### Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Item</th>
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<tbody>
<tr>
<td>4:00 p.m.</td>
<td>1. Introduction of Members and Guests</td>
</tr>
<tr>
<td>4:02</td>
<td>2. Approval of Minutes from September 10, 2014</td>
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<tr>
<td>4:03</td>
<td>3. Comments from the Public</td>
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<td>Members of the public may speak up to 3 minutes each on matters either on or not on this agenda.</td>
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<tr>
<td>4:06</td>
<td>4. Chair’s Report</td>
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<td>Action Requested: Election of Chair for remaining 2015 term of office</td>
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<tr>
<td>4:10</td>
<td>5. Members’ Reports</td>
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<td>4:13</td>
<td>6. Fire Chiefs’ Report</td>
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<td></td>
<td>County Fire Chiefs’ Report on EMS Optimization - TBD</td>
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<td>4:16</td>
<td>7. EMCC Annual Report</td>
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<td>Action Requested: Review/Approve for Submission to the Board of Supervisors</td>
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<td></td>
<td>Leticia Andreas, Contra Costa EMS</td>
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<td>4:20</td>
<td>8. Fall Prevention Project 2014</td>
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<td></td>
<td>Alicia Moore, Community Outreach Coordinator, American Medical Response</td>
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<tr>
<td>4:35</td>
<td>9. EBOLA EMS System Preparedness</td>
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<td>Steve Huck, Contra Costa EMS Emergency Manager/Public Health</td>
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<tr>
<td>4:45</td>
<td>10. Status Report on Doctors Medical Center</td>
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<td>TBA</td>
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<td>4:55</td>
<td>11. Emergency Ambulance RFP Update</td>
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<td>Art Lathrop, Contra Costa EMS</td>
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<td>5:05</td>
<td>12. Update on AOT Workgroup</td>
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<td></td>
<td>Lauren Rettagliata and Douglas Dunn</td>
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<td>5:15</td>
<td>13. EMS Director’s Report</td>
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<td></td>
<td>Pat Frost, EMS Director</td>
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<tr>
<td>5:25</td>
<td>14. EMS Medical Director’s Report</td>
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<td>Joseph Barger, MD, EMS Medical Director</td>
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<td>5:35</td>
<td>15. Agenda Items for Next Meeting – March 11, 2015</td>
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<tr>
<td>5:37</td>
<td>16. Adjournment</td>
</tr>
</tbody>
</table>

Reasonable accommodations can be made for persons with disabilities planning to attend the EMCC Meeting by contacting EMS Staff at least 24 hours in advance at (925) 646-4690.

Any disclosable public records related to an item on a regular meeting agenda and distributed by the County to a majority of members of the Emergency Medical Care Committee less than 96 hours prior to that meeting are available for public inspection at 1340 Arnold Drive, Suite 126, Martinez during normal business hours.
1st Vice Chair Speakman called the meeting to order at 4:02 p.m.

1. **Introduction of Members and Guests**
   
   1st Vice Chair Speakman welcomed all attendees. Self-introductions.

2. **Approval of June 11, 2014 Minutes**: Correction of item EMS System Plan Approval to “motion passed”. It was mentioned that if approval is asked for, opposition needs to be asked for as well. Member Tobias proposed a motion for the change; seconded by Member Swartzell; motion passed.

3. **Approval of July 17, 2014 Minutes**: Member Frost motioned that the header on the second page needs correcting. Approved by Member Tobias; seconded by Member Swartzell; motion passed.

4. **Comments from the Public**
   
   None.

5. **Chair’s Report**

   Darrell Lee submitted his resignation as EMCC Chair via letter to Member Frost, nominating Member Swartzell into his position. (Member Swartzell politely declined.) Darrell Lee’s resignation letter needs to be sent to the Board of Supervisors. EMCC staff shall prepare a recognition certificate for Chair Lee for the December meeting.

6. **Members’ Reports**

   None.

7. **Fire Chiefs’ Reports**

   Member Swartzell: At the June 17 meeting, the EMCC was presented with the optimization report submitted by Contra County EMS. The fire chiefs will be conducting their own presentation at the upcoming Board of Supervisors meeting on September 23rd. All are invited to attend; a follow-up presentation in front of the EMCC can also be arranged.

8. **Update on Laura’s Law – Lauren Rettagliata and Douglas Dunn, Assisted Outpatient (AOT) Workgroup**

   *Alternate
At their last visit at the June EMCC meeting, only Nevada and Yolo Counties had adopted Laura’s Law. In the meantime, Los Angeles, Orange, San Francisco, and Placer Counties have adopted Laura’s Law as well. Santa Barbara, Fresno, Kern, San Diego Counties are going to be making presentations before their Board of Supervisors soon. On October 7, Laura’s Law will be presented to the Board of Supervisors for their consideration. The purpose here today is to obtain a letter of support from the EMCC for a full 45-person county Laura’s Law program. **Member Swartzell** asked for the final report to be sent to EMS Staff to draft the letter to the Board of Supervisors.

8. **Update on Doctors Medical Center - Dawn Gideon, Interim CEO Doctors Medical Center (DMC)**
   - Effective August 7, DMC no longer a 9-1-1 ambulance receiving center for
   - On August 24, DMC’s license changed from basic to standby, and was substantially downsized to a 25-30 bed facility with emergency department and some outpatient services, with funding through beginning of 2015.
   - Multiple conference calls are taking place weekly with the community, other hospitals, and stakeholders, to discuss how future services could be delivered.
   - Options are being considered such as a smaller hospital, a free-standing emergency department, a standby, or urgent care.

9. **Selection of up to three (3) EMCC members for the Request for Proposal (RFP) Workshop on September 17**
   **Member Frost** mentioned that since several EMCC members are already represented by other constituencies at the RFP Workshop, at least one (1) EMCC member should be identified at this time to represent solely the EMCC. Selected was Marcy Dixon, John Muir Health.

10. **EMS Director’s Report - Pat Frost, Contra Costa EMS Director**
    - EMS annual report 2011-2013 is available in print, and was also distributed electronically.
    - Modernization Study is completed. The draft RFP is planned to be submitted to the Board of Supervisors in November.
    - Fitch & Associates will facilitate the RFP Workshop on September 17th.
    - East Contra Costa Fire is still in the process of determining if and when more fire stations will close. They are currently undertaking a benefit assessment process.
    - Contra Costa Local Agency Formation Commission (LAFCO) has decided to postpone their municipal service area review for fire and EMS until the RFP process has been completed.
    - Congratulations were extended to Kaiser Antioch, Sutter Delta, John Muir Walnut Creek and John Muir Concord, who were recognized in the U.S. news as ranking among the best hospitals 2014.
    - Contra Costa EMS provided seven (7) ambulances as mutual aid to the Napa earthquake.
    - 2 MCIs, both level one (I): one located in Richmond, the other in Antioch, involving less than ten (10) patients.
    - EMS’ hospital preparedness grant was approved by the state for $366,000, a 13% decrease from the previous year. It will fund 100% of EMS’ hospital preparedness and disaster planning program.
    - EMS submitted a $50,000 UASI grant to expand placement of AEDs in police vehicles and the community.

11. **EMS Medical Director’s Report - Joseph Barger, MD, Contra Costa EMS Medical Director**
    - The Medical Director position will be taken over by Dr. David Goldstein, currently chief medical officer at Contra Costa Regional Medical Center.
    - EMS’ Prehospital Care Manual has been updated for 2015.
    - Sepsis: What can be maximized in EMS? Many sepsis patients are in Senior Nursing Facilities, and are using non-emergency or BLS ambulances.
    - Cardiopulmonary Resuscitation (CPR) Quality Initiative: All County EMS providers in the 9-1-1 system have been trained on high quality CPR.

12. **Suggested agenda items for the next meeting on December 10, 2014**
    **Note:** ***The meeting date for December has been changed to December 3, 2014.***
    County fire chiefs report on EMS optimization; Update on DMC; Update on AOT Workgroup; Update on RFP; Non-emergency ambulance provider training

13. **Adjournment at 5:20pm**
Contra Costa County
EMERGENCY MEDICAL CARE COMMITTEE

Annual Report for 2014

Advisory Body Name:  Emergency Medical Care Committee (EMCC)
Advisory Body Meeting Time/Location:  4:00 p.m. - 5:30 p.m. on the second Wednesday of March, June, September, and December, unless otherwise noted. Meetings are held at the Contra Costa County Schools Insurance Group in Pleasant Hill.
Chair:  Darrell Lee (11/2013–9/2014); Interim Chair John Speakman (9/2014–present)
Staff person:  Leticia Andreas (9/2013–present), Health Services, Emergency Medical Services
Reporting Period:  January 1, 2014 – December 31, 2014

I. Activities:
The EMCC, over the four (4) regular meetings in the past year, plus two (2) special meetings, was involved in or kept its membership informed about the following:

• Approval of Paramedics to use new pain medication Fentanyl as a safer and shorter acting drug.
• Major revision on spinal immobilization to improve comfort and safety.
• Notable modifications to protocols, training and quality reviews to improve effectiveness of cardiac arrest implemented countywide.
• Annual Quality Improvement (QI) Report presented by EMS staff, outlining how the system is performing and evaluated. EMS is working with all its providers in two key areas: patient events and system wide data. The focus is on three main domains: system performance, patient safety, and cost efficiencies.
• Involvement in drafting and finalizing contingency plans in case of a closure of Doctors Medical Center. Participation leader at Doctors Medical Center community public hearing in June.
• Hospital Offload Times: 9 out of 10 times patients will only wait 15 minutes at Contra Costa Regional Medical Center for offloading; in general all hospitals are at 19 minutes or less. Over 70% of California’s population is affected by ambulance delays.
• Laura’s Law Presentation by the Assisted Outpatient Treatment (AOT) Workgroup: The purpose of Laura’s Law is a permanent care program for the severe mentally ill, and with it reductions to the amounts of hospitalization and EMS involvement. Laura’s Law passed California legislature in 2002, but also needs to be passed by each county supervisor in order to be funded.
• Educational efforts are geared towards high quality Cardiopulmonary Resuscitation (CPR) on an ongoing basis, focusing on the rate and speed of compressions. EMS staff provides education to fire and ambulance providers via a developed curriculum.
• EMS provided seven (7) ambulances as mutual aid to the Napa earthquake.
• Approval of EMS’ hospital preparedness grant for $366,000 by the state.
• Submission of a grant by EMS to expand placement of AEDs in police vehicles and the community.
• Coordination of medical health operational response to Ebola with County Public Health

(Additions will follow from the December EMCC meeting)

II. Accomplishments
• Approval of EMCC 2013 Annual Report
• Active participation in finalization of Fitch EMS System Modernization Study
• Active participation in EMS Ambulance Request for Proposal (RFP)
• Cardiac Arrest Recognitions of Contra Costa Fire dispatcher and two (2) nurses from Juvenile Hall for providing CPR instructions and implementations resulting in saving two lives
• Recognition of San Ramon Valley HeartSafe Community Committee for ten (10) years of service
• Lifeline EMS Bronze Level Recognition Award presented by the American Heart and American Stroke Association to Contra Costa EMS
• Active participation and involvement in drafting a contingency plan for the closure of Doctors Medical Center
• Submittal of and acceptance of the finalized EMS Modernization Study to the Board of Supervisors
• Letter of Support from the EMCC to members to the Board of Supervisors, to endorse the work of the Assisted Outpatient Treatment (AOT) Workgroup to adopt Laura’s Law in Contra Costa County.
• Successful completion of the Request for Proposal (RFP) Workshop
- Successful statewide operational area tabletop and functional disaster exercise Successful training of all Contra Costa County EMS providers in the 9-1-1 system on high quality Cardiopulmonary Resuscitation (CPR) Quality Initiative.
- Election of a new EMCC Chair in December 2014.

(Additions will follow from the December EMCC meeting)

III. Attendance/Representation
The EMCC is a multidisciplinary committee with membership consisting of representation of specific EMS stakeholder groups and organizations plus one consumer member and one alternate nominated by each Board of Supervisor member. There are 40 filled member seats on the EMCC. 12 seats are unfilled. A quorum was achieved at each of the six EMCC meetings in the past year.

IV. Training/Certification
Each EMCC representative and alternate representative was given a copy of the Advisory Body Handbook and copies of the “The Brown Act and Better Government Ordinance - What you Need to Know as a Commission, Board or Committee Member” and “Ethics Orientation for County Officials” videotapes during their two-year term. Responsibilities of County Boards were discussed including the responsibility to view the videotapes and submit signed certifications. Certification forms have been received from 20 of 24 of the representatives and 9 of the 16 alternates. The one (1) certificate received in 2014 is attached.

V. Proposed Work Plan/Objectives for Next Year
Report to the local EMS Agency its observations and recommendations relative to its review of:
- Emergency Ambulance Request for Proposal EOA I, II, and V
- Medical Health Disaster Preparedness Coalition building
- Sustain Medical Reserve Corp capability
- Application of technology and opportunities for Health Information Exchange between EMS providers and EMS System stakeholders
- Seek recommendations and comments for the update of the county ambulance ordinance
- Update 2014 EMS System Plan, Trauma, Stroke, STEMI and EMS for Children Programs
- Monitor EMS System impacts due to changing economics and health care reform
- Monitor and report on EMS System impacts of potential closure of Doctors Medical Center
- Evaluate EMS System performance
- Support innovative models of EMS service delivery
- Enhance non-emergency ambulance disaster response
- Monitor EMS System patient safety and quality initiatives
- Improve transparency of EMS System productivity and performance
- Expand partnerships with cities, law enforcement and citizens supporting capabilities in disasters
- Monitor and report Contra Costa’s high performance STEMI, Trauma, Cardiac Arrest and Stroke Systems
- Complete the EMS System Performance Report
- Expand and sustain community education and outreach, e.g., HeartSafe, Child Injury Prevention
- Appropriate use of 9-1-1, CPR Anytime, and Automatic External Defibrillator (AED) programs through partnerships with Law Enforcement, CERT, Fire First Responders and Community Coalitions.
- Review and update of EMCC Bylaws lasted reviewed in 11/15/2006
Emergency Medical Care Committee
BY-LAWS

MISSION STATEMENT

The goal of the Emergency Medical Care Committee (EMCC) is to assure the availability of an effective and efficient emergency medical services system that provides consistent, high quality emergency medical services to all people in Contra Costa County. The EMCC advocates Emergency Medical Services (EMS) system fiscal stability, provides a means for community involvement in defining levels of EMS, and promotes a system that can withstand future challenges and thrive. The EMCC provides the Board of Supervisors, under which it serves, and the Health Services Director with advice and recommendations on EMS system planning and oversight.

I. AUTHORITY.
The Contra Costa County Board of Supervisors, established the Contra Costa County EMCC (Resolutions 68/404, 77/637, 79/460 and by Board Order on February 24, 1998), in accordance with the California Health and Safety Code Division 2.5, Chapter 4, Article 3, to act in an advisory capacity to the Board and the County Health Services Director on matters relating to emergency medical services.

II. DUTIES.
A. The duties of the EMCC as specified in the California Health and Safety Code Section 1797.274 and 1797.276 are to review the operations of each of the following at least annually:
   1. Ambulance services operating within the county.
   2. Emergency medical care offered within the county, including programs for training large numbers of people in cardiopulmonary resuscitation and lifesaving first aid techniques.
   3. First aid practices in the county.
B. The EMCC shall, at least annually, report to the Authority, and the local EMS Agency its observations and recommendations relative to its review of the ambulance services’ emergency medical care, and first aid practices, and programs for training people in cardiopulmonary resuscitation and lifesaving first aid techniques, and public participation in such programs in the county. The EMCC shall submit its observations and recommendations to the County Board of Supervisors which it serves and shall act in an advisory capacity to the County Board of Supervisors, and to the County EMS Agency, on all matters relating to emergency medical services as directed by the Board.

III. MEMBERSHIP.
A. Membership of the EMCC shall consist of the following:
   1. Consumer representatives - One representative and one alternate representative from each supervisorial district approved by the Board of Supervisors.
   2. One representative and one alternate representative from each of the following organizations or groups approved by the Board of Supervisors:
      a. Alameda-Contra Costa Medical Association
      b. American Heart Association
      c. American Red Cross
      d. California Highway Patrol
      e. Communications Center Managers’ Association
      f. Contra Costa Fire Chiefs’ Association
      g. Contra Costa Police Chiefs’ Association
      h. Emergency Nurses Association
      i. Hospital Council, Bay Area Division
j. Public Managers' Association
k. Trauma Center (Contra Costa Contract)
l. Contra Costa Sheriff-Coroner
m. Contra Costa Health Services
n. Community Awareness and Emergency Response - CAER

3. One representative and one alternate representative of each of the following groups nominated by the Health Services Director and approved by the Board of Supervisors:
   a. Ambulance Providers (Contra Costa Contract)
   b. Air Medical Transportation Provider (Contra Costa Authorized)
   c. Base Hospital
   d. Emergency Department Physicians
   e. EMS Training Institution
   f. Private Provider Field Paramedic
   g. Public Provider Field Paramedic

4. Existing membership-elected EMCC Officers for the remainder of their terms.

B. The EMS Director shall serve as an ex officio member.

IV. APPOINTMENT PROCESS

A. The EMS Agency will contact each of the agencies, organizations and groups listed in Section A, above, to solicit nominations for one representative and one alternate representative prior to the expiration of its representative's and its alternate representative's term.

B. The nominations received from Sections 3.A.1-2 will be submitted to the Clerk of the Board for the Board of Supervisors' consideration and approval.

C. The Health Services Director will consider suggested names received from Section 3.A.3. and will provide nominations for these groups for the Board of Supervisors' consideration and approval.

V. TERMS.

A. EMCC members shall serve for terms not to exceed two years, and elected officers shall remain members of the EMCC for the balance of their terms in office. All terms will expire on September 30th on even-numbered years. There shall be no limit on the number of consecutive terms that an EMCC member may serve.

B. Any Board-appointed member or alternate member choosing to resign from the EMCC must submit a written letter of resignation to the Clerk of the Board of Supervisors with copy to the EMCC Chair.

C. The EMS Agency will follow the initial appointment procedure to fill a position for the remainder of a term when there is a resignation or lack of participation.

VI. OFFICERS.

A. The officers of the EMCC shall be a Chair, First Vice-Chair, and Second Vice-Chair.

B. Officers shall be elected by the EMCC membership to serve for two years or until their successors are elected. The term will begin on December 1st and terminate on November 30th of odd-numbered years.

C. Officers may not be elected for more than two consecutive terms in the same office.

D. In the event of an officer vacancy, the next Vice Chair moves up to the vacant position. In the event of a vacancy of the Second Vice Chair position, the Chair may appoint a member of the EMCC to serve as Second Vice Chair for the remainder of the officer term, subject to an affirmative vote of the EMCC.
VII. DUTIES OF OFFICERS.
A. The Chair shall preside over all meetings of the EMCC in addition to serving as the Chair of the Executive Committee. The Chair will be a spokesperson for the EMCC and assure that the EMCC is informed about County emergency medical services issues and needs.
B. The First Vice-Chair shall assume the duties of Chair in the absence of the Chair and shall render assistance as requested by the Chair. The First Vice-Chair shall also serve as a member of the Executive Committee.
C. The Second Vice-Chair shall assume the duties of Chair in the absence of the First Vice-Chair and shall render assistance as requested by the Chair or First Vice-Chair. The Second Vice-Chair shall serve as a member of the Executive Committee.
D. In the absence of the Chair and Vice-Chairs, one of the two non-officer Executive Committee Members shall preside.

VIII. EXECUTIVE COMMITTEE
A. The Executive Committee is established to conduct the business of the EMCC between regular meetings and shall be composed of the:
   1. EMCC Chair
   2. EMCC First Vice-Chair
   3. EMCC Second Vice-Chair
   4. Two non-officer EMCC members
B. EMCC members elected to the Executive Committee will serve for two years or until their successors are elected. The term will begin December 1st, and terminate on November 30th of odd-numbered years. Executive Committee members may be elected to consecutive terms.
C. At least one member of the Executive Committee shall be a Citizen/Consumer.
D. The Executive Committee shall be subject to the orders of the EMCC and none of its acts shall conflict with action or directions of the EMCC.
E. The Executive Committee shall meet at the call of the Chair, or at the request of a majority of the members of the Executive Committee.
F. Whenever issues arise requiring the attention of the EMCC before its next regularly scheduled meeting, the Executive Committee shall be empowered to meet and take whatever action is considered appropriate. It will be the responsibility of the Chair to assure that all Executive Board members are notified of such meetings.
G. Whenever issues must be voted on at Executive Committee meetings in which other EMCC members are in attendance, the voting shall be limited to Executive Committee members.

IX. OFFICER AND EXECUTIVE COMMITTEE SELECTION
A. The EMCC Chair shall appoint a three-member nominating committee from the membership prior to the June EMCC meeting of odd-numbered years. This committee shall solicit one or more names for each office. The ballot shall be presented at the June meeting, at which time nominations from the floor may be added to the slate. If there are no additions to the slate from the floor and there is a single nomination for each of the Officers, the Chair may call for a vote at the June meeting.
B. The election of Officers and the two non-officer members of the Executive Committee will be carried out by mail ballot of members if there is more than one nomination for any of the positions. Results of any mail ballot elections will be announced at the September EMCC meeting.
C. Nominations and election of the two non-officer Executive Committee members will be handled in the same manner as the nomination of EMCC officers.
D. Whenever a vacancy occurs on the Executive Committee, the Chair shall appoint an EMCC member to fill the vacant position to complete the remainder of the existing term subject to an affirmative vote of the EMCC.

X. MEETINGS.
A. Regular meetings of the EMCC shall be held at least four times per year or more often as deemed necessary. Meetings will convene at 4:00 pm on the second Wednesday of March, June, September, and December unless otherwise directed by the EMCC or its Executive Committee.
B. The EMCC Chair may call special meetings as deemed necessary upon ten days prior written notification.
C. A quorum for the EMCC shall consist of all members (or their alternates) who are present.
D. Staff support for the EMCC will be provided by the County Emergency Medical Services Agency.

XI. ATTENDANCE.
A. EMCC members or their alternate members shall attend EMCC meetings.
B. Whenever a member, or his or her alternate, does not attend three consecutive, regularly scheduled meetings, the Chair of the EMCC may notify the appointing agency/organization of the absences.

XII. VOTING.
A. All motions placed before the EMCC shall be approved or disproved by the majority of members present and voting.
B. An alternate for a member shall have full voting rights in the absence of the appointed member.
C. The EMCC member, or in his or her absence, the alternate member, for each of the groups and agencies identified in Section III, above shall have the right to vote on any motion.

XIII. AD HOC COMMITTEES.
A. The EMCC membership may appoint ad hoc committees to address EMS related matters.
B. The EMCC Chair shall appoint chairs and members of any ad hoc committees.
C. Ad hoc committee members must be members or alternate members of the EMCC.
D. The EMCC Chair shall be ex officio, a member of all ad hoc committees.
E. Ad hoc committees shall meet at the call of the ad hoc committee Chair.
F. Members present shall constitute a quorum.
G. EMS Agency shall provide a staff member to attend each ad hoc committee meeting.

IVX. BROWN ACT AND BETTER GOVERNMENT ORDINANCE.
County advisory bodies are subject to both the Ralph M. Brown Act (Government Code, sections 54950 et seq.) and the County’s expanded open meeting law, the Better Government Ordinance (Contra Costa County Code, Chapter 25-2.)

VX. PARLIAMENTARY AUTHORITY.
All proceedings of the EMCC and its ad hoc committees shall be conducted in a free and open manner. Upon the request of any three members of the EMCC or at the discretion of the Chair, parliamentary procedure as specified in Robert’s Rules of Order will be followed provided they do not otherwise conflict with these by-laws.
VXI. AMENDMENT.
These by-laws may be amended by a two-thirds vote at any regularly scheduled meeting of the EMCC provided that the amendment has been submitted in writing to all members ten (10) working days prior to the meeting.
“Tracking Falls in Contra Costa County”

American Medical Response
Health Improvement Project

By:

Alicia Moore, Community Outreach Coordinator
&
Dino Curzi, Data Analyst
Synopsis

American Medical Response (AMR) gathered pre-hospital data from its Electronic Patient Care Reports (ePCRs) from October 2013 to September 2014 for all of Contra Costa County’s cities with the exception of Danville (including Blackhawk), Moraga, Orinda and San Ramon for patients who were aged 65 and over and called 9-1-1 due to a fall.

Of the 5,105 falls recorded over the past year (October 2013 to September 2014) the data indicated adults between the ages of 80 and 89 years of age to be the most likely to experience a fall. Of the falls reported, 65% were women. The cities of Walnut Creek, Concord, Brentwood and Antioch recorded the highest number of falls. There is a surge of falls between 7am and 7pm. Of patients who fell, 81% were for Caucasian followed by 6% African American¹.

Research and Findings

As requested in VIII.E.2 of the Contra Costa County EMS contract, the impact of AMR’s Health status improvement program is statistically demonstrable. Contra Costa County has seen a steady number of falls by month over the last year (Figure 1). The numbers also trend higher around the fall and winter months of October through December possibly due to weather conditions increasing likelihood of falling. This demonstrates the urgency of this issue, and the importance of community education on risks and preventions.

Figure 1 – Falls by Month (October 2013 – September 2014)

¹ Demographics of Walnut Creek, Concord, and Contra Costa County Overall (According to 2010 United States Census Bureau):
Walnut Creek: Population of 64,173; 78.7% Caucasian, 8.6% Hispanic, 12.7% Asian/Pacific Islander, 1.6% African American
Concord: Population of 122,067; 64.5% Caucasian, 30.6% Hispanic, 11% Asian/Pacific Islander, 3.6% African American
Contra Costa: Population of 1,049,025; 58.6% Caucasian, 24.4% Hispanic, 14.4% Asian/Pacific Islander, 9.3% African American
*Percentages can total more than 100% as people can be of multiple ethnicities.
Contra Costa County AMR ePCR data shows that out of the sample size of the past year (October 2013 to September 2014) the age at which a person is most likely to fall is 80 to 89 (*Figure 2*), and those 80 and older face an increased risk. Identifying an “at risk” population of people who suffer from falls in Contra Costa County also satisfies section VIII.E.1 of the Contra Costa County EMS contract, which states that AMR’s Health status improvement programs target an “*at risk population*.”

From October 2013 to September 2014, AMR responded to significantly more calls where women had fallen (Figure 2). However, this data does not take into account length of lifespan differences between men and women.

*Figure 2 – Falls by Gender and Age (October 2013 – September 2014)*
According to the data obtained, the cities of Walnut Creek, Concord, Brentwood and Antioch recorded the highest number of falls (Figure 3). The city of Walnut Creek suffered the most falls at 1,137, followed by Concord at 735, Brentwood at 588 and Antioch at 469. This could be attributed to the high senior population in these areas especially Rossmoor in Walnut Creek.

Figure 3 – Falls by Cities (October 2013 – September 2014)
The county also sees a spike in the number of fall related calls at 10:00am (Figure 4).

Figure 4 – Falls by Hour of Day

The majority of fall related calls in Contra Costa County occur on Monday with 761 falls, and the other six days of the week following closely behind (Figure 5). Saturday has the least with 693 occurrences.

Figure 5 – Falls by Day of Week (October 2013 – September 2014)
With 81% of the fall calls, Caucasians make up the vast majority of fall related calls in Contra Costa County (Figure 6). The next highest concentration is African-American with 6% and Hispanic with 5%. This could be contributed to the ethnic makeup of the four most common, fall occurring, cities of Walnut Creek, Concord, Brentwood and Antioch which have accounted for about 57% of all 9-1-1 falls during this timeframe. (Figure 3 on Page 4).

Figure 6 – Falls by Ethnicity (October 2013 – September 2014)
AMR is an active member in the Fall Prevention Coalition of Walnut Creek (FPC). The Fall Prevention program provides free preventative services to the senior community. For this year’s Health Improvement Project, we partnered with the FPC to bring a collection of programs to Contra Costa County. Together, we have raised awareness and shared preventative information on falls. Our goal for this project is to decrease the amount of fall calls that come through the 9-1-1 system by providing community engagement and educational activities.

**In-Home Modification Program/ $1,000 Donation:**
The In-Home Modification program is designed for seniors ages 60 and up. This program decreases the opportunity for a fall by providing significant adjustments to senior homes. Modifications range from grab bars to ramp installments. First, a licensed Occupational Therapist visits the senior home to determine the necessary changes. Next, the coalition works with a local contractor to generate the revisions. AMR has assisted with this program by donating $1,000 dollars. These services are offered to Contra Costa citizens at no-cost and AMR’s donation has played a huge role in funding for the program. AMR Paramedics & EMT’s also help with the program by providing recommendations. They are familiar with this service and advise seniors to participate in the program when out on a fall related call.

**Press Release:**
AMR offers free data to the coalition. Our thorough data helps track the progress of the In-home Modification program. Based on our database, we can determine if program participants have reduced their 9-1-1 calls after receiving modifications. This year, an article was release to the press describing our partnership and results from the In-Home modification program. 9-1-1 fall calls were reduced by 50% after going through the modification program. This was an awesome success story and a great way to raise awareness about falls within the community.

**Tai –Chi Classes:**
Research has shown that Ta-Chi increases balance and can prevent falls over time. This year, we started a free Tai-Chi class in San Pablo for seniors. AMR helps with venue research and also helps publicize and promote Ta-Chi to the community. In the future, AMR and the Fall Prevention Coalition want to expand the classes to multiple locations throughout the county including Walnut Creek, Concord, Brentwood and Antioch based on this report’s findings.

**Vial of Life:**
AMR has partnered with the Walnut Creek Fall Prevention Coalition to develop and distribute the Vial of Life packet found below. The Vial of Life is a tool used by First Responders to rapidly gain important information about their patient. During Fall Prevention Awareness week, AMR made a visit to Senior Citizen communities to talk about the Vial of Life program and ways to prevent falls.
**Emergency Medical Information**

<table>
<thead>
<tr>
<th>Data Completed (Fecha Realizada):</th>
<th>/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name (Nombre):</td>
<td>/</td>
</tr>
<tr>
<td>Date of Birth (Fecha de Nacimiento):</td>
<td>/</td>
</tr>
<tr>
<td>Current Address (Dirección actual):</td>
<td>/</td>
</tr>
<tr>
<td>Phone Number (Número telefónico):</td>
<td>( )</td>
</tr>
<tr>
<td>Social Security Number (Número de Seguridad Social):</td>
<td>/</td>
</tr>
<tr>
<td>Languages Spoken (Idiomas hablados):</td>
<td>/</td>
</tr>
<tr>
<td>Primary Insurance Company (Compañía de seguros principales):</td>
<td>/</td>
</tr>
<tr>
<td>Policy Number (Número de póliza):</td>
<td>/</td>
</tr>
<tr>
<td>Medicare/Medicaid #: (Número de Medicare/Medicaid):</td>
<td>/</td>
</tr>
</tbody>
</table>

**Current Medications & Herbal Supplements (Medicamentos y suplementos herbales):**

<table>
<thead>
<tr>
<th>Dosage (Dosis):</th>
</tr>
</thead>
<tbody>
<tr>
<td>/</td>
</tr>
</tbody>
</table>

**Emergency Contact (Contacto de emergencia):**

<table>
<thead>
<tr>
<th>Relationship (Relación):</th>
</tr>
</thead>
<tbody>
<tr>
<td>/</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phone Number (Número telefónico):</th>
</tr>
</thead>
<tbody>
<tr>
<td>( )</td>
</tr>
</tbody>
</table>

**Allergies to Medications (Alergias a Medicamentos):**

<table>
<thead>
<tr>
<th>/</th>
</tr>
</thead>
</table>

**Do Not Resuscitate or POLST? (¿No Resucitar?):**

- [ ] Yes
- [ ] No

**Power of attorney for health care? (¿Poder para el cuidado de la salud?):**

- [ ] Yes
- [ ] No

**Advanced Health Care Directive? (¿Directivo de voluntad anticipada?):**

- [ ] Yes
- [ ] No

Please include a copy of all paperwork (favor de incluir una copia de toda la documentación).
Recent Trends in Survival from Out-of-Hospital Cardiac Arrest in the United States
Paul S. Chan, Bryan McNally, Fengming Tang and Arthur Kellermann

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Recent Trends in Survival From Out-of-Hospital Cardiac Arrest in the United States

Paul S. Chan, MD, MSc; Bryan McNally, MD, MPH; Fengming Tang, BS; Arthur Kellermann, MD, MPH; for the CARES Surveillance Group

Background—Despite intensive efforts over many years, the United States has made limited progress in improving rates of survival from out-of-hospital cardiac arrest. Recently, national organizations, such as the American Heart Association, have focused on promoting bystander cardiopulmonary resuscitation, use of automated external defibrillators, and other performance improvement efforts.

Methods and Results—Using the Cardiac Arrest Registry to Enhance Survival (CARES), a prospective clinical registry, we identified 70,027 U.S. patients who experienced an out-of-hospital cardiac arrest between October 2005 and December 2012. Using multilevel Poisson regression, we examined temporal trends in risk-adjusted survival. After adjusting for patient and cardiac arrest characteristics, risk-adjusted rates of out-of-hospital cardiac arrest survival increased from 5.7% in the reference period of 2005 to 2006 to 7.2% in 2008 (adjusted risk ratio, 1.27; 95% confidence interval, 1.12–1.43; P<0.001). Survival improved more modestly to 8.3% in 2012 (adjusted risk ratio, 1.47; 95% confidence interval, 1.26–1.70; P<0.001). This improvement in survival occurred in both shockable and nonshockable arrest rhythms (P for interaction=0.22) and was also accompanied by better neurological outcomes among survivors (P for trend=0.01). Improved survival was attributable to both higher rates of prehospital survival, where risk-adjusted rates increased from 14.3% in 2005 to 2006 to 20.8% in 2012 (P for trend<0.001), and in-hospital survival (P for trend=0.015). Rates of bystander cardiopulmonary resuscitation and automated external defibrillator use modestly increased during the study period and partly accounted for prehospital survival trends.

Conclusions—Data drawn from a large subset of U.S communities suggest that rates of survival from out-of-hospital cardiac arrest have improved among sites participating in a performance improvement registry. *(Circulation. 2014;130:00-00.)*

Key Words: cardiac arrest ■ survival ■ trends

Despite intensive efforts over 3 decades, the United States has made little progress in improving the overall rate of survival from out-of-hospital cardiac arrest, with survival rates remaining relatively unchanged at 7.6%. However, in recent years, advances in resuscitation science have generated promising findings. In randomized, clinical trials, early use of therapeutic hypothermia and automated external defibrillators (AEDs) were found to improve survival and neurological outcomes in selected populations. National efforts have focused on delivery of higher-quality cardiopulmonary resuscitation.

Editorial see p 1844

Clinical Perspective on p 7

Although there is ample reason to believe that adoption of these practices and other performance improvement activities should lead to higher rates of out-of-hospital cardiac arrest survival in the United States, this has not been consistently demonstrated. If quality improvement efforts are making a difference, it should be possible to document improved survival at the community level. Isolated studies in the United States have generated encouraging findings, but these may not be generalizable to the nation at large.

Accordingly, we analyzed contemporary trends in rates of survival to hospital discharge for out-of-hospital cardiac arrest from 2005 to 2012 in a large and geographically diverse set of U.S. communities—those that participate in the Cardiac Arrest Registry to Enhance Survival (CARES), which was established to improve prehospital care at the local level. To determine which phase of resuscitation care may be influencing outcomes, we examined temporal trends in survival to hospital admission and, among those who survived to hospital admission, their likelihood of surviving to hospital discharge. Finally, to determine whether any survival trends are attributable to improving rates of bystander cardiopulmonary resuscitation (CPR) or AED use, we evaluated trends in both and their aggregate effect on out-of-hospital cardiac arrest survival.
Methods

Data Source and Study Population

CARES is a large, prospective clinical registry of patients with out-of-hospital cardiac arrest in the United States. Since the system was established in 2005, it has grown, by 2012, to collect data from 248 emergency medical services (EMS) systems across 23 states, representing a catchment area of >64 million people. Established by the Centers for Disease Control and Emory University for public health surveillance and continuous quality improvement, the design of the registry has been previously described in detail.6,8 Briefly, all patients with a confirmed out-of-hospital cardiac arrest (defined as apneic and unresponsive) of presumed cardiac cause and for whom resuscitation is attempted are identified and followed, including those with termination of resuscitation before hospital arrival. Data are collected from three sources that together define the continuum of emergency cardiac care: 911 dispatch centers, EMS agencies, and receiving hospitals. Standardized international Utstein definitions for defining CPR and outcomes are used to ensure uniformity.10 A CARES analyst reviews every record for completeness and accuracy.9

Our analysis is based on 73,390 cases submitted to the CARES registry between October 1, 2005 and December 31, 2012 (Figure 1). We excluded 8 patients with obvious signs of death and 315 patients with a valid do-not-attempt resuscitation order, as well as 2544 events occurring in a facility with an on-site healthcare professional (eg, hospital, medical clinic), because these cases have response and treatment times that are different from other out-of-hospital cardiac arrests. We also excluded 496 events (0.7%) in which information on patient survival to hospital admission (n=409 [0.6%]) or discharge (n=87 [0.1%]) was missing. The final sample comprised 70,027 patients treated by 248 EMS agencies.

Independent Variable and Study Outcome

The independent variable was calendar year, which was evaluated as a continuous variable. The primary outcome of interest was survival to hospital discharge. Because the probability of survival from ventricular fibrillation or pulseless ventricular tachycardia is generally better than from asystole or pulseless electric activity, we analyzed temporal survival trends in the overall cohort and separately by these 2 rhythm groups. As secondary outcomes, we analyzed temporal trends in the rate of survival to hospital admission to an inpatient unit (prehospital survival) and, among those who survived to be admitted, the likelihood of survival to hospital discharge (in-hospital survival). To determine whether any recent changes in out-of-hospital cardiac arrest survival could be attributed to rising rates of bystander CPR or AED use, we examined the effect of both interventions on overall survival trends and for prehospital and in-hospital survival.

In addition to documenting survival to hospital discharge, CARES documents the degree of neurological disability from the inpatient record among survivors at discharge, measured by the cerebral performance category (CPC) score.11 A CPC score of 1 denotes a patient with mild or no neurological disability, 2 reflects moderate neurological disability, 3 indicates severe neurological disability, and 4 is assigned to patients in a persistent coma or vegetative state. For this study, we evaluated temporal trends in discharge neurological status as an ordinal variable.

Statistical Analyses

To evaluate changes in baseline characteristics by calendar year, we used the Mantel-Haenszel test of trend for categorical variables and linear regression for continuous variables. To assess whether survival to hospital discharge has improved over time, 3-level multilevel Poisson regression models were constructed for the overall cohort and by rhythm type, in which patients were nested within EMS agencies and EMS agencies were nested within U.S. states. In these models, random intercepts were estimated for each EMS agency and U.S. state.12 Because survival rates for out-of-hospital cardiac arrest have been noted to differ markedly among EMS agencies,13 the use of multilevel models ensures that our analyses reflect survival trends within EMS agency sites. Moreover, multilevel models account for the fact that different EMS agencies joined CARES at different time points. In these models, to obtain more interpretable estimates of effect, we directly estimated rate-ratios instead of odds ratios by specifying a Poisson distribution and including a robust variance estimate in our models.14,15

Our independent variable, calendar year, was included in the model as a continuous variable with polynomial (quadratic and cubic) terms for year, as appropriate. We defined years 2005 to 2006 as the reference period, because CARES did not begin enrollment until October 1, 2005. We multiplied the adjusted rate-ratios for each subsequent year (2007–2012) with the observed survival rate for the reference period (2005–2006) to obtain yearly risk-adjusted survival rates for the study period. These rates represent what the survival would be for each year if the patient case-mix was identical to the reference period within each EMS agency. Our models adjusted for age, sex, race/ethnicity (coded by the EMS provider as white, black, Latino, other, or unknown), initial cardiac arrest rhythm (ventricular fibrillation, pulseless ventricular tachycardia, asystole, pulseless electric activity), location of arrest (private residence, public area with likely AED availability [eg, sporting facility, airport], other public areas, and other), and whether the arrest was witnessed. To examine the robustness of our survival trend findings (because any improvement in survival trends may have been attributable to later enrolling sites with higher survival rates), we repeated the models and included only those patients with a confirmed out-of-hospital cardiac arrest in 2005 through 2006 with an average annual case volume of ≥20 out-of-hospital cardiac arrests.

We conducted several additional analyses. To evaluate whether there were geographical variations in any temporal survival trends, we constructed 2-level models (patients nested within EMS agencies) and evaluated for an interaction between U.S. census region (Northeast, Midwest, South, and West) and time. We also assessed temporal trends in neurological disability among those surviving to hospital discharge. In these analyses, we constructed multinomial 3-level models to evaluate discharge CPC score as an ordinal variable, with time assessed as a continuous variable with polynomial terms (as described for the primary analysis).

Finally, to discern potential reasons for any improvement over time, we constructed similar 3-level logistic regression models to examine whether survival trends were attributable to increased rates of survival to hospital admission, in-hospital survival, or both. Because bystander CPR or AED use are potential mediators of any observed survival trends, we further examined whether increasing rates of bystander CPR or AED use were associated with survival trends by adding these 2 variables to the multilevel models described above and evaluated whether their inclusion attenuated year-over-year risk ratio estimates.

Besides race, data were missing in only 0.3% of cases, and the average number of missing data fields per patient was 0.003. There were no differences in baseline characteristics between those with missing data and those with complete data (results not shown). We used multiple imputation methods to impute missing values on the basis of

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Figure 1. Definition of study cohort. CPR indicates cardiopulmonary resuscitation; DNR, do not resuscitate; and EMS, emergency medical services.
of all other observed data. Imputations were performed with Markov Chain Monte Carlo methods as implemented in SAS PROC MI. Five imputed data sets were generated; analyses were replicated across data sets and pooled to obtain final estimates. Patients with missing information on race were categorized as unknown as a separate dummy variable in our models. Results with and without imputation were very similar; only the former are presented. All statistical analyses were conducted using SAS Version 9.1.3 (SAS Institute, Cary, NC) and R Version 2.6.0 (Free Software Foundation, Boston, MA). All hypothesis tests were 2-sided with a significance level of 0.05. Because this study used only deidentified data, it was considered exempt research by the Mid America Heart Institute’s Institutional Review Board.

Results
Patient and cardiac arrest characteristics of the study cohort are summarized in Table 1. The mean age of the study population was 64.1 years (standard deviation of 18.2 years), and 61% were men. Approximately 5 of 6 cardiac arrests occurred in a private residence, and <2% of all cardiac arrests occurred in a public area with likely access to an AED. Fewer than half of events were witnessed. More than three-quarters of patients were found in asystole or pulseless electric activity, whereas 23.6% had cardiac arrest rhythms amenable to defibrillation treatment. During the study period, there were no temporal differences in patients’ sex or presenting rhythm. There were, however, modest changes in the age and racial composition of the study cohort, with an increasingly older and white population in the later years. There were also small changes in the proportion of patients whose cardiac arrest occurred at home or were witnessed.

Survival to Discharge
During the study interval, unadjusted rates of survival to hospital discharge increased from 5.7% in 2005 to 2006 to 9.8% in 2012 (Figure 2). For cardiac arrests attributable to ventricular fibrillation or pulseless ventricular tachycardia, the unadjusted rate of survival increased from 16.1% to 27.9%, whereas for cardiac arrests attributable to asystole or pulseless

Table 1. Trends in Baseline Characteristics

<table>
<thead>
<tr>
<th>Year Group</th>
<th>2005 to 2007 n = 4630</th>
<th>2008 to 2010 n = 26058</th>
<th>2011 to 2012 n = 39339</th>
<th>P for Trend*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;50</td>
<td>923 (20.1%)</td>
<td>4810 (18.5%)</td>
<td>7148 (18.2%)</td>
<td>0.02</td>
</tr>
<tr>
<td>50–59</td>
<td>901 (19.6%)</td>
<td>4964 (19.1%)</td>
<td>7434 (18.9%)</td>
<td></td>
</tr>
<tr>
<td>60–69</td>
<td>910 (19.8%)</td>
<td>5433 (20.9%)</td>
<td>8509 (21.7%)</td>
<td></td>
</tr>
<tr>
<td>70–79</td>
<td>854 (18.6%)</td>
<td>4944 (19.0%)</td>
<td>7385 (18.8%)</td>
<td></td>
</tr>
<tr>
<td>≥80</td>
<td>1010 (22.0%)</td>
<td>5872 (22.6%)</td>
<td>8786 (22.4%)</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>32</td>
<td>35</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td>0.22</td>
</tr>
<tr>
<td>Female</td>
<td>1846 (39.9%)</td>
<td>10066 (38.6%)</td>
<td>15176 (38.6%)</td>
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</tr>
<tr>
<td>Male</td>
<td>2783 (60.1%)</td>
<td>15980 (61.4%)</td>
<td>24155 (61.4%)</td>
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</tr>
<tr>
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<td>1</td>
<td>12</td>
<td>8</td>
<td></td>
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<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td>0.005</td>
</tr>
<tr>
<td>White</td>
<td>1794 (38.7%)</td>
<td>10037 (38.5%)</td>
<td>16513 (42.0%)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>1236 (26.7%)</td>
<td>6986 (26.8%)</td>
<td>8433 (21.4%)</td>
<td></td>
</tr>
<tr>
<td>Latino</td>
<td>238 (5.1%)</td>
<td>1400 (5.4%)</td>
<td>2314 (5.9%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>88 (1.9%)</td>
<td>697 (2.7%)</td>
<td>1036 (2.6%)</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>1274 (27.5%)</td>
<td>6938 (26.6%)</td>
<td>11043 (28.1%)</td>
<td></td>
</tr>
<tr>
<td>Location of Arrest</td>
<td></td>
<td></td>
<td></td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Private residence</td>
<td>3859 (83.3%)</td>
<td>21809 (83.7%)</td>
<td>33232 (84.5%)</td>
<td></td>
</tr>
<tr>
<td>Public area with likely AED</td>
<td>80 (1.7%)</td>
<td>459 (1.8%)</td>
<td>684 (1.7%)</td>
<td></td>
</tr>
<tr>
<td>Other public areas</td>
<td>575 (12.4%)</td>
<td>3064 (11.8%)</td>
<td>4916 (12.5%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>116 (2.5%)</td>
<td>726 (2.8%)</td>
<td>507 (1.3%)</td>
<td></td>
</tr>
<tr>
<td>First documented rhythm</td>
<td></td>
<td></td>
<td></td>
<td>0.24</td>
</tr>
<tr>
<td>Asystole and PEA</td>
<td>3536 (76.4%)</td>
<td>19965 (76.7)</td>
<td>30283 (77.0)</td>
<td></td>
</tr>
<tr>
<td>VF and pulseless VT</td>
<td>1092 (23.6%)</td>
<td>6081 (23.3%)</td>
<td>9056 (23.0%)</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Witnessed arrest</td>
<td>2208 (47.7%)</td>
<td>12052 (46.3%)</td>
<td>18815 (47.8%)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

*Temporal changes in patient characteristics were assessed, with calendar year evaluated as a continuous variable, and expressed as a P for trend.
electric activity, the unadjusted rate of survival increased from 2.1% to 4.4%.

After adjusting for temporal trends in patient and cardiac arrest characteristics, risk-adjusted rates of survival improved markedly over the study period (P for trend <0.001). For instance, compared with the 5.7% survival rate in 2005 to 2006, the risk-adjusted survival rate in 2008 increased to 7.2% (adjusted risk ratio, 1.27; 95% confidence interval [CI], 1.12–1.43) and continued to increase more modestly thereafter (eg, 8.3% in 2012; adjusted risk ratio, 1.47; 95% CI, 1.26–1.70; Table 2; full model in Table I in the online-only Data Supplement). These gains were observed for both types of arrest rhythms (P for interaction between calendar year and rhythm type = 0.22), and yearly risk-adjusted survival rates by rhythm type are summarized in Table II in the online-only Data Supplement. The improved survival trends persisted (P for trend <0.001) when our analyses were restricted to only those EMS agencies which participated in CARES throughout the entire study period (Table III and Figure I in the online-only Data Supplement). Importantly, this improvement in overall rates of survival to hospital discharge was also accompanied by lower rates of neurological disability in survivors over time (P value of 0.01 for yearly trend, compared with discharge CPC of 1; Figure 3). Finally, there were geographical differences in overall survival trends (P for interaction of 0.04), with the greatest improvement in out-of-hospital cardiac arrest survival in the Northeast and little to no improvement in the Midwest (Table IV in the online-only Data Supplement).

Secondary Outcomes

Because gains in survival to hospital discharge might be attributable to better prehospital or in-hospital care, we examined temporal trends in these 2 phases of resuscitation care. Unadjusted rates of prehospital survival improved from 14.3% in 2005 to 2006 to 26.4% in 2012 (Table 3). After multivariable adjustment, prehospital survival improved by 45% from 2005 to 2012 (P for trend <0.001). There was also a significant, though less substantial, temporal trend for improved in-hospital survival for patients who survived to hospital admission (P for trend of 0.015).

To discern potential reasons for the improvement in prehospital survival, we considered several potential explanations (Table 4). Bystander CPR increased from 28.2% of cases in 2005 to 2006 to 36.3% of cases in 2012 (P for trend <0.001). In addition, there was a modest increase in rates of bystander AED use over the study period (P for trend <0.001 for all arrests and 0.048 for witnessed arrests). Further adjustment for these 2 factors in our models showed modest attenuation of the adjusted rate ratios for prehospital survival, whereas estimates for overall and in-hospital survival were not affected (Table V in the online-only Data Supplement).

Discussion

Based on data collected from a large, prospectively collected registry of cardiac arrest cases in communities across the United States, we found that overall rates of survival from out-of-hospital cardiac arrest improved dramatically between 2005 and 2012, with accompanying improved trends in both prehospital and in-hospital survival. This finding stands in stark contrast to the lack of progress in out-of-hospital cardiac arrest
Table 3. Prehospital and In-Hospital Survival*

<table>
<thead>
<tr>
<th>Year</th>
<th>Unadjusted Rate</th>
<th>Adjusted Rate</th>
<th>Adjusted Rate Ratio (95% CI)</th>
<th>P Value for Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prehospital survival</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005–2006</td>
<td>14.3%</td>
<td>Reference</td>
<td>Reference</td>
<td>0.001</td>
</tr>
<tr>
<td>2007</td>
<td>22.2%</td>
<td>17.9%</td>
<td>1.25 (1.14–1.37)</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>26.1%</td>
<td>20.0%</td>
<td>1.40 (1.23–1.59)</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>27.0%</td>
<td>20.8%</td>
<td>1.45 (1.27–1.65)</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>27.1%</td>
<td>20.7%</td>
<td>1.45 (1.28–1.64)</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>26.2%</td>
<td>20.5%</td>
<td>1.43 (1.27–1.61)</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>26.4%</td>
<td>20.8%</td>
<td>1.45 (1.28–1.65)</td>
<td></td>
</tr>
<tr>
<td>In-hospital survival</td>
<td></td>
<td></td>
<td></td>
<td>0.015</td>
</tr>
<tr>
<td>2005–2006</td>
<td>34.6%</td>
<td>Reference</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>35.6%</td>
<td>35.9%</td>
<td>1.02 (1.00–1.04)</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>32.1%</td>
<td>35.6%</td>
<td>1.04 (1.01–1.07)</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>35.5%</td>
<td>37.2%</td>
<td>1.06 (1.02–1.11)</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>36.9%</td>
<td>39.3%</td>
<td>1.08 (1.01–1.15)</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>39.4%</td>
<td>40.7%</td>
<td>1.10 (1.02–1.19)</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>37.2%</td>
<td>39.5%</td>
<td>1.12 (1.02–1.24)</td>
<td></td>
</tr>
</tbody>
</table>

Model-adjusted rates of survival to hospital admission and in-hospital survival (among those surviving to hospital admission) are compared against the reference period, 2005 to 2006.

*Rates are adjusted for emergency medical services agency and temporal changes in age, sex, race/ethnicity, initial cardiac arrest rhythm, location of arrest, and whether the arrest was witnessed.

The improvement in survival over the preceding 30 years in the United States.1 Improved rates of survival were noted in both shockable and nonshockable cardiac arrest rhythms and were also accompanied by lower rates of neurological disability over time. Finally, bystander CPR and use of AEDs modestly increased during the study period and appeared to, in part, account for some of the observed improved trends in prehospital survival.

We are not the first to report encouraging survival trends for out-of-hospital cardiac arrest. Recent studies involving single communities or much smaller populations have also reported improved rates of survival,” but the generalizability of these findings was unknown. Non-U.S. groups have also documented favorable survival trends.16–18 However, these studies did not account for the potentially confounding role of EMS agency, and findings in other countries may not pertain to the United States, given differences in the organization and delivery of emergency care. Our study—by far the largest conducted to date in the United States—includes data from a much larger and more diverse set of U.S. communities than previous studies and takes local characteristics into account.

Several aspects of our study warrant comment. Our use of multilevel models allowed us to control for clustering of patients within sites to estimate overall survival trends across EMS agencies. In addition, we confirmed a similar survival trend when we restricted our analyses to only those sites that began participation in CARES from its inception. These analyses ensured that our findings were not simply attributable to recruitment of higher-performing EMS systems during the later years. Moreover, we found that the improvement in survival was not at the expense of higher rates of neurological disability among survivors; in fact, we found that rates of neurological disability actually decreased over time. We also examined temporal trends in survival from out-of-hospital cardiac arrests caused by ventricular fibrillation or pulseless ventricular tachycardia—cardiac arrest rhythms less likely to be confounded by differences in patient characteristics over time—and found the same pattern of improved survival. Lastly, we observed that the improvement in out-of-hospital cardiac arrest survival was attributable to both gains in prehospital resuscitation and in-hospital survival, although the improvement in prehospital survival appeared larger.

What might explain the recent improvements in rates of out-of-hospital cardiac arrest survival? In contrast to a recent study from Denmark,18 we found that the higher rates of bystander CPR and AED use did not appear to be the principal contributors to overall improvements in survival, perhaps owing to the fact that overall rates of bystander CPR and AED use in the United States increased only modestly during the study interval and remained relatively low. However, higher rates of bystander CPR and AED use did attenuate the adjusted rate ratios for prehospital survival trends, suggesting that these factors may have mediated, in part, some of the prehospital survival improvement. Other factors that were not measured within CARES but may have contributed to the survival trends we observed include a renewed focus on the delivery of high quality CPR (eg, appropriate depth and rate of

Table 4. Trends in Bystander CPR and AED Use

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</tr>
</thead>
<tbody>
<tr>
<td>Bystander</td>
<td>28.2%</td>
<td>33.1%</td>
<td>33.8%</td>
<td>31.6%</td>
<td>31.8%</td>
<td>36.7%</td>
<td>36.3%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>First responder</td>
<td>35.1%</td>
<td>32.1%</td>
<td>35.0%</td>
<td>36.4%</td>
<td>38.1%</td>
<td>26.5%</td>
<td>29.3%</td>
<td></td>
</tr>
<tr>
<td>EMS personnel</td>
<td>36.7%</td>
<td>34.8%</td>
<td>31.2%</td>
<td>32.0%</td>
<td>30.1%</td>
<td>36.8%</td>
<td>34.4%</td>
<td></td>
</tr>
<tr>
<td>Bystander AED use*</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All arrests</td>
<td>1.9%</td>
<td>2.3%</td>
<td>3.7%</td>
<td>3.5%</td>
<td>3.6%</td>
<td>4.5%</td>
<td>4.2%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(18/946)</td>
<td>(49/2173)</td>
<td>(138/3686)</td>
<td>(210/6021)</td>
<td>(298/8270)</td>
<td>(493/10853)</td>
<td>(692/16614)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Witnessed arrests</td>
<td>6.5%</td>
<td>5.6%</td>
<td>9.2%</td>
<td>9.1%</td>
<td>10.3%</td>
<td>9.5%</td>
<td>9.4%</td>
<td>0.048</td>
</tr>
<tr>
<td>(14/217)</td>
<td>(27/481)</td>
<td>(78/847)</td>
<td>(122/1340)</td>
<td>(183/1784)</td>
<td>(259/2719)</td>
<td>(398/4224)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rates of both bystander CPR and lay person deployment of AEDs increased during the study period. AED indicates automated external defibrillator; CPR, cardiopulmonary resuscitation; and EMS, emergency medical services.

*By convention, for calculations of bystander AED use, we excluded from consideration patients with a witnessed arrest for whom CPR was initiated by a first responder (police, firemen) or EMS personnel, because bystanders would not be expected to deploy an AED in these circumstances.

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chest compressions), avoidance of interruptions in compressions, and elimination of stacked defibrillations and frequent pulse checks after defibrillation, but these require confirmation in future studies.

Our findings indicate that the pace of improvement in study communities has slowed in recent years, but it has not stopped. It is possible that additional progress can be achieved. For example, clinical trials have reported that compression-only (ie, hands only) CPR is as effective as conventional CPR, and is considerably easier to perform and retain.19 If national efforts to disseminate an easier to perform and retain method of CPR lead to marked improvements in rates of bystander CPR, which parenthetically was initiated in only one-third of our study cohort, additional gains in survival may be realized.19,20 Likewise, more consistent provision of advanced cardiac life support, including techniques that emphasize uninterrupted delivery of chest compressions and postcardiac arrest care, may produce better outcomes.21

Our study is limited in certain respects. CARES was designed as a public health surveillance system to make it less burdensome for communities to participate. For that reason, it only collects essential data elements.8 Therefore, we do not have access to detailed clinical information to assess other factors (eg, comorbidities or EMS response times) that may influence survival. However, because the average age of patients with an out-of-hospital cardiac arrest increased over the study interval, it is unlikely that the survival gains we observed were attributable to lower severity of illness. Second, although we had information on rates of bystander CPR and AED use, CARES does not collect information on every aspect of resuscitation care, including the quality of CPR. Third, before 2011, information on therapeutic hypothermia was not systematically collected in CARES. Consequently, we were unable to assess trends in hypothermia use. Fourth, because CARES does not specify the catchment area of individual EMS agencies, we cannot compare local differences in cardiac arrest incidence. Fifth, although many studies have documented neurological outcomes based on the broad categories encompassed in a CPC score, interpretation of a particular neurological outcome as a CPC score of 1 or 2 may vary somewhat among sites. Therefore, this secondary outcome should be interpreted with some caution. Sixth, CARES collected information on only cardiac arrests attributable to a presumed cardiac cause during the study period. Because noncardiac arrests (eg, drowning, trauma, progressive respiratory failure, overdoses, asphyxia, primary respiratory arrests) may be associated with different outcomes, our findings of improved trends could reflect, in part, differences in classification of cardiac arrests as cardiac versus noncardiac over time. Because CARES did not collect information on noncardiac arrests we could not exclude this possibility, although there were no changes in the registry’s definition of cardiac arrest during the study period. Finally, although this study encompassed communities representing nearly 25% of the U.S. population, our findings may not apply to communities that do not participate in CARES.

In conclusion, in a large, prospective, quality improvement registry, we found that rates of survival from out-of-hospital cardiac arrest in the United States have substantially improved since 2005. This improvement was attributed to both improved prehospital and in-hospital survival and was accompanied by lower rates of neurological disability over time among survivors. These findings indicate that the dismal rates of out-of-hospital cardiac arrest survival that have persisted for so long are not immutable.

Appendix

Member sites of the Cardiac Arrest Registry to Enhance Survival (CARES) Surveillance Group are depicted at https://mycares.net/cares_maps.jsp.

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Disclosures

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References

Survival Trends in Out-of-Hospital Cardiac Arrest

Over the past several decades, the United States has made little progress in improving the overall rate of survival from out-of-hospital cardiac arrest, with survival rates remaining relatively unchanged at 7.6%. In recent years, advances in resuscitation science and a renewed focus on early delivery of high-quality cardiopulmonary resuscitation (CPR) have offered hope for improvements in survival. In this article by Chan and colleagues, the authors leveraged contemporary data from a large, prospective U.S. registry for out-of-hospital cardiac arrest and examined whether survival for this condition has indeed increased. The authors found that rates of overall survival (ie, to hospital discharge) for out-of-hospital cardiac arrest between 2005 and 2012 have increased by ≈50%, and these gains were attributable to both improvements in prehospital and in-hospital survival. Among those surviving to hospital discharge, the authors also found that there was a temporal trend for less severe neurological disability. Rates of bystander CPR and use of automated external defibrillators modestly increased during this study period and, in part, accounted for the gains in prehospital survival. Collectively, these findings indicate that the dismal rates of out-of-hospital cardiac arrest survival that have persisted for so long in the United States are not immutable, and they suggest the possibility of achieving further gains in survival.