• This presentation/self-study provides a basic introduction to Contra Costa County STEMI System
• For questions contact Contra Costa EMS
Welcome to our STEMI System!

Together we are Contra Costa Team STEMI!

• You are joining Team STEMI!
• A collaborative network of EMS provides, ED physicians and nursing personnel and Cardiac Intervention Specialists working together 24/7 to triage high risk heart attack patients for rapid intervention.
• Time is muscle in a STEMI System and participating in this program enhances the quality of emergency care provided in our community.
What you need to know!

- What is a STEMI System?
- How EMS helps improve STEMI outcomes.
- STEMI destination and how it works.
- How to identify a STEMI patients in the field.
- What a STEMI Alert is.
- How to give a STEMI radio and bedside report.
- How the STEMI System quality process works.
- How all participants work together to improve performance.

• The purpose of this educational presentation/self study is to help you understand and describe to others how the Contra Costa STEMI System works.
• By the end of this presentation/self study you should be able to answer the objectives listed above.
• A STEMI System is a collaborative network of EMS providers and specialized hospitals willing to provide 24/7/365 cardiac intervention for an entire community. The system is supported by protocol and continuous process improvement with the goal of rapid reperfusion of the heart to prevent mortality and morbidity in Chest Pain Patients. It relies on the accurate identification of STEMI patients in the field with the use of prehospital 12-lead.

• STEMI Systems have a mandate to work with the community to educate patients about healthy lifestyles, knowing how to identify a heart attack and calling 911 first in the event of chest pain.

The 2005 AHA Conference Proceedings on STEMI Systems of Care called on health care providers to create STEMI Systems based on the following findings:

• 30% of STEMI patients receive no reperfusion therapy despite availability and absence of contraindications
• <50% of patients treated with fibrinolysis have a door to needle within 30 minutes
• 35% have PCI door to intervention within 90 minutes
• 20% of STEMI patients have contraindications to fibrinolytic therapy, but 70% of these do not receive reperfusion with PCI
• EMS activation of the cardiac catheterization laboratory speeds the time to diagnosis and reperfusion therapy
• But >75% of patients drive themselves or are transported to the hospital by a family member

STEMI Systems create a FAST TRACK direct to the cath lab in some STEMI systems including ours.
STEMI System Development

- 1999 Prehospital 12 lead piloted by Fire Transport
- 2006 Prehospital 12 lead implemented EMS system-wide by ALS first responders & transport
- 2006-2007 STEMI System Advisory Council
- April 2008 STEMI designation process started
- Sept 8, 2008 STEMI System was launched

Aug 17 2009 at 0800
Sutter Delta Medical Center joined
Contra Costa County STEMI System

• The development of the Contra Costa STEMI System required participation and support of all stakeholders in the EMS system.

• The STEMI System of Contra Costa was developed under the medical leadership of Dr. Joe Barger, EMS Medical Director, in collaboration with hospital, ED, cardiology, nursing, and prehospital provider leadership.

• It took a number of years and there has been a huge investment in prehospital training, 12 lead equipment, and time by all those who have participated.
STEMI Systems of Care
National Goals of Therapy

- Rapid reperfusion
- Prevent or minimize myocardial damage
- Prevent major adverse cardiac events/complications
- Anticipate and treat life-threatening complications

• These are the goals of STEMI reperfusion in STEMI Systems of care as described by the American Heart Association.
In a STEMI System the EMS Agency designates STEMI Receiving Centers based on a set of criteria.

Contra Costa criteria for STEMI Center Designation is on our website at www.cccems.org and includes:

- STEMI Centers provide 24/7/365 cath lab capability—There is NO diversion process
  - If the cath lab is down or busy the STEMI Center would manage the patient with thrombolytics as they do now with walk-in patients when this event occurs
  - Contra Costa EMS reserves the right to modify the STEMI destination in the rare event of hospital internal disaster or prolonged Cath lab malfunction
- Each Center must meet rigorous requirements, enter into contract with EMS and commit to providing:
  - Personnel
  - Policy/Protocols
  - Equipment
  - Participation in a collaborative program of STEMI System Oversight in partnership with the EMS Agency.
  - Rapid transfer plan when cardiovascular surgical services are required in facilities who do not have CV surgery support.
• With Sutter Delta joining our STEMI System Network in August 2009 there are now 6 strategically located STEMI Centers in Contra Costa County.

• We also have 2 out of county STEMI Centers. These Centers are part of the Alameda County STEMI System.
Paramedics decide destination when a STEMI patient is identified based on the protocol
- Patient choice is preserved
- Condition of the patient is considered (stable airway)
- Closest STEMI Centers are identified

Goal: EMS transport should not exceed 30 minutes

- Please review EMS Policy 25: STEMI Triage and Destination
- In our destination policy patients with an identified STEMI are to go to the closest STEMI Receiving Center unless
  - The patient requests another facility
  - A STEMI Center that is not the closest is acceptable if the estimated additional time does not exceed 15 minutes. This allows for the patient to get to their desired facility and physician.
- Patient has an unmanageable airway. In those cases the patient goes to the closest ED.
- Effective 8/17/09 Contra Costa EMS enhanced our STEMI destination policy to enable patients with cardiac arrest who have a STEMI identified before or after the arrest to be triaged to a STEMI Receiving Center and NOT the closest ED. These patients require rapid reperfusion with intervention to improve their chance for survival.
There is some flexibility in our destination protocol for the following reasons:

• It gets the patient to their desired facility and physician.
• Cath lab startup is most time-consuming step and if it takes a while to get to the ED.
• By alerting the STEMI Center early the time cath lab activation can be done during the time the patient is in transit.
What happens to patients who do not go directly to a STEMI Center?

- Thrombolytics
- ED triage to STEMI Center if this fails
- ED-SRC Center coordinated interfacility transport

• Patients may enter the STEMI system through a non-STEMI center in a number of ways:
  • The patient always has a choice although they are advised of what resources we have available in our STEMI system. That choice has to be respected.
  • The patients may walk into a non-STEMI center. All STEMI Centers are required to accept patients from non-STEMI centers and work with those facilities to create effective mechanisms for rapid transport. Contra Costa STEMI System is working to improve rapid interfacility transport of these patients between our STEMI and non-STEMI Centers.
  • Finally the non-STEMI centers are capable of administering first line therapy to treat MI’s as they do and have done for many years prior to triaging the patient to a STEMI center.
STEMI Triage and Destination

- Depends on early prehospital 12-lead identification
  - Chest Pain Patient
  - Device identifies
  - Medic assures quality 12 lead
  - Medic may do additional interpretation

- STEMI Alert applies *only* to STEMIIs identified by 12 lead.

- Other messages
  - *Do not* qualify as STEMI
  - Do not merit transport to STEMI Center

-Zoll **ACUTE MI**

(LP-12)***ACUTE MI SUSPECTED***

• Prehospital paramedics use Zoll 12 lead and LP-12 (Physio-Control) devices that “diagnose rhythm”.
• By EMS protocol, prehospital providers rely primarily on 12 lead device algorithm identification which has good reliability IF artifact is minimized.
• Other messages – e.g., possible MI, possible ischemia, MI age undetermined *do not* qualify as STEMI and do not merit transport to STEMI Center
• All prehospital providers are to be trained in Contra Costa STEMI protocols, 12 lead interpretation and evaluating the quality of the 12-lead.
• Eventually Contra Costa EMS hopes to include 12 lead transmission in our system but the technology is expensive and is difficult to implement county-wide.
• In the future you may be involved in a 12 lead transmission pilot.
STEMI Prehospital Triage and Destination

- 12-lead needs to be rapidly obtained
  - Acceptable quality
    » good QRS in all 12 leads
    » no significant artifact
- STEMI determined by 12 lead
  - Determine destination
  - Perform “STEMI Alert”
  - Transport-Load and Go
- STEMI Alert needs to give critical information to STEMI Center

• This is what we want to happen in the field. However in all STEMI Systems there are no perfect circles and this may not happen every time. That is why there is a STEMI QI review process involved. **One of the biggest challenges in ANY STEMI System is the task of reducing false positives.**

• Each STEMI response in the system is reviewed by the STEMI Center, Contra Costa EMS and your agency’s CQI Coordinator.

• Each STEMI Center QI/Program Coordinator is responsible for submitting a STEMI Report to EMS for each “STEMI ALERT” that enters a STEMI Receiving Facility (whether an actual STEMI or not). This allows EMS to track the root causes of false positives in the system and provides an opportunity for the STEMI Center to give timely constructive feedback (positive and corrective) to the prehospital providers.

• The expectations for the prehospital providers in the field are defined by EMS protocol for ACS and include:
  - Treatment of Chest pain e.g. ASA and Nitro unless contraindicated
  - 12-lead needs to be rapidly obtained. Less than 5 minutes from arrival is the gold standard.
    - The 12 lead must be of acceptable quality with good QRS complexes in all 12 leads and no significant artifact
  - Once the 12 lead is obtained, destination needs to be determined and contact of STEMI center by “STEMI Alert” should happen as soon as possible.
  - Prehospital providers are not to wait until ready for transport or after departure to call a STEMI Alert.
  - As soon as the paramedics determine this is a STEMI patient the STEMI Alert call goes out.
    - Understand that the prehospital providers are doing many things simultaneously en route under at times, challenging circumstances.
    - STEMI patients can be quite ill and unstable.
    - Contra Costa has had numerous instances where a STEMI patient deteriorates at the scene or en route.
    - The number of cardiac arrests associated with STEMI patients has prompted an additional change in our policy to triage those patients to a STEMI Center instead of just the closest ED.

• STEMI Report needs to give critical information to hospital
Upon STEMI patient identification in the field the medic is to alert the closest STEMI Center with a “STEMI Alert”

Contra Costa EMS uses SBAR (Situation, Background, Assessment, Rx/Recap) to assure effective communication during radio and bedside report.

SBAR is also used in all our hospitals to relay patient handoff information. ED personnel are very familiar with SBAR patient handoff.

SBAR brings urgent essential information to the forefront to assure things do not get missed.

**B is for Background:** Pacemakers are included in background since pacer spikes can interfere with the reliability of the machine interpretation.

- This may help STEMI Centers decide if they want to activate their Cath Lab teams or not
- The decision to activate from the field is an individual STEMI Center’s decision
- EMS, AHA, ACC and the Society of Chest Pain all recommend that activation from the field should be the “Gold Standard”
- Most STEMI Center’s in our System activate from the field
- This is why Contra Costa County has achieved such outstanding STEMI System performance metrics.
- Offer information about the quality of the 12 lead
Report at Hospital – SBAR should include:

**Situation**
Repeated including patient identification with urgent concerns up front.

**Background**
Repeated including past history if known (e.g. history of MI, clot busters, cath, or surgery, cardiologist). High risk medications (especially anticoagulants, insulin, erectile dysfunction drugs), allergies, advanced directives.

**Assessment**
Repeated pertinent VS, ALOC Pain level

**Rx/Recap**
Prehospital treatments given and patient response. Concerns repeated and questions addressed.

• Once the patient arrives they are met by the STEMI Center response team and rapidly triaged through the ED.
• In most cases a confirmatory 12 lead is done and the cath lab will be “called down” if the patient’s 12 lead does not show ST elevation.
• If the prehospital 12 lead is of good quality some STEMI Centers do not repeat the 12 lead to save time.
• Once at the STEMI Center medics are to give another SBAR report with additional information as described above.
  • This is the report EMS has told our STEMI Centers to expect from EMS providers during patient handoff.
  • Some of the information may not be known to the you but if it is let the STEMI Center team meeting you know e.g. the name of cardiologist.
• Prehospital SBAR flows like a conversation and helps you prioritize critical information effectively and efficiently.
• In STEMI Centers who offer EMS direct to cath lab access this verbal report may be done on the way or in the cath lab.
• Prehospital providers are encouraged and allowed to follow the patient into the cath lab when those opportunities arise unless they are urgently needed to return to service.
Prehospital 12-Lead ECG

- First responders (Fire medics)
  - May do the STEMI Alert 12-lead
  - Can activate from the field prior to transport arrival
- STEMI 12-lead copies
  » 1 to STEMI Center
  » 1 to Transport Agency Pt Record
- Multiple 12-leads may be done
- 12-lead handoff directly to STEMI Team MD/Nurse caring for patient

• Prehospital providers are to give the STEMI Receiving Center the following:
  • A copy of 12-lead must be left at ED (if multiple valid tracings are done, all should be left)
  • First responders doing 12-lead should provide 2 copies for transport (one for hospital and one for transport agency) when possible
  • The field personnel giving report to the hospital on arrival should hand the 12 lead directly to the nurse caring for patient
  • Copy of 12-lead should be submitted to your agency if not uploaded into record

• EMS understands that in the excitement of getting the patient to the cath lab patient care records and 12 leads can get misplaced or lost. We need your help to assure these documents stay with the patient and get into the patients record.
12-Lead Lessons Learned

- Quality of ECG’s has markedly increased since startup
- Still have occasional issues with artifact or incomplete ECG or incorrect lead placement
- All 12 leads must have readable complexes with stable baseline

• The Lifepak 12 if left on the patient will continue to assess the patient and automatically print out another 12 lead if there is a change in the ECG reading.
• To capture another 12 lead with the Zoll device you have to push the print button.
Several instances where initial ECG is abnormal but second ECG confirms MI

Leaving leads on and repeating ECG is appropriate

- This demonstrates the proper placement of 12 leads on a cardiac patient.
- The type of 12 leads your agency uses can make a difference in the quality of the tracing by reducing artifact and skin contact.
12-Lead Lessons Learned

- Skin Prep remains the single most important issue in getting good tracing.
- Rub vigorously with gauze to remove superficial layer of skin.

• See your provider agency education specialist to brush up on 12 leads at any time.
• They are there to help support your success in the field.
• The baseline in this ECG is nowhere near acceptable.
• The machine can still read this as an Acute MI even though it was not.
• Again, this is hard to see, but the machine read it as an MI and it was not.
• The baseline is too unsteady and the machine may overread when this occurs.
• We have seen a number of cases like this, and in most cases a better ECG is done that shows no MI.
• This ECG is hard to see, but it is definitely hard to see something when it is not there.
• There are only 9 leads shown (V3, V5, and V6 are missing).
• The machine actually said this was an ACUTE MI, even with the missing leads.
• In this case there was a call to a hospital from the field, and the hospital called in their cath lab team.
• Unfortunately this was not an MI and the activation was not indicated.
• Lesson learned: the 12-lead needs to have all 12 leads to be reliable!!!!
• This is a real MI.
• There are ST elevations in leads II, III, and avF – an inferior MI.
• Nice steady baseline
• Here is another real MI.

• Big ST elevations are see from V1 to V4, indicating an anterior MI.
• This is a case that was read as an MI, but it looks more like V-Tach.
• In reality the patient has a pacemaker, and the spikes do not show up.
• Getting a history of pacemaker placement is important.
• Almost all of these patients have a bundle branch block pattern because of the electrical stimulus to the ventricle.
• So the machine is not perfect, but we can decrease the false readings by making sure we have a complete 12-lead, that the baseline is steady, and that the patient does not have a paced rhythm.
• In addition a number of patients very rapid heart rates get called MI, and some of these likely are false positives.
• When you do call a STEMI alert, the heart rate is always an important finding to report (HR > 120 are associated with false positives)
Required Prehospital Documentation

- All prehospital providers create an electronic patient care record (ePCR)
- ePCR documentation is very important and all cases reviewed by EMS
- Can’t evaluate STEMI system performance without this!

• Each prehospital provider is required to document in an electronic patient care record (ePCR) specific things about the STEMI alert and activation
• This documentation is reviewed for each and every STEMI alert in the system and is a critical part of the STEMI CQI process.
• You should expect a draft or complete prehospital PCR before the prehospital providers leave.
• All 12 leads should have been uploaded or scanned into the patient's ePCR.
Contra Costa STEMI System Performance

- 911 Call to intervention time average 83 minutes
- EMS to Intervention time averages 75 minutes
- Door to balloon median is 62 minutes (all SRC centers)
- Door to intervention time < 90 minutes 100%

Contra Costa STEMI Data Q1 2009

- Contra Costa EMS has a STEMI System Newsletter called STEMI News.
- Goal is share the newsletter with all stakeholders to keep them informed of our STEMI program process and performance.
- Being part of a STEMI System helps each stakeholder achieve amazing outcomes due to the strong partnership with EMS.
- Our statistics demonstrate that consistently.
- Visit our website at www.cccems.org for more STEMI information
One of the events that we did not expect to find in our STEMI System were the number of evolving STEMIs identified in the field.

These are cases where the initial 12-lead does not indicate a STEMI but en route the patient condition changes and our process of repeating 12-leads en route catches the event.

In these situations the paramedics will change destination to the appropriate STEMI facility.

These cases demonstrate the dynamic process of how STEMIs can evolve in an individual chest pain patient and is why we now train our paramedics to perform multiple 12-leads whenever possible.
STEMI Lessons Learned
We need to multitask

- EMS Scene Time
- Benchmark
  - < 15 minutes
- Q4 2008 13-14 min
- Q1 2009 12 minutes

- Our current prehospital data demonstrate a significant reduction in average scene times.
- The gold standard is a scene time < 15 minutes and a EMS provider (medic at the patient) to cardiac intervention time of <90 minutes.
- If cases have scene times >20 minutes – want to minimize this but usually associated with complicated patient or difficulty at the scene.
- QI program coordinators in each of our EMS provider agencies, our STEMI RN program managers and EMS will be working together to capture this information and work to shorten our times and do our best to eliminate delays.
- We need your cooperation to get information to the appropriate parties and work cooperatively giving positive and constructive feedback so we can improve.
**STEMI Lessons Learned**

**False positives need to be actively addressed**

- False positive rate around 20-38%
- What is a False positive
  - When 12-lead ECG says **Acute MI** and the patient turns out not to be a STEMI
- Most common reasons:
  - Baseline artifact
    - Poor skin contact
    - Motion artifact
  - Rapid rates sometimes fool device
  - Paced rhythms
  - Patient factors
    - Normal variant ST elevation
    - Electrolyte imbalances

- Our current statistics suggest that if we can eliminate artifact that we can reduce our false positive rate to 13-14%
- In North Carolina where STEMI systems have been in place for over 10 years EMS providers in rural and urban areas have reduced their false positive rate to 5-10% through training alone.
- What is a False positive? It is when the ECG says **Acute MI** but is NOT
  - Baseline artifact is the most common cause
  - Tachycardia may fool machine, especially heart rates >120
  - Wide complex rhythms also cause problems
  - Paced rhythms
    - Patient variant due to electrolyte abnormality or other metabolic condition (only can be determined by cardiology or at the ED)
- Occasionally computer reading is just wrong despite no artifact or other finding (rare)
- When multiple ECG’s are obtained and there is a lot of artifact the chances of false positive goes up!
- If computerized readings are of variable quality be sure that you look at the “best tracing”.
- An **ACUTE MI** reading when there is a lot of artifact is much less likely to be read accurately by the 12 lead device.
STEMI Lessons Learned
We need a high index of suspicion

- STEMI patients with classic presentations of chest pain are typically male and younger (30-50’s)
- Atypical presentations present commonly in older patients, diabetics and women.

• Atypical patient presentations have included extreme sudden fatigue, weakness, syncope, SOB
• The average false positive rate for prehospital 12 leads interpretation devices is about 20% when looking at STEMI systems that are established.
• Contra Costa has about 7000 chest pain calls per year but only about 150 to 200 STEMI activations at the present time.
• STEMI patients are a what is called a high risk low frequency population where as Chest Pain patients make up a much high percentage of our calls
• We have over 400 paramedics in the Contra Costa System and many have still not gone on a call with a STEMI patient so keeping up your skills is important and requires ongoing practice and training.
• EMS has been working with all our prehospital providers to do a 12 lead in ALL Chest Pain patients and be alert to atypical presentations. In other words have a high index of suspicion!
Atypical Presentations

Who is at risk?
- Diabetics....Women.....Elderly

Chest pain may not be their chief complaint
- Shortness of Breath
- Nausea & Abdominal discomfort
- Weakness or Syncope
- Neck, jaw, shoulder or upper back pain.
- Indigestion
- Unexplained Fatigue

- Diabetics and the Elderly experience pain differently and may not report “classic symptoms” of Acute Coronary Syndrome (ACS).
- Women also present frequently with atypical symptoms.
- Sometimes atypical patients are difficult to pick up in the field.
- Be alert for these patients if they are brought to you from EMS and were not assessed as a potential ACS.
- Not all STEMIs are picked up in the field!
  - Sometimes the presentation of the patient is so atypical it is missed in the field.
  - In these cases report this to your STEMI coordinator who will submit a STEMI report so EMS can review the case for opportunities to improve.
• Contra Costa STEMI System Oversight Process involves
  • Case Review for each STEMI Alert
  • Data Collection on outcome of each STEMI Alert.
  • Quarterly STEMI Center Coordinator Meetings.
  • Biannual STEMI System Oversight Meetings with all stakeholders.
  • Routine performance reporting based on local and national metrics.
    • Prehospital quarterly data reports
    • STEMI Center data reports
    • STEMI System data reports

• The EMS agency coordinates this effort and EMS provider agencies and STEMI Centers have a designated individual that is the lead for the process.

• The CQI process is extensive, accountable and focused on respectful positive corrections to enhance problem resolution when required.
Overall Experience

- Contra Costa has achieved outstanding STEMI System performance!
- Prehospital has made a significant difference in decreasing time to intervention.
- EMS providers are committed and accountable throughout the system!

• Based on all national metrics the Contra Costa STEMI System has demonstrated outstanding performance in a short time.
• EMS have been instrumental in allowing our STEMI Centers to decrease time to intervention to significantly better than national standards.
• Contra Costa is a high performer by all STEMI System performance measures!
• You will be an active part of that program and because of this we will save even more lives throughout our community!
But we need your help….

- An effective STEMI system relies on good communication!
- Make sure ECG’s get into the patient’s chart.
- Give constructive timely feedback.
- Report issues

Contra Costa EMS works with our STEMI Center providers to give constructive feedback when a STEMI Alert is not properly identified in the field.

• These are “teachable moments” for the prehospital providers involved and we want our EMS providers to respond positively to explanations about why the patient was not a STEMI patient after all.

• When these situations occur take a few minutes to review the case and 12 lead with the STEMI Center providers involved.

• They are committed to improving your experience and expertise.

• This is how each individual can “make that difference” in improving the system for the next patient.

• Everyone understands that false positives are frustrating for all involved but with the current technology and limitations in our system, training and appropriate feedback are our best tools to decrease false positives.

• All STEMI prehospital issues are reported to your agency CQI coordinator so EMS can appropriately review and support positive corrections.
Constructive Timely Feedback

- Fundamental to process improvement
- Timely
- Respectful
- Specific
- Directed toward improvement
- Helps prevent the same problem from occurring in the future
- Considerate
- Requires practice

• In the heat of the moment when things go sideways it is easy to let emotions and frustrations take over.
• Letting frustrations get in the way undermines the collaboration and teamwork that is required to manage a high performance STEMI System.
• There are numerous factors to look at when an event does not go as planned and rarely is it due to just one thing.
  • Technology limitations.
  • Training issues.
  • Experience of the provider.
  • Instability of the patient.
  • Some of these factors are controllable and some of them are situational and are not due to human error.
• STEMI Systems provide an opportunity to establish a new level of teamwork and collaboration between the ED and Prehospital providers.
• This new level of teamwork will spill over to other aspects of care.
Finally one of the most important parts of a STEMI System is that it helps to create a strong base of community education around heart disease.

Contra Costa EMS recommends using the NIH best practice patient education materials at our STEMI Centers.

These materials are available from the NIH and are posted on our website at www.cccems.org.

Duplication of these materials does not require special permissions.

EMS is committed to working with all our STEMI Centers to support community education about what to do in the event of chest pain.

Make sure your family members and community know to call 911 first in event of chest pain.
• Contra Costa EMS looks forward to working with you on this important community program.
• This presentation was developed by Contra Costa EMS STEMI Project Manager Pat Frost RN, MS, PNP

For more information on
Contra Costa EMS STEMI System
visit www.cccems.org