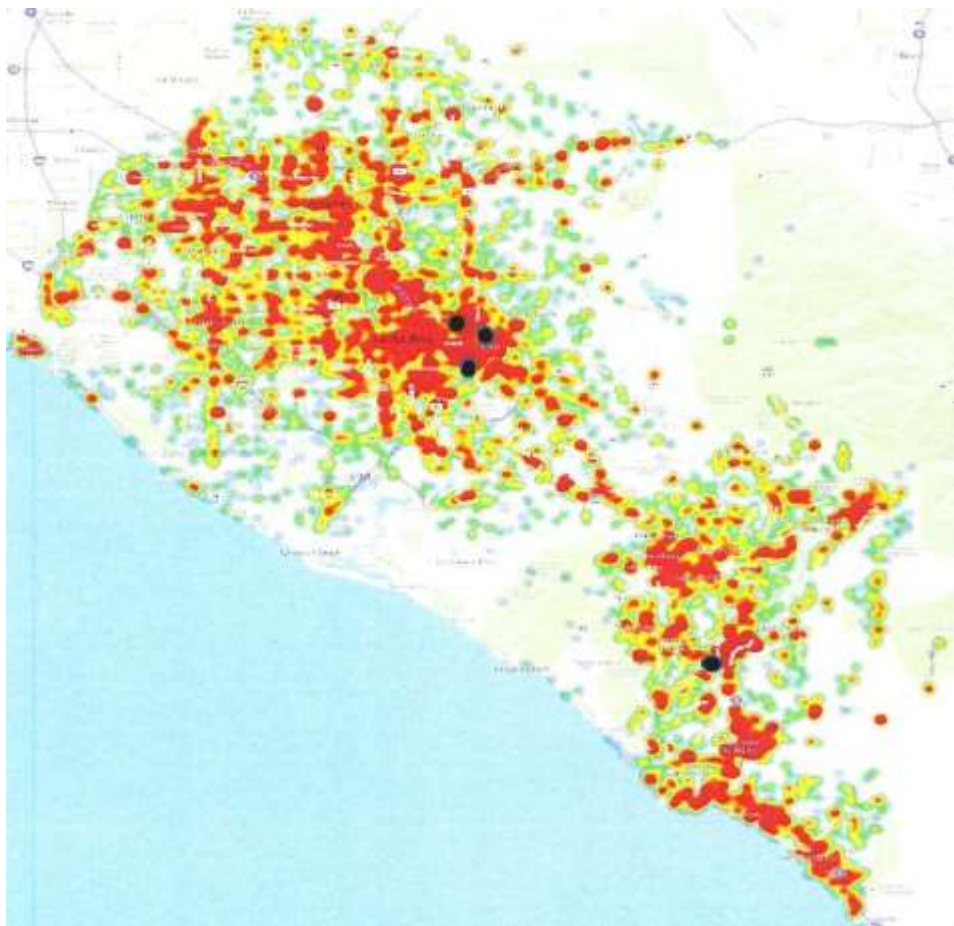
## THE ORANGE COUNTY TRAUMA SYSTEM 2018

Children's Hospital of Orange County (2017 site visit data):

Total pediatric trauma activation visits:	488 patients
Trauma admits:	452 patients
Trauma admits with ISS > 15:	21 patients

All Orange County trauma centers are within volume and injury severity targets set by the American College of Surgeons.

The following figure shows the location of Orange County trauma centers and field (911) trauma activations in the form of a heat map. The figure combines both adult and pediatric trauma field activations. Red colored areas indicate the highest numbers of trauma events, with yellow intermediate, blue-green significant transports, and uncolored areas with the least amount of events.



Data Source: OC-MEDS Database

Black dots shown in the figure are Orange County trauma center locations, with  
Farthest North= UCIMC  
East of UCIMC = CHOC  
South of UCIMC and CHOC = OC Global  
Farthest South = Mission Hospital (MV)



## THE ORANGE COUNTY TRAUMA SYSTEM 2018

Trauma volume data and heat mapping show a distribution of trauma center resources and areas of trauma activation occurrence distributed along major transportation corridors. Of note is that just below 90% of trauma that occurs in Orange County is blunt in origin, caused by auto accidents, falls, and similar types of mechanisms as opposed to penetrating trauma that occurs with gunshot wounds, stabbing, and similar mechanisms.

### Diversion Time /Ambulance Patient Offload Time:

When a hospital is on diversion, that hospital is beyond capacity to provide adequate medical services for further incoming patients. Hospitals in Orange County have the option to declare that they are on diversion status when it is unsafe for 911 or non-emergency ambulances to transport patients to their emergency department or trauma service due to being overwhelmed with patients or because of internal disruption of operations within the hospital.

The Orange County Emergency Medical Care Committee has established upper limits for acceptable annual total diversion time by designated trauma centers at 2% and for Emergency Receiving Centers at 6%. Elevated diversion times suggest that the institution is reaching a volume threshold that is unsafe for patients. The reported diversion times for Orange County trauma centers along with corresponding emergency department diversion are listed below:

#### Trauma Center Diversion Times 10/2016 to 9/2017: Metric $\leq$ 2%

Mission Hospital, Mission Viejo:	65 hrs, 46 mins	(0.8%)
Orange County Global Medical Center:	75 hrs, 52 mins	(0.9%)
UC Irvine Medical Center:	142 hrs, 38 mins	(1.6%)
Children's Hospital of Orange County	0 hrs, 0 mins	(0%)

#### Emergency Department Diversion Times 10/2016 to 9/2017: Metric $\leq$ 6%

Mission Hospital, Mission Viejo:	332 hrs, 27 mins	(3.8%)
Orange County Global Medical Center:	154 hrs, 33 mins	(1.8%)
UC Irvine Medical Center:	680 hrs, 0 mins	(7.8%)
Children's Hospital of Orange County	0 hrs, 0 mins	(0%)

Ambulance Patient Offload Time (APOT) is defined as the time taken from when an ambulance arrives at a hospital emergency department to the time the care of the patient has been transferred to the hospital medical staff and placed into a hospital bed. By California state standard, APOT time is measured at the 90<sup>th</sup> fractal, meaning that for 90% of occurrences, the reported APOT time is less or the same as that reported. Hospitals that are overwhelmed with patient volume or that are holding admissions in the emergency department will typically have prolonged APOT times, which results in delays

## THE ORANGE COUNTY TRAUMA SYSTEM 2018

for ambulances to return to service and respond to the next emergency call.

Emergency Department Ambulance Patient Offload Times for Trauma Centers:

Mission Hospital, Mission Viejo:	within 36 minutes 90% of time
Orange County Global Medical Center:	within 26 minutes 90% of time
UC Irvine Medical Center:	within 29 minutes 90% of time
Children's Hospital of Orange County	within 19 minutes 90% of time

Trauma victims take priority over almost all other emergencies (excluding myocardial infarction or heart attack and stroke victims). A hospital overloaded with trauma will result in delayed medical care for the majority of emergency cases presenting to that hospital. Use of emergency department beds for observation of trauma victims and use of intensive care unit beds for stabilization of trauma patients has impact on hospital capacity to provide services and when a hospital is overwhelmed (trauma cases or otherwise) this problem is illustrated, in part, by elevated diversion and APOT times.

### DATA ANALYSIS

The population of Orange County is stable and projected to increase at slightly less than 1% a year in the next decade. A steady growth in system trauma activations directly proportional to projected population growth indicates that there will be a 1% annual increase in demand for trauma services or a total 10% increase in demand at the end of a decade. Trauma centers in Orange County are located in areas of high population density and near major transportation corridors. During times of high volume demand, the Orange County Base Hospitals can direct trauma victims to centers that are less impacted.

Field transport times from an accident scene to a trauma center are acceptable in Orange County when compared to national transport time standards for urban population centers. While there are hypothetical arguments surrounding traffic delays within the County, current data fails to support a problem with prolonged transport times within the County.

Based on national standards, trauma volume for adult patients is high at UCI Medical Center and acceptable at Mission Hospital Regional Medical Center and Orange County Global Medical Center. An issue of concern is the number of patients that arrive at an Orange County Trauma Center as a field activation that do not require hospitalization and rather are held in the emergency department area and discharged (1,959/year for UCI, 1,116/year for Mission, 268/year for Orange County Global). These non-admitted injury victims represent 34.5% of the cases transported to the adult trauma centers.

While considered an acceptable over-triage rate, it is likely that developing field trauma triage protocols that are more selective than the currently used national guidelines could reduce this 34.5%.

## THE ORANGE COUNTY TRAUMA SYSTEM 2018

There is excess pediatric trauma capacity in the system when considering the activations transported to Children's Hospital. In addition to Children's Hospital, the County adult trauma centers are capable of providing pediatric trauma care.

While not solely specific to the trauma system, trauma activations do directly affect hospital diversion and APOT times. Because trauma cases "bump" other emergency cases, those emergency departments that are already near capacity or near overwhelmed may become unsafe due to incoming trauma and require diversion status to stabilize. Diversion is a declaration by a hospital that it has become unsafe for incoming patients and most would consider that such a situation is unsafe for those patients already being treated or waiting to be seen. Each of the three Orange County adult trauma centers have required some diversion during the past year, but the diversion time for UGI (total of 28.3 days-time for the year) has been above the Orange County accepted standard and likely shows an impact that is partly due to high trauma volume. Associated with emergency department diversion is the amount of time that patients are observed in an emergency department bed while a decision is being made by the trauma service as to admission to the hospital or discharge from the emergency department.

Conservatively estimating that this average observation time is three hours per patient, within the trauma system in Orange County during the time frame studied, there would be an estimated 10,029 hours (417.9 days) of emergency department bed time availability consumed for trauma observation.

As with diversion, APOT times directly affect ambulance availability and safety for a community. All three adult trauma centers have APOT time that are in the median range for Orange County hospitals, median = 25 minutes 90% of the time (25%, 75% IQR 20, 33.5).

### CONCLUSION

Limited land for housing development, high costs for housing, high California tax rates, and transportation limitations will limit population growth in Orange County. The current population is served by the existing trauma system and projected population growth is low. The greatest risk for the Orange County Trauma System is loss of an adult trauma center.

Data taken directly from the Orange County EMS system database system does not show current problems with transport from scene to trauma center times.

Adult trauma volume is high but managed by the three adult trauma centers. Pediatric trauma capacity within the County is good. Adults and children have access to EMS transport and trauma center services throughout the County.

One trauma center has excessive emergency department diversion time that may partly be the result of trauma volume. APOT times for trauma centers in the County are within the median and range for all hospitals.

## THE ORANGE COUNTY TRAUMA SYSTEM 2018

### HYPOTHETICAL PROJECTIONS

Assuming steady population and uniform distribution of trauma activations:

Addition of an adult trauma center in the northern part of Orange County would result in the following volume distribution projections:

Orange County Global Medical Center	
Total trauma activation visits:	1924 patients
Trauma admits:	1746 patients
Trauma admits with ISS > 15:	203 patients
UC Irvine Medical Center	
Total trauma activation visits:	2524 patients
Trauma admits:	1218 patients
Trauma admits with ISS > 15:	282 patients
New Designated Trauma Center, Northern County	
Total pediatric trauma activation visits:	2224 patients
Trauma admits:	1482 patients
Trauma admits with ISS > 15:	242 patients

Addition of an adult trauma center in the southern part of Orange County would result in the following volume distribution projections:

Orange County Global Medical Center	
Total trauma activation visits:	1924 patients
Trauma admits:	1746 patients
Trauma admits with ISS > 15:	203 patients
Mission Hospital Regional Medical Center	
Total trauma activation visits:	2055 patients
Trauma admits:	1311 patients
Trauma admits with ISS > 15:	175 patients
New Designated Trauma Center, Southern County	
Total pediatric trauma activation visits:	1989 patients
Trauma admits:	1529 patients
Trauma admits with ISS > 15:	188 patients

## THE ORANGE COUNTY TRAUMA SYSTEM 2018

Loss of a current adult trauma center would result in the following annual volume redistributions:

Total trauma activations visits at 3 trauma centers: 9,756\*

Loss of one trauma center re-distributes 3,252 patients

Additional 1,626-trauma activation visits per remaining trauma center

Total trauma admits at three trauma centers: 6,413\*

Loss of one trauma center re-distributes 2,137 patients

Additional 1,069 trauma admits per remaining trauma center

Total trauma admits with ISS >15 at three trauma centers: 989\*

Loss of one trauma center re-distributes 329 patients

Additional 165 trauma admits with ISS >15 per remaining trauma center

\*Annual site visit data from adult trauma centers, page 7

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Impact Evaluation Report Level III Trauma Designation - Mission Hospital Laguna Beach. Orange County Emergency Medical Services, March 2017.

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# **ORANGE COUNTY TRAUMA SYSTEM: 2018**

## ANNEX #1

### Trauma Transport Time for Individual Zip Codes



<b>Scene Incident City</b>	<b>Zip Code</b>	<b>Median Transport</b>
Buena Park	90620	0:14:00
Buena Park	90621	0:13:00
LA PALMA	90623	0:15:00
Cypress/Los Alamitos	90630	0:19:00
Fullerton/ La Habra	90631	0:19:00
Stanton	90680	0:13:30
Los Alamitos	90720	0:17:00
Seal Beach	90740	0:17:00
Irvine	92602	0:13:00
Irvine	92603	0:16:30
Irvine	92604	0:14:00
Irvine	92606	0:12:00
Lake Forest	92610	0:18:00
Irvine	92612	0:16:00
Irvine	92614	0:14:00
University of California at Irvine	92617	0:18:30
Irvine	92618	0:14:00
Irvine	92620	0:13:00
DANA POINT	92624	0:14:00
Costa Mesa	92626	0:13:00
Costa Mesa	92627	0:14:00
DANA POINT	92629	0:14:00
Lake Forest	92630	0:14:00
LAGUNA WOODS	92637	0:14:00
HUNTINGTON BEACH	92646	0:21:00
HUNTINGTON BEACH	92647	0:20:00
HUNTINGTON BEACH	92648	0:22:00
HUNTINGTON BEACH	92649	0:22:00
LAGUNA BEACH	92651	0:09:30
Laguna Hills	92653	0:10:00
Westminster/Midway City	92655	0:13:00
ALISO VIEJO	92656	0:14:00
San Clemente	92672	0:16:00
San Clemente	92673	0:15:00
San Juan Capistrano/ Ortega Hwy	92675	0:11:00
Santiago/Silverado/Modjeska/Trabuco Canyon	92676	0:20:00
Laguna Niguel	92677	0:10:00
Coto De Caza/RSM/Trabuco Canyon	92679	0:16:00
WESTMINSTER	92683	0:14:00
Rancho Santa Margarita/Las Flores	92688	0:15:00
Mission Viejo	92691	0:09:00
MISSION VIEJO	92692	0:10:00
Ladera Ranch	92694	0:09:00
SANTA ANA	92701	0:07:00

SANTA ANA	92703	0:10:00
SANTA ANA	92704	0:12:00
Tustin/Redhill Lemon/Cowan Heights/Santa Ana	92705	0:07:00
SANTA ANA	92706	0:08:00
SANTA ANA/John Wayne Airport	92707	0:10:00
Fountain Valley	92708	0:15:00
Tustin/Redhill Lemon/Cowan Heights	92780	0:07:00
Tustin	92782	0:11:00
ANAHEIM	92801	0:10:00
ANAHEIM	92802	0:08:00
ANAHEIM	92804	0:13:00
ANAHEIM	92805	0:08:00
ANAHEIM	92806	0:09:00
ANAHEIM	92807	0:13:00
ANAHEIM	92808	0:17:00
Brea	92821	0:15:00
Brea	92823	0:17:00
FULLERTON	92831	0:12:00
FULLERTON	92832	0:13:00
FULLERTON	92833	0:13:00
FULLERTON	92835	0:16:00
GARDEN GROVE	92840	0:08:00
GARDEN GROVE	92841	0:12:00
GARDEN GROVE	92843	0:09:00
GARDEN GROVE	92844	0:11:00
GARDEN GROVE	92845	0:14:00
VILLA PARK	92861	0:11:00
Orange	92865	0:10:00
Orange	92866	0:06:00
Orange	92867	0:08:00
Orange	92868	0:05:00
Orange Park Unincorporated	92869	0:10:00
Placentia	92870	0:14:00
Yorba Linda	92886	0:18:00
Yorba Linda	92887	0:15:00

# **ORANGE COUNTY TRAUMA SYSTEM: 2018**

## ANNEX #2

Trauma Triage Criteria: OCEMS Policy 310.30



**TRAUMA TRIAGE**

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I. AUTHORITY:

*Health & Safety Code, Division 2.5, Sections 1797.258, 1798, 1798.160-1798.169, and 1798.2; California Code of Regulations, Title 22, Division 9, Chapter 7.*

II. POLICY:

This policy identifies the types of injuries and situations that require transport of trauma victims to an Orange County EMS (OCEMS) designated Trauma Center (TC).

III. DEFINITION OF A TRAUMA VICTIM ("MEETS TRAUMA CRITERIA"):

A trauma victim is someone who has a blunt or penetrating injury with the presence of any of the following:

A. Abnormal Vital Signs:

- Glasgow Coma Score (GCS) less than 14 (in the presence of head injury)
- RESPIRATION:  
Adult/Adolescent/ Children<sup>1</sup>: less than 12 per minute OR greater than 30 per minute
- SYSTOLIC BLOOD PRESSURE:  
Adult/Adolescent: less than 90  
Children<sup>1</sup>: less than 80

Note #1: A child is defined as those ages 14 years-old and younger.

B. Injuries:

- Penetrating or open injury of the head
- Depressed skull fracture
- Blunt head injury with loss of consciousness greater than 5 minutes
- Penetrating injury to the neck, chest, abdomen, back, or groin
- Penetrating injury to extremity above elbow or knee
- Extremity with poor circulation or without a pulse
- Paralysis or numbness of arm or leg
- Suspicion of spinal cord injury
- Flail chest
- Seat belt bruising or abrasion of neck, chest or abdomen
- Abdominal injury, blunt, with tenderness of 2 or more quadrants
- Fracture of two or more long-bones (femur, humerus)
- Pelvic pain or deformity on palpation
- Amputation above the wrist or ankle
- Crushed, degloved, or mangled extremity (excluding only fingers or toes)

C. Mechanism of Injury

- Falls
  - Adult/Adolescent: greater than 15 feet (one story is equal to 10 feet)<sup>2</sup>
  - Children<sup>1</sup>: greater than 10 feet or 2-3 times the height of the child<sup>2</sup>
  - Falls from a galloping horse



**TRAUMA TRIAGE**

Mechanism of Injury (continued)

- High-Risk Auto Crash
  - Passenger space intrusion greater than 12 inches where an occupant (who would be defined as a trauma victim) is sitting or any occupant in a passenger seat when there is greater than 18 inches intrusion at any site within the passenger space.<sup>2</sup>
  - Ejection (partial or complete) from automobile.
  - Person who is in same passenger compartment in which a trauma death has occurred.
- Dive and shore break injuries with suspected spinal cord injury
- Auto vs. Pedestrian / Bicyclist who is thrown any distance, run-over, or with significant (greater than 20 mph<sup>2</sup>) impact
- Motorcycle Crash greater than 20 mph<sup>2</sup>, including "laying bike down"

Note # 2. Heights, speeds and distances are best estimates

IV. SPECIAL CONSIDERATIONS:

Patients with significant injury and any of the following may benefit from specialized trauma services; contact Base Hospital for destination decision regarding those with injury and:

- Age 75 years-old or greater
- Anticoagulation<sup>3</sup> and bleeding disorders
- End-stage renal disease on dialysis
- Pregnancy greater than 20 weeks
- EMS provider judgment that transport to a TC will benefit the injury victim

Note # 3. Patient is on or states is taking a "blood thinner" or "anticoagulant" excluding aspirin

V. DESTINATION DECISIONS:

Base hospital contact is required for all patients described in this policy. Trauma victim destination is determined by the base hospital.

VI. TRAUMATIC RESPIRATORY AND CARDIOPULMONARY ARREST:

At the discretion of the BH physician, trauma patients presenting with any of the following and for who resuscitation and transport is pursued should be triaged as follows:

- |                                    |                |
|------------------------------------|----------------|
| • Unmanageable airway              | Triage to PTRC |
| • Traumatic cardiopulmonary arrest | Triage to PTRC |



**TRAUMA TRIAGE**

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**Approved:**

Sam J. Stratton, MD, MPH  
OCEMS Medical Director

Tammi McConnell, MSN, RN  
OCEMS Administrator

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Reviewed Date(s): 3/2015  
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Effective Date: 12/01/2016