PREHOSPITAL MEDICAL ADVISORY COMMITTEE MEETING AGENDA (PMAC)

This Meeting of PMAC is on:
Monday, November 16, 2020
9:00 AM to 11:00 AM
Virtual Session via Zoom

PMAC MEMBERS PER POLICY 8202:

Air Transport Provider Representative
11-

American Medical Response
5-Douglas Key
Seth Dukes, MD (Chair)

BLS Ambulance Service Representative
12-Lori Lopez

Cathedral City Fire Department
5-Justin Vondriska

Corona Regional Medical Center
1-Robert Steele, MD
4-Tamera Roy

County Fire Chiefs' Non-Transport ALS Provid
10-VACANT

County Fire Chiefs' Non-Transport BLS Provid
9-Phil Rawlings

Desert Regional Medical Center
1-Joel Stillings, D.O
4-G. Stanley Hall

Eisenhower Health
1-Mandeep Daliwhal, MD
4-Tasha Anderson

EMT / EMT-P Training Programs
6-Maggie Robles

EMT-at-Large
13 David Olivas

Paramedic-at-Large
14-Sarah Coonan

Hemet Valley Medical Center
1-Todd Hanna, MD
4-Victoria Moor

Idyllwild Fire Protection District
5-Patrick Reitz

Inland Valley Regional Medical Center
1-Zeke Foster MD
4-Daniel Sitar

JFK Memorial Hospital
1-Troy Cashatt, MD
4- Evelin Millsap

Kaiser Permanente Riverside
1-Jonathan Dyreyes, MD
4-Carol Fuste

1. **CALL TO ORDER & HOUSEKEEPING (3 Minutes)**
   Seth Dukes, MD (Chair)

2. **VIRTUAL ATTENDANCE (taken based on participant list)**
   Evelyn Pham (REMSA)

3. **APPROVAL OF MINUTES (3 Minutes)**
   August 24, 2020 Minutes— Seth Dukes, MD (Attachment A)

4. **STANDING REPORTS**
   4.1. Trauma System—Shanna Kissel (Attachment B)
   4.2. STEMI System— Leslie Duke (Attachment C)
   4.3. Stroke System— Leslie Duke (Attachment D)

5. **Other Reports**
   5.1. EMCC Report – Dan Bates

6. **DISCUSSION ITEMS, UNFINISHED & NEW BUSINESS**
   6.1. Unfinished Business –
   - **6**.1.1. PMAC Representation
     - **6**.1.1.1. Resignation of Air Transport Providers Representative
     - **6**.1.1.2. Changes in RCFCA Non-Transport ALS Provider position

   6.2. CQI Update – Lisa Madrid (Attachment E = Attached Reports)
   6.3. Literature Review – Reza Vaezazizi, MD (Attachment F = Literature)
   6.4. Education / Policy Update – Dustin Rascon (Attachment G)
   6.5. BVM, CPAP Device – Tim Buckley, Cal Fire
   6.6. HEMS Unified Protocol – Bryan Harrison, Mercy Air
   6.7. Video Laryngoscopy **–** Stephen Patterson, MD, RCH
   6.8. COVID update – Misty Plumley (Attachment H)
   6.9. Legislation Update – Reza Vaezazizi, MD (Attachment I = Article)
   6.10. PMAC 2021 Meeting Dates (Attachment J) – REMSA Clinical Team
   6.11. Action Item Review – REMSA Clinical Team

7. **REQUEST FOR DISCUSSIONS**
   Members can request that items be placed on the agenda for discussion at the following PMAC meeting. References to studies, presentations and supporting literature must be submitted to REMSA three weeks prior to the next PMAC meeting to allow ample time for preparation, distribution and review among committee members and other interested parties.

Loma Linda University Med. Center Murrieta
1-Kevin Flaig, MD
4-Kristin Butler

Menifee Valley Medical Center
1-Todd Hanna, MD
4-Janny Nelsen

Kaiser Permanente Moreno Valley
1-George Salameh, MD
4-Katherine Heichel-Casas

Palo Verde Hospital
1-David Sincavage, MD
4-Carmelita Aquines

Parkview Community Hospital
1-Chad Clark, MD
4-Guillean Estrada

Rancho Springs Medical Center
1-Zeke Foster, MD
4-Sarah Young

Riverside Community Hospital
1-Stephen Patterson, MD
4-Sabrina Yamashiro

Riverside County Fire Department
5-Scott Visyak
8-Tim Buckley

Riverside County Police Association
7-Sean Hadden

Riverside University Health System Med. Center
1-Michael Mesisca, DO (Vice Chair)
4-Lori Maddox

San Gorgonio Memorial Medical Center
1-Richard Preci, MD
4-Trish Ritarita

Temecula Valley Hospital
1-Pranav Kachhi, MD
4-Jacquelyn Ramirez

Trauma Audit Comm. & Trauma Program Managers
2-
3-Charlie Hendra

Ex-officio Members:
1-Cameron Kaiser, MD, Public Health Officer
2-Reza Vaezazizi, MD, REMSA Medical Director
3-Bruce Barton, REMSA Director
4-Jeff Grange, MD, LLUMC
5-Phong Nguyen, MD, Redlands Community Hospital
6-Rodney Borger, MD, Arrowhead Regional Medical Center

8. ANNOUNCEMENTS (15 Minutes)

This is the time/place in which committee members and non-committee members can speak on items not on the agenda but within the purview of PMAC. Each announcement should be limited to two minutes unless extended by the PMAC Chairperson.

9. NEXT MEETING / ADJOURNMENT (1 Minute)

—Virtual Session via web platform

Members are requested to please sit at the table with name plates in order to identify members for an accurate count of votes

Please come prepared to discuss the agenda items. If you have any questions or comments, call or email Evelyn Pham at (951) 358-5029 / epham@rivco.org. PMAC Agendas with attachments are available at: www.rivcoems.org. Meeting minutes are audio recorded to facilitate dictation for minutes.

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TOPIC	DISCUSSION	ACTION
1. CALL TO ORDER	PMAC Chair Dr. Seth Dukes called the meeting to order at 9:04 a.m.	
2. Virtual Attendance	Attendance taken based on participant list on Zoom.	
3. Approval of Minutes		The February 24, 2020 PMAC meeting minutes were approved with no changes.
4. STANDING REPORTS		
4.1 Trauma System Updates	Riverside Community Hospital was designated by REMSA as a Level 1 Trauma Center, meeting state regulations. This designation does not affect field level triage to trauma centers. IVMC is doing direct data entry into the ImageTrend Trauma Patient Registry since April 1, 2020. The hospital can link the prehospital PCRs into the trauma registry and send outcome data back to field providers. Penetrating trauma protocol implemented on October 1, 2019, REMSA is continuing to CQI all penetrating trauma pronounced in the field without making BH contact. Data to be presented at TAC in August. EMSA trauma regulation rewrite workgroup on hold due to COVID-19 activity at the state level. Updates will be provided once the committee resumes. New Trauma Center Standards for adults and pediatrics policy 5304 and 5305 implemented on July 1, 2020. This is an Administrative policy specific to the trauma center requirements and designation. American College of Surgeons surveys extended until further notice due to COVID-19.	Information only.
4.2 STEMI System Updates	STEMI projects, data and reports have been delayed due to COVID-19. Data reports will resume by the next STEMI meeting. ImageTrend STEMI Patient Registry is one year into implementation. To date, there are over 1500 suspected and confirmed STEMI cases entered into the registry. Development of useful data quality reports and metrics are in progress. STEMI volume is down nearly 20% in the first six months of 2020 compared to the last 6 months of 2019. It is unclear as to	Information only.

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	the cause for this decrease; further review of the data and discussion will take place at the October STEMI meeting. Nitroglycerin was placed fully back into standing orders as of October 1st, 2019. Data audits indicate there is no change in the use of nitrates and no increase in adverse events as a result of the change. If this data trend holds, the audit will be discontinued as of October 1st, 2020. Targeted STEMI education has been created as part of Policy Update Courses (PUC) with a tentative implementation during Spring 2021 PUC. No STEMI policy changes pending. Until further notice, all STEMI Committee meetings will take place via a virtual platform. Please note, meeting invites should not be shared with outside entities. Case reviews will resume at the October meeting. The next STEMI meeting is on October 8, 2020.	
4.3 Stroke System Updates	Stroke projects, data and reports have been delayed due to COVID-19. Data reports will resume by the next stroke meeting. The ImageTrend Stroke Patient Registry is a full year into implementation with over 6,700 suspected and confirmed stroke cases entered thus far. Development of useful data quality reports and metrics are in progress. Countywide stroke volume for the first six months of 2020 is consistent compared to the last six months of 2019. The data will be further analyzed to see if there has been an impact on stroke mortality or morbidity during the pandemic period. Targeted Stroke education has been created for EMS personnel as part of Policy Update Courses (PUC) with a tentative implementation during the Spring 2021 PUC. The content is based upon identified educational needs and includes feedback on system-wide metrics. Stroke diversion was retired as of July 1, 2020. The option for facilities to trigger stroke diversion in ReddiNet has been disabled. The requirement for each designated stroke facility to have a recorded, dedicated phone or radio line for EMS arrivals wil take effect on July 1st, 2021. Recordings of EMS arrivals are intended to facility quality assurance processes.	Information only.

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	Desert Regional Medical Center has joined Riverside Community Hospital as a designated Comprehensive Stroke Center. This does not affect field triage of stroke patients. No Stroke policy changes pending. Until further notice, all Stroke Committee meetings will take place via a virtual platform. Please note, meeting invites should not be shared with outside entities. Case reviews will resume at the November meeting. The next STEMI meeting is on November 12, 2020.	
5. OTHER REPORTS		
5.1 EMCC Report	EMCC's last meeting focused on the update of the COVID-19 situation and what the system has been doing in response to the pandemic. The next EMCC meeting is on December 16th, 2020.	Information only.
6. DISCUSSION ITEMS, UNFINISHED & NEW BUSINESS		
6.1 Unfinished Business	Unfinished business	
6.1.1 PMAC Structure Review **6.1.1.1 Resignation of Air Transport Providers Representative** **6.1.1.2 Changes in RCFCA Non-Transport ALS Provider Position**	PMAC Structure review (attachment E) PMAC structure was edited per feedback received from shareholders. Attachment E redisplays the proposed structure that was developed and discussed with PMAC to see if members would like to take action to utilize the new structure, change it, or leave our current structure as the same. Continued discussion led the committee to a standstill with split opinions, half of which favored the new structure and the other half with leaving it as is. Since no considerable dialogue was had to sway more towards one side or the other, the committee agreed to close the item without further action. In the future, if any agency feels strongly, they may propose a new proposal. With the resignation of the current air transport provider representative, Reach will discuss amongst their agency to elect a new member to fill the position. Their nominee will be brought to the next PMAC meeting for consideration. It was suggested that their representative for PMAC would also be their representative for EMCC as well. Moved off the table and sent back to the County Chief Fire Association.	Close this item without further action.

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6.1.2 King Airway Data Review	Providers were instructed to maintain carrying King Airway for use, aside from OHCA, and their data would be monitored for six months. In looking at the data from the past 6 months, there was no difference in carrying King Airway. King airway was used only once in January for a trauma patient. The members proposed having King Airway removed from the required drug and equipment list. Tim Buckley, Cal Fire motioned to remove King Airway completely, and Dr. Steve Patterson, RCH seconded the motion. Discussion was had regarding an alternate option for allowing providers to continue carrying King Airway if they chose to. The motion for optional carry was then rescinded after further discussion. Motion passed with none opposed to remove King Airway from the Drug and Equipment list effective October 1st, 2020. During this time, training will re-emphasize on BVM.	King Airway will be removed from the Drug and Equipment list effective October 1, 2020.
6.2 CQI Update	CQI update Epinephrine administration report was shared for review. REMSA is continuing to monitor push dose epi, ketamine and TXA on a high level, but due to COVID-19, no further review on individual cases for now. CORE Measures was received last week and will be due in October 2020. REMSA has requested to remove any time-based intervals out of the categories. Aside from the time intervals, not much change from last year. New BVM and CPAP device was presented at the last CQILT meeting for consideration to adopt. The main concern with changing to a new device would be requiring all agencies to use the same universal device. Interchangeability would give our system the ability to stay limber. Cal Fire expressed their desire to change to this new device because it offers more simplicity in using only 1 cap, instead of 4, saves space and reduces cost. In addition, the single smaller bag that works for both adults and pediatrics prevents over inflation. A suggestion was brought up for Cal Fire to trial this new product first for adults only and to report back with their data after 6 months of use. Cal Fire will work with the manufacturer to gather more information and present a formal proposal at the next PMAC meeting to formally request to use the new BVM and CPAP device. Medical cardiac arrest and traumatic cardiac arrest data was reviewed.	Information only.
6.3 Education / Policy Update	Policy changes were made effective on July 1st, 2020 to remove stroke diversion from REMSA policy 6103, with an adjacent overlap to REMSA policy 2202 ReddiNet.	Information only.

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	Minor administrative changes to report title were made to REMSA policy 2101 Emergency Medical Dispatch to more accurately title reporting mechanisms.
	
	REMSA policy 8101 Resource List – Hospital page, was updated with changes in hospital capabilities as noted in Stroke Updates. Those stroke updates do not impact current field triage of stroke patients.
	
	Additional trauma policies related to Trauma Center Standards, and Pediatric Trauma Center Standards were added to administratively align with contract periods and were effective July 1, 2020.
	
	REMSA policy 3307A will continue to evolve along with the COVID pandemic, and as treatment standards evolve based on CDC recommendations.
	
	Policy Manual Changes effective October 1:
	• Addition of ketamine as BHO to REMSA 4606 Snakebite (for continuity of controlled substance
	• administration through all traumatic injuries protocols).
	• Addition of COVID Surge plan protocols:
	  o Assign and Refer – only activated as EMS COVID XRI Surge triggers are met
	  o COVID XRI with specific triggers for COVID surge thresholds
	• *Addition for King Airway removed from drug and equipment list	

6.4 Ketamine Study Published	Our Ketamine trial was published and is a peer-reviewed online publication. Thank you to all REMSA EMS Providers who participated and put in their contributions to further patient care initiatives and adding to the Local Optional Scope of Practice for Riverside County. The publication can be accessed at the link below, please share this article with all field personnel. https://www.cureus.com/articles/33489-evaluation-of-safety-and-efficacy-of-prehospital-paramedic-administration-of-sub-dissociative-dose-of-ketamine-in-the-treatment-of-trauma-related-pain-in-adult-civilian-population	Information only.
6.5 COVID-19 Update	Riverside County is starting to see a downward trend of hospitalization of COVID-19 patients. There has been increases in ICU hospitalization, but not COVID related.	Information only.

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	An SOS team has been developed in April for assistance to health care facilities, skilled nursing and long-term homes in response to the challenges identified by the Magnolia case. Staffing of the team consists of EMTs and Paramedics working with home health nurses to provide education and support onsite. Prehospital health care providers are prepared to assist in cases of short staffing in community test sites and supporting the SOS team. Prehospital volumes are back up to its normal volume, whereas IFT remains on a downward trend. Providers have until November 12th to complete their KN95 fit testing.	
6.6 LOSOP Application Update	REMA is completing a Local Optional Scope of Practice (LOSOP) application with CA EMSA to facilitate Static Site Practice. This LOSOP application would further facilitate: • EMS and Paramedic functioning within their scope of practice at long term care facilities (LTCF) as needed during times of surge (and only when specifically deployed by REMSA), also assistance with COVID-19 testing • Paramedic assistance with vaccination points of distribution (POD's) or vaccination clinics. This would serve as part of a planning effort for the upcoming flu season	Information only.
6.7 Action Item Review	King Airway will be removed from the drug and equipment list effective October 1st, 2020.	
7. Request for Discussions	Train to trainer will be revamped with more of an orientation piece with standardized talking points. Training will be done via a virtual platform. Dr. Seth Dukes, AMR, request to present on the agenda at the next PMAC meeting, Ketamine used for excited delirium for prehospital providers. A polished draft will be brought to PMAC for consideration. Tim Buckley, Cal Fire, has recently purchased 250 devices for video laryngoscopy with McGrath and implementing those within the next 30 days. Their request to PMAC is to no longer carry the old laryngoscope blades. With the video laryngoscopy, providers can still intubate manually if the screen does not work. Brian Harrison, Mercy Air request to present at the November meeting with REACH to propose an expanded scope for flight paramedics.	

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	EMT at Large position will also be open for nomination as the current member has retired.	
8. Announcements	Dr. Michael Mesisca announced, RUHS PLN Kay Schulz will be retiring soon and the members thanked her for her time and commitment to our patient care system. Lori Maddox will be transitioning into her role as the new PLN.	
9. NEXT MEETING/ADJOURNMENT	Monday, November 16th, 2020 (9:00 – 11:00 a.m.) Virtual Platform - Zoom	Information only.

FOR CONSIDERATION BY PMAC

DATE: November 1, 2020

TO: PMAC

FROM: Shanna Kissel, RN, Assistant Nurse Manager

SUBJECT: Trauma System

1. 2019 Trauma plan update submitted to EMSA. Pending approval.
2. Traumatic arrest data is now reported out at TAC and will be a standing report for the committee.
3. Trauma Diversions are now being reported out monthly APOT reports.

ACTION: PMAC should be prepared to receive the information and provide feedback to REMSA.

FOR CONSIDERATION BY PMAC

DATE: November 16, 2020

TO: PMAC

FROM: Dan Sitar Specialty Care Consultant RN

SUBJECT: STEMI System

1. REMSA has hired a full-time Specialty Care System Coordinator for the STEMI and Stroke programs. The consultant contract will be phased out by the end of November 2020.

2. The REMSA STEMI System Advisory Committee has begun to meet quarterly in regional meetings with the ICEMA STEMI CQI Committee. Collaboration between the two systems allows for knowledge sharing and improvement of patient care across county lines.

3. STEMI-specific education is being finalized and will be ready for the Spring 2021 Policy Update Course.

4. An annual EMS plan update will be sent to the State for approval. Goals for 2021 are included in the update and pending approval.

5. Policies: No changes to stroke treatment policies.

Next STEMI Committee meeting is on January 12th, 2021 via video conference

Action: PMAC should be prepared to receive the information and provide feedback to the EMS Agency

FOR CONSIDERATION BY PMAC

DATE: November 16, 2020

TO: PMAC

FROM: Dan Sitar, Specialty Care Consultant RN

SUBJECT: Stroke System

1. REMSA has hired a full-time Specialty Care System Coordinator to assume the Stroke and STEMI programs. The consultant contract will be phased out by the end of November 2020.
2. Targeted Stroke specific education is being finalized and will be ready for the Spring 2021 Policy Update Course.
3. Isolated Stroke diversion was eliminated on July 1st, 2020.
4. To align with all other specialty care programs, each designated stroke center will be required to maintain a dedicated, recorded phone or radio line for all incoming EMS patients by July 1st, 2021.
5. The annual EMS plan update will be sent to the State for approval. Goals for 2021 are included in the update and pending approval.
6. The REMSA Stroke System Advisory Committee is planning to regionalize one of the quarterly meetings with the ICEMA Stroke CQI Committee. Collaboration between the two systems allows for knowledge sharing and improvement of patient care across county lines.
7. Policies: No changes to stroke treatment policies.

Next Stroke Committee meeting is on February 11th, 2021 (tentative)

Action: PMAC should be prepared to receive the information and provide feedback to the EMS Agency

Medical Cardiac Arrest- 4/1/2019- 9/30/2020

"911 Response", "Cardiac arrest during EMS event is not blank ", Primary or Secondary impression "Cardiac arrest"

		2019						2020						Average	
		Qtr2		Qtr3		Qtr4		Qtr1		Qtr2		Qtr3			
	Total Incidents	1317		1255		1381		1649		1610		1631		**1474**	
	Total Approx., Patients	938		886		992		1175		1212		1260		**1077**	
By Age group	Children (<=12)	15	2%	23	3%	9	1%	12	1%	15	1%	11	1%	**14**	**1%**
	Adolescents (13-17)	6	1%	6	1%	4	0.4%	7	1%	4	0%	7	1%	**6**	**1%**
	Young Adults (18-35)	70	7%	59	7%	70	7%	94	8%	94	8%	113	9%	**83**	**8%**
	Adults(36-64)	328	35%	296	33%	335	34%	392	33%	393	32%	424	34%	**361**	**34%**
	Adults(65-79)	296	32%	283	32%	334	34%	371	32%	415	34%	426	34%	**354**	**33%**
	Older Adults (>=80)	223	24%	218	25%	239	24%	299	25%	291	24%	279	22%	**258**	**24%**
ROSC	Yes	195	21%	161	18%	156	16%	233	20%	173	14%	183	15%	**184**	**17%**
	No	743	79%	725	82%	836	84%	942	80%	1039	86%	1077	85%	**894**	**83%**
Cardiac Arrest during EMS event	Yes, Prior to EMS Arrival	855	91%	822	93%	926	93.3%	1079	91.8%	1117	92%	1174	93.2%	**996**	**92.4%**
	Yes, After EMS Arrival	83	9%	64	7%	64	6.5%	94	8.0%	95	8%	84	6.7%	**81**	**7.5%**
	No					2	0.2%	2	0.2%			2	0.2%	**2**	**0.2%**
Disposition	Treated and Transported	288	31%	257	29%	248	25%	323	27%	262	22%	274	22%	**275**	**26%**
	Prounounced in Field	650	69%	629	71%	744	75%	852	73%	949	78%	986	78%	**802**	**74%**

	2019						2020						Average	
	Qtr2		*Qtr3*		*Qtr4*		*Qtr1*		*Qtr2*		*Qtr3*			
Total Transports	**288**		**257**		**248**		**323**		**263**		**276**		**276**	
STEMI center	**143**	**50%**	**139**	**54%**	**140**	**56%**	**190**	**59%**	**151**	**57%**	**167**	**61%**	**155**	**56%**
Riverside Community Hospital	49	34%	53	38%	41	29%	64	34%	49	32%	49	29%	51	33%
Desert Regional Medical Center	21	15%	23	17%	28	20%	34	18%	23	15%	30	18%	27	17%
Loma Linda University Medical Center, Murrieta	24	17%	18	13%	30	21%	33	17%	31	21%	36	22%	29	18%
Eisenhower Medical Center	29	20%	15	11%	14	10%	30	16%	20	13%	17	10%	21	13%
JFK - John F Kennedy Memorial Hospital	9	6%	21	15%	19	14%	23	12%	25	17%	25	15%	20	13%
Temecula Valley Hospital	11	8%	9	6%	8	6%	6	3%	3	2%	10	6%	8	5%
Non-STEMI Center	**145**	**50%**	**118**	**46%**	**108**	**44%**	**133**	**41%**	**112**	**43%**	**109**	**39%**	**121**	**44%**
Hemet Valley Medical Center	25	17%	24	20%	26	22%	34	26%	24	18%	20	15%	26	21%
Riverside University Health System Medical Center	30	21%	15	13%	22	19%	21	16%	14	11%	18	14%	20	17%
Corona Regional Medical Center	17	12%	10	8%	10	8%	17	13%	20	15%	18	14%	15	13%
San Gorgonio Memorial Hospital	13	9%	14	12%	11	9%	13	10%	8	6%	14	11%	12	10%
Inland Valley Medical Center	15	10%	10	8%	6	5%	10	8%	7	5%	5	4%	9	7%
Parkview Community Hospital Medical Center	9	6%	11	9%	6	5%	7	5%	14	11%	5	4%	9	7%
Kaiser Permanente, Riverside	11	8%	5	4%	4	3%	12	9%	4	3%	11	8%	8	6%
Menifee Valley Medical Center	7	5%	5	4%	8	7%	5	4%	4	3%	1	1%	5	4%
Kaiser Permanente, Ontario	5	3%	9	8%	1	1%	2	2%	2	2%	2	2%	4	3%
Palo Verde Hospital	2	1%	6	5%	3	3%	3	2%	5	4%	2	2%	4	3%
Rancho Springs Medical Center	3	2%	2	2%	5	4%	3	3%	4	3%	3	2%	3	3%
Kaiser Permanente, Moreno Valley	2	2%			2	2%			2	2%	3	2%	2	2%
Redlands Community Hospital	1	1%	2	2%									2	1%
Loma Linda University Medical Center	1	1%							1	1%	2	2%	1	1%
Hemet Valley Healthcare Center	1	1%											1	1%
Kindred Hospital, Ontario					1	1%							1	1%
Kaiser Permanente, Fontana									1	1%	1	1%	1	1%
Facility name not available	3	3%	5	4%	3	3%	6	5%	2	2%	4	3%	4	3%

Data is based on Incidents and documentation

Median Time		2019			2020			
		Qtr2	Qtr3	Qtr4	Qtr1	Qtr2	Qtr3	
Patient contact time (etimes07-etimes03)	First Response	0:06:57	0:07:08	0:07:39	0:07:07	0:07:59	0:07:57	**0:07:28**
	Ground Transport	0:08:11	0:08:28	0:09:08	0:08:48	0:08:29	0:08:46	**0:08:38**
	Total	**0:07:34**	**0:07:48**	**0:08:23**	**0:07:58**	**0:08:11**	**0:08:19**	**0:08:02**
Scene time (etimes09-etimes07)	First Response	0:20:19	0:23:06	0:20:00	0:22:34	0:19:57	0:22:49	**0:21:27**
	Ground Transport	0:17:08	0:18:21	0:16:44	0:18:03	0:18:58	0:18:00	**0:17:52**
	Total	**0:18:43**	**0:20:44**	**0:18:22**	**0:20:18**	**0:19:22**	**0:19:34**	**0:19:31**
First CPR to Determination of Death (earrest15-earrest19) Disposition :"Dead at Scene"	First Response	0:25:01	0:26:00	0:24:57	0:25:00	0:24:58	0:24:43	**0:25:07**
	Ground Transport	0:27:03	0:26:52	0:24:45	0:26:21	0:25:44	0:26:40	**0:26:14**
	Total	**0:26:02**	**0:26:26**	**0:24:51**	**0:25:41**	**0:25:11**	**0:25:10**	**0:25:33**
First CPR to Transport (etimes09-earrest19)	Ground Transport	0:22:21	0:23:53	0:22:51	0:24:45	0:24:19	0:24:02	**0:23:27**
Patient contact to transport time (etimes11-etimes07) Dispo= "Patient treated and transported by this unit"	**Ground Transport**	0:27:48	0:27:57	0:27:56	0:29:28	0:29:18	0:30:15	**0:28:47**
Patient contact to detemination of death (earrest15-etimes07)	**First Response**							
	Dead at Scene, No Resuscitation, No Transport	0:01:00	0:01:00	0:00:44	0:01:00	0:01:00	0:00:42	**0:00:54**
	Resuscitation Attempted, Dead at Scene, No Transport	0:22:32	0:23:26	0:23:00	0:23:00	0:23:08	0:23:06	**0:23:02**
	Ground Transport							
	Dead at Scene, No Resuscitation, No Transport	0:02:00	0:01:05	0:01:36	0:01:07	0:01:05	0:01:00	**0:01:19**
	Resuscitation Attempted, Dead at Scene, No Transport	0:23:14	0:23:15	0:21:31	0:22:00	0:22:00	0:21:43	**0:22:17**

Traumatic Cardiac Arrest- 1/1/2019- 9/30/2020

"911 Response", "Cardiac arrest during EMS event=Yes", Cardiac arrest Etiology="Trauma"

		2019								2020						Average	
		Qtr1		*Qtr2*		*Qtr3*		*Qtr4*		*Qtr1*		*Qtr2*		*Qtr3*			
	Total Incidents	112		159		153		147		137		129		175		**145**	
Age	Average Age	39		40		42		44		39		41		42		**41**	
	Median Age	37		40		40		40		35						**38**	
By Age group	0-9	8	7%	14	9%	10	7%	2	1%	7	5%	6	5%	12	7%	**8**	**6%**
	10-14	1	1%			3	2%	1	1%	1	1%	4	3%	2	1%	**2**	**1%**
	15-24	10	9%	26	16%	10	7%	16	11%	23	17%	17	13%	14	8%	**17**	**11%**
	25-34	32	29%	20	13%	35	23%	41	28%	34	25%	38	29%	36	21%	**34**	**23%**
	35-44	17	15%	27	17%	26	17%	18	12%	26	19%	16	12%	46	26%	**25**	**17%**
	45-54	19	17%	26	16%	19	12%	22	15%	15	11%	7	5%	17	10%	**18**	**12%**
	55-64	6	5%	30	19%	24	16%	24	16%	9	7%	12	9%	17	10%	**17**	**12%**
	65-79	16	14%	13	8%	22	14%	16	11%	8	6%	20	16%	18	10%	**16**	**11%**
	80+	3	3%	3	2%	4	3%	7	5%	10	7%	9	7%	13	7%	**7**	**5%**
By Ambulance Zone	Northwest Zone	31	28%	41	26%	40	26%	39	27%	46	34%	40	31%	38	22%	**39**	**27%**
	Desert Zone	34	30%	32	20%	32	21%	30	20%	18	13%	18	14%	38	22%	**29**	**20%**
	Southwest Zone	15	13%	29	18%	21	14%	20	14%	19	14%	16	12%	29	17%	**21**	**15%**
	Central Zone	16	14%	25	16%	29	19%	22	15%	25	18%	27	21%	30	17%	**25**	**17%**
	San Jacinto Zone	6	5%	18	11%	16	10%	24	16%	20	15%	22	17%	22	13%	**18**	**13%**
	Pass Zone	7	6%	6	4%	7	5%	5	3%	4	3%	3	2%	7	4%	**6**	**4%**
	Mountain Plateau Zone	1	1%	4	3%		0%	5	3%	4	3%	1	1%	10	6%	**4**	**3%**
	Palo Verde Zone	2	2%	3	2%	8	5%	2	1%	1	1%	2	2%	1	1%	**3**	**2%**
Injury Mechanism	Blunt only	58	52%	99	62%	73	48%	78	53%	76	55%	82	64%	80	46%	**78**	**54%**
	Penetrating	21	19%	29	18%	40	26%	36	24%	34	25%	19	15%	46	26%	**32**	**22%**
	Blunt and penetrating	4	4%	2	1%	3	2%	3	2%	3	2%	3	2%	3	2%	**3**	**2%**
	Burn					1	1%	1	1%					1	1%	**1**	**1%**
	Blunt and Burn	2	2%						0%	4	3%			2	1%	**3**	**2%**
	Other	19	17%	18	11%	25	16%	16	11%	10	7%	13	10%	33	19%	**19**	**13%**
	Not documented	8	7%	11	7%	11	7%	13	9%	10	7%	12	9%	10	6%	**11**	**7%**
Odomeater Reading	Total Incidents documented Odometer reading	28		30		31		29		25		20		25		**27**	
	Sum of Odometer Reading	180		160		168		296		259		172		229		**209**	
	Average of Odometer Reading	6		5		5		10		10		9		9		**8**	
	Max of Odometer Reading	15		14		25		26		26		20		25		**22**	

	2019								2020						Average	
	Qtr1		*Qtr2*		*Qtr3*		*Qtr4*		*Qtr1*		*Qtr2*		*Qtr3*			
Total Transports Dispo:Treated and Transported by this unit	**28**		**30**		**31**		**29**		**25**		**20**		**25**		**27**	
Trauma center	**15**	**54%**	**17**	**57%**	**21**	**68%**	**21**	**72%**	**17**	**68%**	**13**	**65%**	**14**	**56%**	**17**	**63%**
Riverside Community Hospital	5	18%	7	23%	8	26%	7	24%	2	8%	1	5%	3	12%	5	18%
Riverside University Health System Medical Center	3	11%	4	13%	7	23%	8	28%	6	24%	7	35%	5	20%	6	21%
Desert Regional Medical Center	4	14%	3	10%	3	10%	4	14%	5	20%	1	5%	5	20%	4	13%
Inland Valley Medical Center	3	11%	3	10%	3	10%	2	7%	4	16%	4	20%	1	4%	3	11%
Non-Trauma Center	**13**	**46%**	**13**	**43%**	**10**	**32%**	**8**	**28%**	**8**	**32%**	**7**	**35%**	**11**	**44%**	**10**	**37%**
Hemet Valley Medical Center	2	7%	2	7%	2	6%	4	14%			3	15%	3	12%	3	10%
JFK - John F Kennedy Memorial Hospital	1	4%	3	10%	1	3%	2	7%			1	5%	1	4%	2	6%
Corona Regional Medical Center	2	7%	2	7%					1	4%	1	5%	2	8%	2	6%
San Gorgonio Memorial Hospital	3	11%			1	3%			1	4%			1	4%	2	6%
Eisenhower Medical Center	1	4%	3	10%	1	3%	1	3%			1	5%			1	5%
Palo Verde Hospital	2	7%			1	3%					1	5%	1	4%	1	5%
Rancho Springs Medical Center	1	4%	1	3%			1	3%							1	4%
Menifee Valley Medical Center			1	3%	1	3%			1	4%					1	4%
Kaiser Riverside Medical Center					1	3%			1	4%					1	4%
Loma Linda University Medical Center, Murrieta									4	16%			2	8%	3	11%
Temecula Valley Hospital			1	3%	2	6%									2	6%
Parkview Community Hospital Medical Center	1	4%											1	4%	1	4%

	2019								2020						Average	
Base Hospital contact("Yes/No") (itdisposition.007)	*Qtr1*		*Qtr2*		*Qtr3*		*Qtr4*		*Qtr1*		*Qtr2*		*Qtr3*			
	112		**159**		**153**		**147**		**137**		**129**		**175**		**145**	
Yes	**29**	**26%**	**46**	**29%**	**42**	**27%**	**47**	**32%**	**30**	**22%**	**27**	**21%**	**32**	**18%**	**36**	**25%**
First Response	16	14%	24	15%	21	14%	23	16%	19	14%	15	12%	13	7%	19	13%
Ground Transport	13	12%	22	14%	21	14%	24	16%	11	8%	12	9%	19	11%	17	12%
No	**83**	**74%**	**113**	**71%**	**111**	**73%**	**100**	**68%**	**107**	**78%**	**102**	**79%**	**143**	**82%**	**108**	**75%**
First Response	49	44%	77	48%	73	48%	69	47%	64	47%	72	56%	96	55%	71	49%
Ground Transport	34	30%	36	23%	38	25%	31	21%	43	31%	30	23%	47	27%	37	26%

	2019								2020						Average	
	Qtr1		*Qtr2*		*Qtr3*		*Qtr4*		*Qtr1*		*Qtr2*		*Qtr3*			
Total Transports Dispo:Treated and Transported by this unit	**28**		**30**		**31**		**29**		**25**		**20**		**25**		**27**	
Trauma center	**15**	**54%**	**17**	**57%**	**21**	**68%**	**21**	**72%**	**17**	**68%**	**13**	**65%**	**14**	**56%**	**17**	**63%**
Riverside Community Hospital	5	18%	7	23%	8	26%	7	24%	2	8%	1	5%	3	12%	5	18%
Riverside University Health System Medical Center	3	11%	4	13%	7	23%	8	28%	6	24%	7	35%	5	20%	6	21%
Desert Regional Medical Center	4	14%	3	10%	3	10%	4	14%	5	20%	1	5%	5	20%	4	13%
Inland Valley Medical Center	3	11%	3	10%	3	10%	2	7%	4	16%	4	20%	1	4%	3	11%
Non-Trauma Center	**13**	**46%**	**13**	**43%**	**10**	**32%**	**8**	**28%**	**8**	**32%**	**7**	**35%**	**11**	**44%**	**10**	**37%**
Hemet Valley Medical Center	2	7%	2	7%	2	6%	4	14%			3	12%	3	12%	3	10%
JFK - John F Kennedy Memorial Hospital	1	4%	3	10%	1	3%	2	7%			1	4%	1	4%	2	6%
Corona Regional Medical Center	2		2	7%					1	4%	1	4%	2	8%	2	6%
San Gorgonio Memorial Hospital	3	11%			1	3%			1	4%			1	4%	2	6%
Eisenhower Medical Center	1		3		1	3%	1	3%			1	4%			1	5%
Palo Verde Hospital	2				1	3%					1	4%	1	4%	1	5%
Rancho Springs Medical Center	1		1				1	3%							1	4%
Menifee Valley Medical Center			1		1	3%			1	4%					1	4%
Kaiser Riverside Medical Center		0%			1	3%			1	4%					1	4%
Loma Linda University Medical Center, Murrieta									4	16%			2	8%	3	11%
Temecula Valley Hospital			1		2	6%									2	6%
Parkview Community Hospital Medical Center	1												1	4%	1	4%

	2019								2020						Average	
Base Hospital contact("Yes/No", Disposition)	**112**		**159**		**153**		**147**		**137**		**129**		**175**		**145**	
Yes	**29**	**26%**	**46**	**29%**	**42**	**27%**	**47**	**32%**	**30**	**22%**	**27**	**21%**	**32**	**18%**	**36**	**25%**
Patient Treated and Transported by this EMS Unit	11	38%	15	33%	19	45%	20	43%	11	37%	10	37%	8	25%	13	37%
Dead at scene	7	24%	19	41%	10	24%	15	32%	7	23%	7	26%	9	9%	11	29%
Patient Treated and Transported with this Crew in Another EMS Unit	10	34%	12	26%	13	31%	9	19%	11	37%	9	33%	6	19%	10	28%
Patient Treated and Care Transferred to Another EMS Unit	1	3%					3	6%	1	3%	1	4%			2	4%
No	**83**	**74%**	**113**	**71%**	**111**	**73%**	**100**	**68%**	**107**	**78%**	**102**	**79%**	**143**	**82%**	**108**	**75%**
Dead at scene	59	71%	90	80%	84	76%	88	88%	86	80%	86	84%	127	89%	89	82%
Patient Treated and Transported by this EMS Unit	17	20%	15	13%	12	11%	9	9%	14	13%	10	10%	8	6%	12	11%
Patient Treated and Transported with this Crew in Another EMS Unit	7	8%	7	6%	13	12%	3	3%	6	6%	6	6%	6	4%	7	6%
Patient Treated and Care Transferred to Another EMS Unit		0%	1	1%	2	2%		0%	1	1%			2	1%	2	1%

Median Time		**2019**				**2020**			
		Qtr1	**Qtr2**	**Qtr3**	**Qtr4**	**Qtr1**	**Qtr2**	**Qtr3**	
Patient contact time (etimes07-etimes03)	First Response	0:08:10	0:07:32	0:07:59	0:08:10	0:07:48	0:08:22	0:08:18	**0:08:03**
	Ground Transport	0:09:21	0:07:09	0:09:18	0:07:37	0:08:28	0:08:06	0:08:20	**0:08:20**
	Total	**0:08:45**	**0:07:20**	**0:08:39**	**0:07:53**	**0:08:08**	**0:08:20**	**0:08:18**	**0:08:12**
Scene time (etimes09-etimes07)	First Response	0:16:36	0:10:06	0:16:00	0:12:12	0:14:52	0:11:01	0:25:07	**0:15:08**
	Ground Transport	0:08:19	0:09:03	0:08:52	0:08:34	0:10:06	0:09:16	0:09:11	**0:09:03**
	Total	**0:12:28**	**0:09:34**	**0:12:26**	**0:10:23**	**0:12:29**	**0:11:01**	**0:13:56**	**0:11:45**
Patient contact to transport time (etimes11-etimes07) Dispo= "Patient treated and transported by this unit"	Ground Transport	0:19:11	0:15:04	0:17:30	0:24:10	0:25:56	0:24:59	0:24:28	**0:21:37**
Patient contact to detemination of death (earrest15-etimes07)	**First Response**								
	Dead at Scene, No Resuscitation, No Transport	0:01:39	0:02:10	0:02:00	0:01:00	0:01:00	0:01:00	0:00:50	**0:01:23**
	Resuscitation Attempted, Dead at Scene, No Transport		0:20:58	0:20:00	0:18:15	0:16:45	0:11:32	0:20:30	**0:18:00**
	Ground Transport								
	Dead at Scene, No Resuscitation, No Transport				0:02:13	0:01:32	0:00:40	0:01:57	**0:01:35**
	Resuscitation Attempted, Dead at Scene, No Transport				0:21:00	0:18:09	0:17:11	0:19:29	**0:18:57**

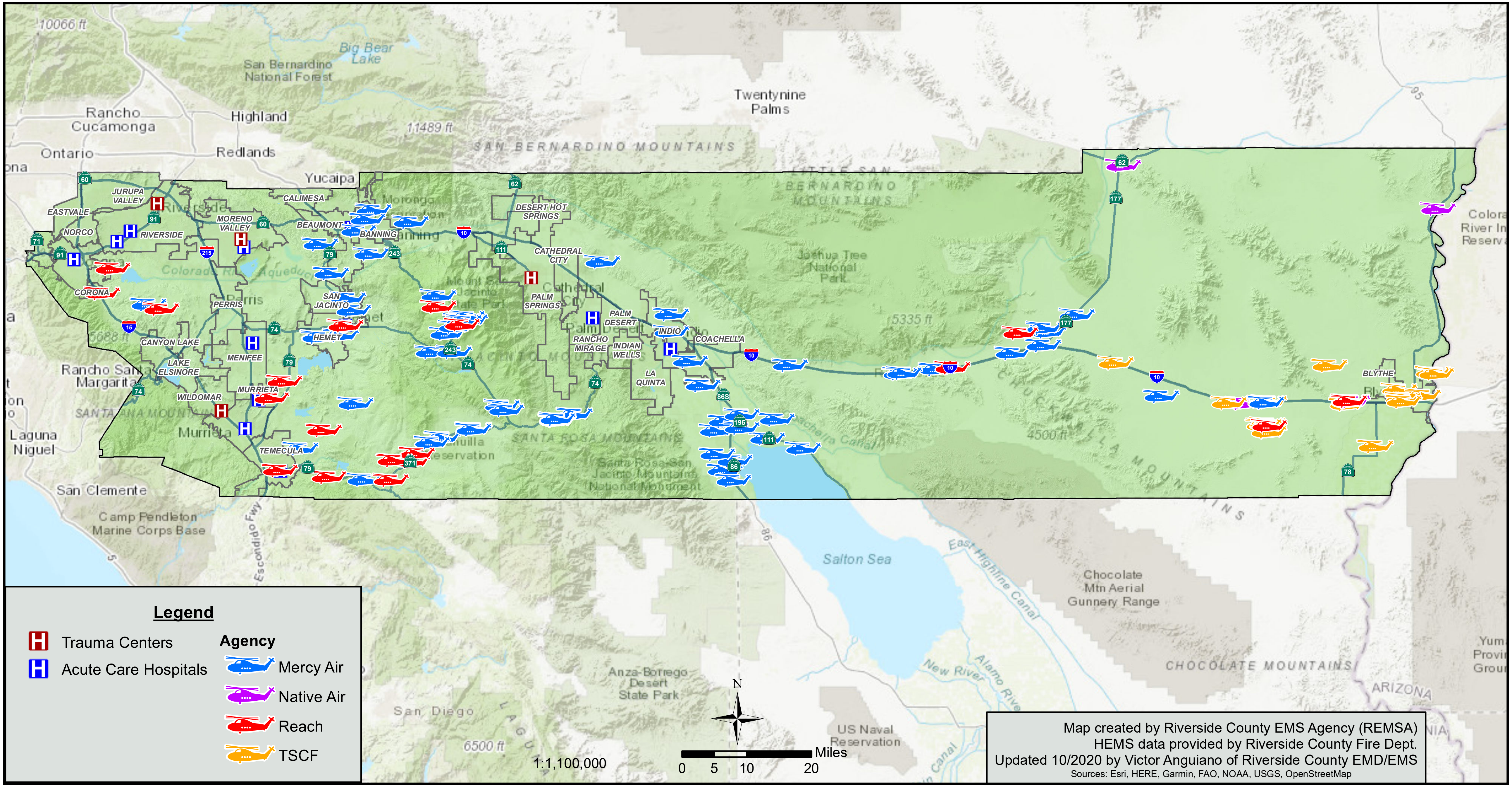
Number of Responses		2019				2020		
		Qtr1	Qtr2	Qtr3	Qtr4	Qtr1	Qtr2	Qtr3
Patient contact time (etimes07-etimes03)	First Response	65	101	94	92	83	85	100
	Ground Transport	47	58	59	55	54	42	66
	Total	**112**	**159**	**153**	**147**	**137**	**127**	**166**
Scene time (etimes09-etimes07)	First Response	22	23	29	20	22	17	22
	Ground Transport	27	30	32	27	26	21	25
	Total	**49**	**53**	**61**	**47**	**48**	**38**	**47**
First CPR to Determination of Death (earrest15-earrest19) Disposition :"Res., attempted, Dead at Scene"	First Response	2	7	6	13	5	8	16
	Ground Transport	1	7	3	8	4	4	12
	Total	**3**	**14**	**9**	**21**	**9**	**12**	**28**
First CPR to Transport (etimes09-earrest19)	Ground Transport	13	14	12	10	12	9	10
Patient contact to transport time (etimes11-etimes07) Dispo= "Patient treated and transported by	Ground Transport	26	28	29	27	24	20	24
Patient contact to detemination of death (earrest15-etimes07)	**First Response**	**14**	**29**	**28**	**67**	**52**	**60**	**69**
	Dead at Scene, No Resuscitation, No Transport	12	16	18	43	38	41	46
	Resuscitation Attempted, Dead at Scene, No Transport	2	13	10	24	14	19	23
	Ground Transport	**3**	**10**	**14**	**27**	**28**	**20**	**35**
	Dead at Scene, No Resuscitation, No Transport	1	3	6	14	16	10	16
	Resuscitation Attempted, Dead at Scene, No Transport	2	7	8	13	12	10	19
		17	**39**	**42**	**94**	**80**	**80**	**104**

RIVERSIDE COUNTY EMS AGENCY

Helicopter EMS Calls by Provider 2020

DRAFT

N = 168 - 167 Within Riverside County



JAMA | Original Investigation

Association of Intra-arrest Transport vs Continued On-Scene Resuscitation With Survival to Hospital Discharge Among Patients With Out-of-Hospital Cardiac Arrest

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IMPORTANCE There is wide variability among emergency medical systems (EMS) with respect to transport to hospital during out-of-hospital cardiac arrest (OHCA) resuscitative efforts. The benefit of intra-arrest transport during resuscitation compared with continued on-scene resuscitation is unclear.

OBJECTIVE To determine whether intra-arrest transport compared with continued on-scene resuscitation is associated with survival to hospital discharge among patients experiencing OHCA.

DESIGN, SETTING, AND PARTICIPANTS Cohort study of prospectively collected consecutive nontraumatic adult EMS-treated OHCA data from the Resuscitation Outcomes Consortium (ROC) Cardiac Epidemiologic Registry (enrollment, April 2011-June 2015 from 10 North American sites; follow-up until the date of hospital discharge or death [regardless of when either event occurred]). Patients treated with intra-arrest transport (exposed) were matched with patients in refractory arrest (at risk of intra-arrest transport) at that same time (unexposed), using a time-dependent propensity score. Subgroups categorized by initial cardiac rhythm and EMS-witnessed cardiac arrests were analyzed.

EXPOSURES Intra-arrest transport (transport initiated prior to return of spontaneous circulation), compared with continued on-scene resuscitation.

MAIN OUTCOMES AND MEASURES The primary outcome was survival to hospital discharge, and the secondary outcome was survival with favorable neurological outcome (modified Rankin scale <3) at hospital discharge.

RESULTS The full cohort included 43 969 patients with a median age of 67 years (interquartile range, 55-80), 37% were women, 86% of cardiac arrests occurred in a private location, 49% were bystander- or EMS-witnessed, 22% had initial shockable rhythms, 97% were treated by out-of-hospital advanced life support, and 26% underwent intra-arrest transport. Survival to hospital discharge was 3.8% for patients who underwent intra-arrest transport and 12.6% for those who received on-scene resuscitation. In the propensity-matched cohort, which included 27 705 patients, survival to hospital discharge occurred in 4.0% of patients who underwent intra-arrest transport vs 8.5% who received on-scene resuscitation (risk difference, 4.6% [95% CI, 4.0%- 5.1%]). Favorable neurological outcome occurred in 2.9% of patients who underwent intra-arrest transport vs 7.1% who received on-scene resuscitation (risk difference, 4.2% [95% CI, 3.5%-4.9%]). Subgroups of initial shockable and nonshockable rhythms as well as EMS-witnessed and unwitnessed cardiac arrests all had a significant association between intra-arrest transport and lower probability of survival to hospital discharge.

CONCLUSIONS AND RELEVANCE Among patients experiencing out-of-hospital cardiac arrest, intra-arrest transport to hospital compared with continued on-scene resuscitation was associated with lower probability of survival to hospital discharge. Study findings are limited by potential confounding due to observational design.

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Supplemental content

CME Quiz at jamacmelookup.com

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Emergency medical services (EMS) personnel follow established guidelines for the treatment of out-of-hospital cardiac arrest (OHCA).[1-5] If, and when, patients without return of spontaneous circulation (ROSC) are transported to the hospital, however, varies considerably by agency and region.[6] Previous data show wide variability in rates of intra-arrest transport, with some EMS agencies transporting nearly all patients regardless of ROSC, while for others this practice is uncommon if ROSC is not achieved.[6]

Interventional clinical trial data comparing strategies of intra-arrest transport vs the same duration of continued on-scene treatment are lacking. Further evidence is required to determine the potential patient outcomes related to transport with ongoing resuscitation compared with continued efforts on scene, especially given the potential risk to paramedic and public safety that may be attributed to intra-arrest transport.[7]

It is unclear if and to what extent resuscitation quality may be altered by transport to hospital.[8,9] However, in EMS systems where full advanced cardiac life support therapies are available at the scene of the cardiac arrest—the same algorithms that are followed in the emergency department—the mechanism of benefit from intra-arrest transport is debatable. A clinical trial, randomizing to either exclusive on-scene resuscitation or transport to the hospital at a prespecified time (if ROSC is not achieved) would offer the best level of evidence but would require a large sample size and would be limited to a constrained number of intra-arrest transport criteria. Hence, this cohort study used the large population-based cardiac arrest cohort from the Resuscitation Outcomes Consortium (ROC). The primary aim was to determine, among adult patients in refractory arrest, the association of intra-arrest transport compared with continuation of on-scene resuscitation, with respect to survival at hospital discharge.

Key Points

Question Is transport to hospital during adult out-of-hospital cardiac arrest resuscitation compared with continued on-scene treatment associated with a difference in survival to hospital discharge?

Findings In this cohort study that used a time-dependent propensity score–matched analysis including 27 705 patients with out-of-hospital cardiac arrest, intra-arrest transport compared with continued on-scene resuscitation had a probability of survival to hospital discharge of 4.0% vs 8.5%, a difference that was statistically significant.

Meaning These results do not support the practice of routinely transporting patients during resuscitation from out-of-hospital cardiac arrest to the hospital.

Methods

Study Design

We performed a secondary analysis from the ROC Cardiac Epidemiologic Registry-Cardiac Arrest OHCA registry. The registry and secondary analyses were approved by research ethics boards for each participating site, which also waived the requirement for informed consent.[10] These data are publicly available from the National Heart, Lung, and Blood Institute Biologic Specimen and Data Repository Information Coordinating Centre, which can be used to replicate the methods of this investigation.

Study Setting and Data Collection

We used a prospective population-based registry of 10 North American study sites that included consecutive EMS-assessed nontraumatic OHCAs between 2005 and 2015.[10] Trained research personnel at individual sites identified OHCA through dispatch logs, patient care records, defibrillator files, and hospital records. Patient characteristics and time-stamped treatments, interventions, and events were recorded according to standard definitions.[11] Chest compression fraction was measured within the first 10 minutes of the professional resuscitation. There were 2 clinical trials which took place during the study period (participants were included in the registry); one comparing continuous vs interrupted chest compressions and the other comparing 2 antiarrhythmic drugs with placebo for refractory ventricular fibrillation.[12,13] Neither of these trials demonstrated a statistically significant benefit in either group under investigation,[12,13] suggesting that a low risk of bias is introduced from inclusion in observational analyses. The registry collected hospital discharge outcomes of survival for all patients and neurological status for clinical trial–enrolled patients, both of which are ascertained from review of patients' medical records.[13] ROC clinical trial patients have demonstrated similar patient characteristics and outcomes when compared with nonenrolled patients.[14]

EMS Medical Care

Out-of-hospital medical care of the ROC EMS agencies consisted of a coordinated effort between fire department first responders, emergency medical technicians, and paramedics trained in basic life support (BLS) alone or in BLS plus advanced life support (ALS).[1,2] All medical care was carried out per local protocols, including decisions of hospital transport and termination of resuscitation.

Study Population and Primary Exposure

We included consecutive EMS-treated patients with nontraumatic OHCA between April 2011 and June 2015. We included patients as of April 2011 as there were differences in data definitions prior to this date and not after June 2015 as the ROC registry was discontinued (the data used in this study are the most recent data available in this registry). Follow-up for each patient was continued until the date of hospital discharge or death, regardless of when either event occurred. The registry included 192 EMS agencies grouped into 44 treatment regions to achieve a similar number of patients per region and to consolidate overlapping EMS agencies with similar treatment practices. OHCA was defined as persons found apneic and without a pulse who received one of the following interventions: (1) external defibrillation by bystanders or EMS; or (2) chest compressions from EMS.[10] Patients with the following characteristics were excluded: (1) age younger than 18 years; (2) those in whom resuscitative efforts were ceased when a do-not-resuscitate order was discovered; (3) transport was initiated prior to the cardiac arrest; (4) missing time data required to classify as intra-arrest transport or to classify the primary outcome; and, (5) with missing variables required for the propensity score analysis. The primary variable of interest was intra-arrest transport, defined as transport to the hospital initiated prior to any episodes of ROSC. All other patients were classified as receiving on-scene resuscitation.

Outcome Measures and Variable Definitions

The primary end point was survival to hospital discharge. The secondary end point was survival with favorable neurological outcome, defined as a modified Rankin scale of less than 3 at hospital discharge (range: 0, no symptoms or disability; 3, moderate disability, requires some help but able to walk without assistance; 6, death).[11] The definition for ROSC was a palpable pulse for any duration.[11] Time intervals for resuscitation events were calculated between the time that EMS commenced resuscitation and the time the event occurred.

Statistical Analysis

We used R (Foundation for Statistical Computing, Vienna, Austria) for analysis. Categorical variables were reported as counts (frequencies) and continuous variables as means (with standard deviation). Standardized mean differences were used to compare patients excluded due to missing data with the full study cohort. A *P* value of less than .05 was considered a significant result for all analyses.

Primary Analysis

For primary analyses, a time-dependent propensity score analysis was used (based on a model design previously described).[15-17] This methodology accounts for resuscitation time bias in which those eligible for intra-arrest transport have already failed initial resuscitative efforts, which is a predictor of poor outcomes.[18] The linear component of a Cox proportional hazards model was used to generate time-dependent propensity scores for intra-arrest transport assignment (the dependent variable). The following potential confounders of the treatment-outcome relationship were included in the model: patient age, sex, episode location (public vs not), witnessed status (bystander vs EMS vs not witnessed), bystander CPR performed (vs not), interval from 911 call to EMS arrival, initial EMS-recorded rhythm (shockable or nonshockable), etiology (presumed cardiac vs obvious noncardiac cause), ALS unit first on scene (vs not), and treatment region.[11] The proportional hazards assumption was assessed using residual plots. Patients were then paired using a time-dependent, nearest-neighbor, propensity score-matching algorithm using a maximum caliper of 0.01 standard deviations. A given intra-arrest patient (exposed) was matched (1:1) to the closest propensity score within a caliper that was still undergoing on-scene resuscitation (unexposed); ie, at risk of intra-arrest transport regardless of subsequent treatment when the given patient was transported. Exposed patients without possible matches were excluded. In the same fashion, the remaining unexposed patients were then matched with previously matched exposed patients (1 exposed patient could be matched with multiple unexposed patients). Standardized mean differences were calculated (using the stddiff package in R) for patient characteristics. The matched set was used to calculate risk differences (RDs) using the standard method for a difference between proportions, and a modified Poisson regression model with robust standard errors[19,20] was fit to estimate the association between intra-arrest transport and survival to hospital discharge, expressed as a risk ratio (RR). We repeated this analysis for the secondary end point of survival with favorable neurological outcome, including clinical trial-enrolled patients for whom neurological status data were available. We used all available patients from the registry and thus did not perform a power calculation.

Secondary Analyses

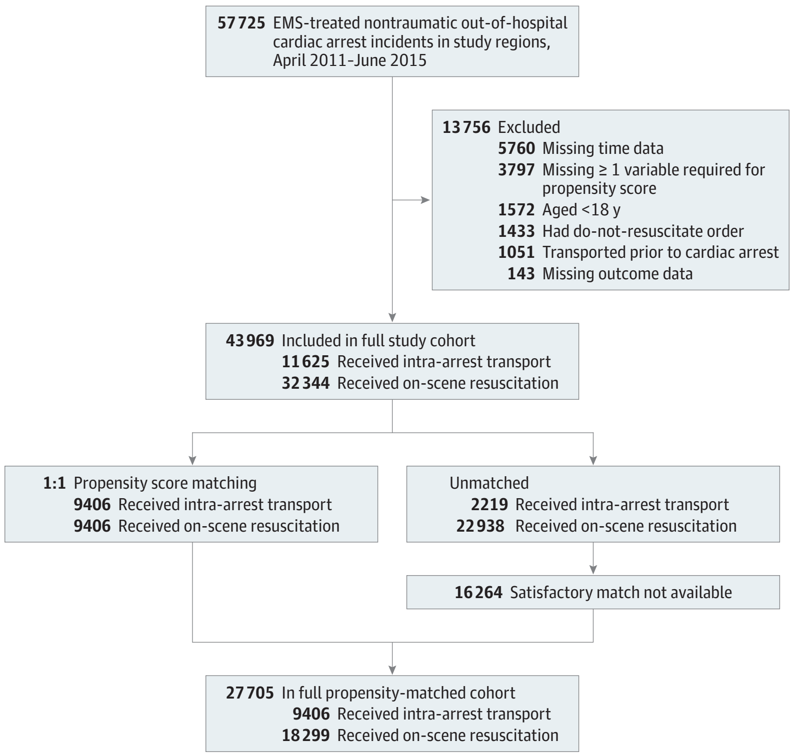
To investigate whether the association between to hospital discharge and intra-arrest transport varied depending on the time of transport, we repeated the analysis and included an interaction term between the intra-arrest transport variable and the time of matched exposure to transport. We then repeated the analysis within 5-minute time-based epochs defined by the time of matching. Because of the potential for type I error due to multiple comparisons, findings for analyses of secondary end points and subgroup analyses should be interpreted as exploratory.

We examined subgroups based on several categories: by EMS level of care (ALS first, BLS first then ALS, BLS only), EMS-witnessed status, initial cardiac rhythm, treatment with a mechanical CPR device, and study site. In addition, we created subgroups based on the universal termination of resuscitation rule[21,22]: (1) patients with EMS-witnessed arrests or initial shockable rhythm; and (2) patients with arrests that were not EMS witnessed and had initial nonshockable rhythms. All patients in this analysis were without a pulse. The initial cardiac rhythm category was used instead of grouping by any shock delivered (as stipulated in the rule) so that patients would not require reclassification at different time junctures of the resuscitation. Comparisons of subgroups were performed using robust Wald tests for interaction terms in the Poisson regression models.

Sensitivity Analyses

The primary analysis was repeated with the 1:1 propensity-matched cohort. Although a smaller cohort, as these patients were matched first, the comparator groups were more closely aligned. Second, although the treatment region was included in the propensity score, we repeated the primary analysis with a random-effects Poisson regression model fit by maximum likelihood with site as a random effect. In a third sensitivity analysis, we repeated the primary analysis and included cases that were excluded due to missing data and conducted multiple imputation using 5 hot-deck imputations based on all variables used in the analysis.

Figure 1. Flow of Participants in a Study of Intra-arrest Transport vs On-Scene Resuscitation in Patients With Out-of-Hospital Cardiac Arrest



EMS indicates emergency medical system. Unmatched on-scene resuscitation patients were matched with the best possible intra-arrest transport patient within 1 caliper. Of the 9406 intra-arrest transport patients in the full matched set, 6025 were matched with 1 on-scene resuscitation patient, 1024 were matched with 2 on-scene resuscitation patients, and the remaining 2357 were matched with 3 or more on-scene resuscitation patients.

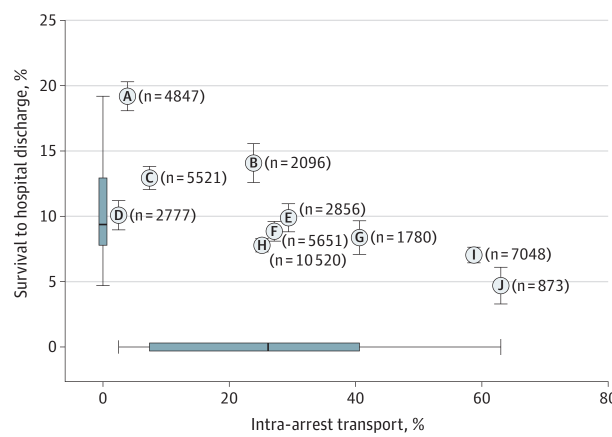
Results

Characteristics of Study Patients

A total of 57 725 consecutive OHCAs were treated by EMS in the study regions (**Figure 1**) between April 2011 and June 2015 (inclusive). eTable 1 in the Supplement shows characteristics of patients excluded due to missing data. After exclusions, 43 969 patients were included in this study, of whom 11 625 (26%) underwent intra-arrest transport and 32 344 (74%) were treated with on-scene resuscitation until ROSC or termination of resuscitation. **Figure 2** demonstrates the variability among the 10 study sites with respect to intra-arrest transport and overall survival to hospital discharge. The median duration of transport from the scene to the hospital was similar between study sites (eTable 2 in the Supplement), with an overall median of 9.9 minutes (interquartile range [IQR], 6.8-13.4).

Table 1 shows patient characteristics of the full study cohort, dichotomized by whether the patient was treated with intra-arrest transport or on-scene resuscitation until termination of resuscitation or ROSC. Survival to hospital discharge was 3.8% for patients who received intra-arrest transport and 12.6% for those who received on-scene resuscitation (**Table 2**). Overall, the mean (SD) duration of attempted out-of-hospital resuscitation was 21.8 (11.8) minutes. A total of 17 468 (40%) achieved out-of-hospital ROSC, and 18 373 (42%) had medical care terminated in the out-of-hospital setting. Among those

Figure 2. Relationship Between Overall Survival by Study Site and the Proportion of Patients Treated With Intra-arrest Transport Using the Full Study Cohort (N = 43 969)



Study sites are ordered by overall survival, from A to J. Numbers in parentheses indicate the number of patients from each study site; error bars indicate 95% CIs for the proportion of survival at hospital discharge. Box plots display the median (solid line in the box), interquartile range (ends of the box), and range (whiskers) of unadjusted study site proportions for survival and intra-arrest transport. Point locations for E and F are minimally adjusted to avoid overlap.

treated with intra-arrest transport 1834/11 625 (16%) achieved ROSC prior to hospital arrival. Of the 446 intra-arrest transport survivors, 265 (59%) achieved ROSC between the times

Table 1. Patient Characteristics of the Full Study Cohort and Full Propensity-Matched Cohort[a]

	Full study cohort			Full propensity-matched cohort[b]		
	No. (%)			No. (%)		
	Intra-arrest transport (n = 11 625)	On-scene resuscitation (n = 32 344)	Absolute difference (95% CI)[c]	Intra-arrest transport (n = 9406)[d]	On-scene resuscitation (n = 18 299)[e]	Standard mean difference[f]
Sex						
Women	3943 (33.9)	12 141 (37.5)	−3.6 (−4.6 to −2.6)	3213 (34.2)	6551 (35.8)	0.034
Men	7682 (66.1)	20 203 (62.5)	3.6 (2.6 to 4.6)	6193 (65.8)	11 748 (64.2)	0.034
Age, mean (SD), y	63.9 (17.2)	67.1 (17.0)	−3.2 (−3.6 to −2.8)	64.2 (17.2)	66.8 (16.7)	0.156
Private location	9125 (78.5)	28 624 (88.5)	−10.0 (−10.8 to −9.2)	7537 (80.1)	15 509 (84.8)	0.122
Witness status						
Bystander	4609 (39.6)	12 129 (37.5)	2.1 (1.1 to 3.2)	3692 (39.3)	7239 (39.6)	0.167
EMS	2035 (17.5)	2705 (8.4)	9.1 (9.9 to 8.4)	1557 (16.6)	2021 (11.0)	
None	4981 (42.8)	17 510 (54.1)	−11.3 (−12.3 to −10.2)	4157 (44.2)	9039 (49.4)	
Bystander CPR	4509 (47.0)[g]	15 014 (50.7)[g]	−7.6 (−8.7 to −6.6)	3706 (47.2)[g]	8163 (50.1)[g]	0.059
Dispatch to EMS interval, mean (SD), min	5.8 (2.8)	5.9 (3.0)	−0.1 (−0.2 to −0.03)	5.8 (2.8)	5.9 (2.7)	0.024
EMS level of care						
BLS only[h]	473 (4.1)	674 (2.1)	2.0 (1.6 to 2.4)	450 (4.8)	235 (1.3)	0.272
ALS[h]						
Administered first	7252 (62.4)	12 320 (38.1)	24.3 (23.3 to 25.3)	5603 (59.6)	9709 (53.1)	
Administered later	3900 (33.5)	19 350 (59.8)	−26.3 (−27.3 to −25.3)	3353 (35.6)	8355 (45.7)	
Initial cardiac rhythm						
VF/VT	3028 (26.0)	6541 (20.2)	5.8 (4.9 to 6.7)	2401 (25.5)	4045 (22.1)	0.122
PEA	3424 (29.5)	7445 (23.0)	6.4 (5.5 to 7.4)	2673 (28.4)	4758 (26.0)	
Asystole	4856 (41.8)	16 737 (51.7)	−10.0 (−11.0 to −8.9)	4039 (42.9)	8756 (47.8)	
No shock advised	317 (2.7)	1621 (5.0)	−2.3 (−2.7 to −1.9)	293 (3.1)	740 (4.0)	
Presumed cardiac etiology	10 897 (93.7)	30 028 (92.8)	0.9 (0.4 to 1.4)	8810 (93.7)	17 213 (94.1)	0.017
Chest compression fraction, mean (SD)	0.81 (0.13)	0.83 (0.12)	−0.02 (−0.02 to −0.02)	0.81 (0.13)	0.82 (0.12)	0.119
Out-of-hospital resuscitation duration, mean (SD), min[i]	29.3 (11.4)	19.1 (10.7)	10.2 (10.0 to 10.4)	29.1 (11.1)	22.9 (11.1)	0.552
ROC study site[j]						
A	188 (3.9)	4659 (96.1)		178 (23.8)	569 (76.2)	0.396
B	500 (23.9)	1596 (76.1)		427 (26.3)	1199 (73.7)	
C	407 (7.4)	5114 (92.6)		392 (25.4)	1152 (74.6)	
D	69 (2.5)	2708 (97.5)		64 (23.6)	207 (76.4)	
E	810 (28.4)	2046 (71.6)		673 (26.2)	1896 (73.8)	
F	1589 (28.1)	4062 (71.9)		1395 (30.9)	3116 (69.1)	
G	723 (40.6)	1057 (59.4)		512 (36.4)	895 (63.6)	
H	2649 (25.2)	7871 (74.8)		2371 (29.4)	5693 (70.6)	
I	4140 (58.7)	2908 (41.3)		2996 (49.1)	3109 (50.9)	
J	550 (63.0)	323 (37.0)		398 (46.2)	463 (53.8)	

Abbreviations: ALS, advanced life support; BLS, EMS unit with basic life support training; CPR, cardiopulmonary resuscitation; EMS, emergency medical system; PEA, pulseless electrical activity; ROC, Resuscitation Outcomes Consortium; VF/VT, ventricular fibrillation or pulseless ventricular tachycardia.

[a] Of the 9406 exposed patients in the matched set, 6025 were matched with 1 unexposed patient, 1024 were matched with 2 unexposed patients, and the remaining were matched with at least 3 unexposed patients. All proportions were rounded to 1 decimal place (indicating totals may not sum to exactly 100%).

[b] Propensity score matching was conducted using patient age, sex, episode location, witnessed status (bystander vs EMS vs not witnessed), bystander CPR, interval from 9-1-1 call to EMS arrival, initial shockable rhythm, presumed cardiac etiology, ALS unit first on scene, and treatment region.

[c] Absolute differences were calculated as a percent for categorical data and as mean differences for continuous data.

[d] Intra-arrest patients in the propensity score cohort were categorized as exposed.

[e] On-scene resuscitation patients in the propensity score cohort (categorized as unexposed) indicate that this was the treatment strategy at the time of matching; 11.9% of patients later underwent intra-arrest transport.

[f] The standard mean difference was calculated for variables used in the propensity score.

[g] The denominator indicates the number of cardiac arrests not witnessed by EMS.

[h] Indicates an EMS unit with ALS or BLS level of training.

[i] Measured from the commencement of professional resuscitation until either ROSC, termination, or arrival at the hospital.

[j] Indicates percent of a row's total.

Table 2. Patient Outcomes of the Full Study Cohort and Full Propensity-Matched Cohort

	Full study cohort			Full propensity-matched cohort[a]		
	No. (%)			No. (%)		
	Intra-arrest transport (n = 11 625)	On-scene resuscitation (n = 32 344)	Absolute difference (95% CI)[b]	Intra-arrest transport (n = 9406)	On-scene resuscitation (n = 18 299)[c]	Absolute difference (95% CI), %
Primary end point						
Survival to hospital discharge	446 (3.8)	4072 (12.6)	−8.8 (−8.3 to −9.3)	372 (4.0)	1557 (8.5)	−4.6 (−5.1 to −4.0)
Secondary end point						
Survival with favorable neurological outcome	162 (2.6)[d]	2000 (10.2)[d]	−7.6 (−8.2 to −7.0)	148 (2.9)[d]	733 (7.1)[d]	−4.2 (−4.9 to −3.5)
Additional end points						
Out-of hospital return of spontaneous circulation	1834 (15.8)	15 634 (48.3)	−32.6 (−33.4 to −31.7)	1522 (16.2)	7199 (39.3)	−23.2 (−24.2 to −22.1)
Interval, mean (SD), min[e]	32.9 (11.4)	23.3 (10.1)	9.6 (9.4 to 9.8)	33.0 (11.5)	25.3 (10.1)	7.7 (7.4 to 8.0)
Out-of-hospital termination of resuscitation	29 (0.2)	18344 (56.7)	−56.5 (−57.0 to −55.9)	25 (0.3)	9937 (54.3)	−54.0 (−54.8 to −53.3)
Interval, mean (SD), min[f]	35.4 (14.8)	23.9 (11.0)	11.5 (11.2 to 11.8)	36.1 (15.3)	26.1 (10.0)	10.0 (9.7 to 10.3)
Survival to hospital admission[g]	2226 (19.1)	9950 (30.8)	−11.6 (−12.5 to −10.7)	1815 (19.3)	4532 (24.8)	−5.5 (−6.5 to −4.5)
Hospital stay, mean (SD), d	5.4 (7.3)	6.6 (10.5)	−1.2 (−1.4 to −0.99)	5.4 (7.3)	6.6 (10.3)	−1.2 (−1.4 to −0.97)

[a] Propensity score matching was conducted using patient age, sex, episode location, witnessed status (bystander vs EMS vs not witnessed), bystander cardiopulmonary resuscitation, interval from 9-1-1 call to emergency medical systems arrival, initial shockable rhythm, presumed cardiac etiology, advanced life support unit first on scene, and treatment region. Patients in the intra-arrest transport group were categorized as exposed, and those in the on-scene resuscitation group were categorized as unexposed.

[b] Absolute differences were calculated as a percent for categorical data and as mean differences for continuous data.

[c] On-scene resuscitation patients in the propensity score cohort indicate that this was the treatment strategy at the time of matching; 11.9% of patients later underwent intra-arrest transport.

[d] The denominator indicates patients with data available for neurological outcomes. For the full study cohort the denominator was 6223 for intra-arrest transport and 19 636 for on-scene resuscitation, and for the full propensity-matched cohort, the denominator was 5066 for intra-arrest transport and 10 317 for on-scene resuscitation.

[e] Measured from the commencement of professional resuscitation until time of return of spontaneous circulation.

[f] Measured from the commencement of professional resuscitation until time of out-of-hospital termination of resuscitation. For the intra-arrest transport patients, this only applies to those who had termination of resuscitation after leaving the scene but before arriving to the hospital.

[g] Patient survived until hospital admission from the emergency department.

of scene departure and hospital arrival. Of intra-arrest transport survivors who were transported after 30 minutes, 61% achieved ROSC prior to hospital arrival.

Primary Analysis

Using a propensity score, 9406/11 625 of the exposed patients (81%) were matched in a 1:1 ratio to unexposed patients (eTable 3 in the Supplement). Remaining unexposed patients were then resampled and an additional 8893 unexposed patients were matched, resulting in a total of 27 705 unique patients in the full propensity-matched cohort analysis (9406 exposed and 18 299 unexposed patients; Table 1). The median time of matching was 18.4 minutes (IQR, 12.5-24.9). The assumptions of the proportional hazards model were met. Overall, survival to hospital discharge was lower among patients treated with intra-arrest transport (372/9406 [4.0%]) compared with continued on-scene resuscitation (1557/18 299 [8.5%]), and the risk difference was 4.6% (95% CI, 4.0-5.1) with an adjusted risk ratio of 0.48 (95% CI, 0.43-0.54) (**Figure 3**; eTable 4 in the Supplement). Among the 15 383 matched patients with available neurological outcome data, survival with favorable neurological outcome was lower among patients treated with intra-arrest transport (148/5066 [2.9%]) compared with continued-on scene resuscitation (733/10 317 [7.1%]), and the risk difference was 4.2% (95% CI, 3.5-4.9) with an adjusted risk ratio of 0.60 (95% CI, 0.47-0.76).

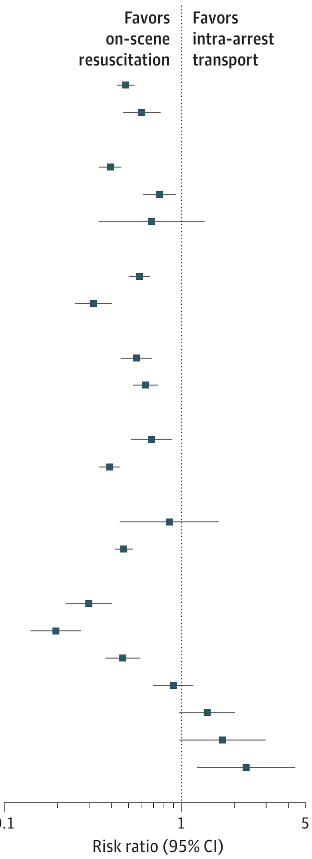
Secondary Analyses

The interaction term between exposure status and the time of matching was statistically significant (P = .001), indicating that the association of intra-arrest transport and survival to hospital discharge varied depending on the timing of transport. Figure 3 displays the association of intra-arrest transport and survival to hospital discharge within time-based epochs defined by the time between start of EMS resuscitation and time of matching.

Intra-arrest transport was significantly associated with a lower probability of survival to hospital discharge within the subgroups of ALS first, ALS second, EMS witnessed, not EMS witnessed, initial shockable cardiac rhythm, and initial nonshockable cardiac rhythm. The combined categories of (1) EMS-witnessed or an initial shockable rhythm, and (2) not EMS-witnessed and initial nonshockable rhythm both showed a significant association between intra-arrest transport and a lower probability of survival to hospital discharge. There was no significant association seen in the BLS-only and mechanical CPR-treated subgroups; however, these analyses were limited by a low sample size. Within subgroups defined by study site (eTable 5 in the Supplement), intra-arrest transport was associated with a significantly lower probability of survival to hospital discharge for 7 sites, neutral results were observed for 2 subgroups (both with point estimates favoring on-scene resuscitation), and intra-arrest transport was associated with

Figure 3. Adjusted Analyses Examining the Association of Intra-arrest Transport and Survival Among the Full Propensity-Matched Cohort and Subgroups

	No. of events/patients			
	On-scene resuscitation	Intra-arrest transport	Risk ratio (95% CI)	Interaction *P* value
Full cohort	1557/18 299	372/9406	0.48 (0.43-0.54)	
Neurological outcome	733/10 317	148/5066	0.60 (0.47-0.76)	
EMS level of care				.001
ALS first	936/9709	213/5603	0.40 (0.34-0.46)	
ALS second	599/8355	143/3353	0.75 (0.61-0.93)	
BLS only	22/235	16/450	0.68 (0.34-1.35)	
EMS witnessed				.001
Yes	313/2021	98/1557	0.58 (0.50-0.66)	
No	1244/16 278	274/7849	0.32 (0.25-0.41)	
Initial shockable rhythm				.38
Yes	1101/4045	230/2401	0.55 (0.45-0.68)	
No	456/14 254	142/7005	0.63 (0.53-0.74)	
EMS witnessed or shockable				.001
Yes	1272/5727	293/3753	0.68 (0.52-0.89)	
No	285/12 572	79/5653	0.39 (0.34-0.45)	
Mechanical chest compressions				.08
Yes	47/832	19/505	0.85 (0.45-1.62)	
No	1510/17 467	353/8901	0.47 (0.42-0.53)	
Time-based epochs. min				.001
0-5	490/1319	49/411	0.30 (0.22-0.41)	
5-10	472/2013	45/849	0.20 (0.14-0.27)	
10-15	341/3619	96/1757	0.47 (0.37-0.59)	
15-20	145/3815	86/2031	0.90 (0.69-1.17)	
20-25	65/3322	51/1837	1.40 (0.97-2.01)	
25-30	27/2112	25/1220	1.70 (0.97-2.98)	
>30	17/2099	20/1301	2.31 (1.22-4.38)	



The primary outcome for all analyses is survival to hospital discharge, with the exception of the "neurological outcome" subgroup, for which the outcome variable is survival with favorable neurological outcome, defined as Modified Rankin Scale score <3. The *P* value for interaction is between intra-arrest transport and a subgroup. Time-based epochs include intra-arrest transport patients who were transported during that time interval (measured from the onset of EMS-commenced resuscitation) and the on-scene resuscitation patients whom they were matched to. The right end points are included in the time interval. ALS indicates advanced life support; BLS, basic life support; EMS, emergency medical systems.

a significantly higher probability of survival to hospital discharge for 1 site. There was statistically significant interaction for EMS level of care (*P* = .001), EMS witnessed status (*P* = .001), the combination of EMS-witnessed or shockable initial rhythm (*P* = .001), and study site (*P* < .001). There were no subgroup differences detected according to initial shockable rhythm (*P* = .38) or mechanical chest compression use (*P* = .08).

Sensitivity Analyses

The analysis of the 1:1 propensity-matched cohort (eTable 3 in the Supplement) was consistent with the primary analysis that survival to hospital discharge was lower among patients treated with intra-arrest transport compared with continued on-scene resuscitation (372/9406 [4.0%] vs 763/9406 [8.1%]; adjusted risk ratio, 0.49 [95% CI, 0.43-0.55]). The analysis with adjustment for site as a random effect (adjusted risk ratio, 0.46 [95% CI, 0.41-0.52]; estimated SD for random effects, 1.01) and the analysis with multiple imputation that incorporated the 9700 cases excluded due to missing data (adjusted risk ratio, 0.48 [95% CI, 0.43-0.54]) were both also consistent with the primary analysis.

Discussion

In this large multicenter time-dependent propensity score-matched cohort study of patients experiencing out-of-hospital cardiac arrest, intra-arrest transport to the hospital compared with continued on-scene treatment was significantly associated with a lower probability of survival to hospital discharge. Likewise, intra-arrest transport was significantly associated with a lower probability of survival to hospital discharge with favorable neurological outcome.

Consistent with a previous analysis, these data demonstrate a marked heterogeneity in intra-arrest transport practices across EMS systems.[6] Although important differences in management may be expected between systems with variable structure and history,[23,24] all EMS systems in this study had the same basic structure (strengthening internal validity) with protocols based on American Hospital Association guidelines and response teams with BLS-trained and ALS-trained personnel (without out-of-hospital physicians).[25,26] Given the statistically significant association between intra-arrest transport and lower survival to hospital discharge and the variability in resuscitation practices across ROC sites, the current results provide a potential explanation, in part, for why survival may differ markedly across the network sites.[27] Overall, despite more favorable characteristics among those treated with intra-arrest transport, intra-arrest transport was significantly associated with adverse outcomes, supporting a strategy that EMS dedicate effort and expertise on scene rather than prioritizing transport to hospital. The majority of survivors treated with intra-arrest transport achieved ROSC prior to arriving at the hospital, raising questions about the hospital-based contributions to intra-arrest transport survivors.

This analysis examined subgroups for which early hospital transport might be considered potentially advantageous (ie, those with favorable phenotypes such as shockable rhythms or EMS-witnessed arrests). Despite smaller sample sizes, the significant adverse association between intra-arrest transport and outcomes was consistent with the primary analysis. When examining subgroups defined by EMS level of care, outcomes among ALS-treated subgroups were consistent with the primary analysis. The analysis did not detect a significant association within the BLS-only subgroup, however this subgroup was limited by a small sample size.

In a secondary analysis, the association of intra-arrest transport and survival to hospital discharge varied within differing times of matched exposure. The following differing strata, defined by exposure match time, were explored: (1) within the first 15 minutes intra-arrest transport was associated with significantly decreased survival; (2) between 15 and 30 minutes results were neutral; (3) but the greater than 30-minute strata showed a significant association with improved survival. These findings raise the possibility that the overall association of intra-arrest transport and worse outcomes may be driven by a detrimental effect of intra-arrest transport early in the resuscitation, with benefit from intra-arrest transport after 30 minutes. However, patients who received intra-arrest transport were treated with significantly longer attempts of out-of-hospital resuscitation. This may lead to a particularly important bias when comparing patients within time-based strata late in the resuscitation: those chosen for intra-arrest transport underwent a median of 10 additional minutes of resuscitation attempts while en route to hospital (and likely further efforts in hospital); whereas patients who received on-scene resuscitation were likely declared dead soon after (given the mean duration until termination of 26 minutes). Furthermore, of those who received intra-arrest transport after 30 minutes and who survived, two-thirds were successfully resuscitated prior to hospital arrival.

There are several possible explanations for the overall adverse association of transport prior to ROSC. Although there are novel hospital-based resuscitation strategies (such as extracorporeal CPR[28]) that may ultimately advance resuscitation in select subgroups, in many settings, conventional advanced life support resuscitation can be fully implemented in the out-of-hospital setting so that there is no clear hospital-based advantage. Thus the logistical obstacle of moving the patient with ongoing resuscitation may impair or delay best practices including CPR quality. Extrication and transport may impair quality of manual compression, which has been demonstrated in some studies[8,29]; whereas it was not observed in another EMS.[9] Data on chest compression fraction or other measures of CPR quality during the extrication period were not available. The physical tasks of patient movement may also interfere or delay resuscitative maneuvers such as defibrillation or drug delivery. Transport during an active resuscitation may also produce a cognitive distraction and inhibit a paramedic's ability to deliver high-quality resuscitative efforts and treat possible reversible causes.

The study cohort did not contain data on hospital-based invasive resuscitative techniques such as extracorporeal CPR,[28] intra-arrest coronary angiography,[30] or advanced monitoring techniques.[31] However, it is likely that the majority of patients in the cohort who arrived at the hospital without a pulse were treated with continued standard management by advanced cardiac life support. Likely only a small number of patients with ongoing resuscitation at the hospital would have been considered eligible for novel invasive treatments,[32,33] though these select patients groups in refractory arrest may benefit from early transport for hospital-based invasive strategies. Data are not currently available to inform this hypothesis. Based on data from this study, caution may be warranted with regards to changes in EMS policy favoring routine intra-arrest transport for the purpose of extracorporeal CPR candidacy assessment at the hospital as most will likely prove ineligible, and overall survival statistics may actually worsen. Rather, in settings evaluating extracorporeal CPR provision for OHCA, systems might consider applying eligibly criteria prior to transport, which may mitigate these risks. Further study is required to determine the efficacy of intra-arrest transport plus extracorporeal CPR compared with exclusive on-scene resuscitation.[34] Alternatively, out-of-hospital on-scene initiation of extracorporeal CPR may benefit from access to mechanical perfusion without the risks of hospital transport.[35]

Limitations

This study has several limitations. First, results of this investigation are limited to association, not causation. Ideally the results should be validated in a randomized evaluation. Second, although these data originated from a North American collaboration with wide variability in transport practices, external validity may not be generalizable to systems with differing patient characteristics and medical management (including physician-based EMS systems). Specifically, as out-of-hospital ALS was utilized in the majority of patients, the results may not be valid in BLS-only resuscitations. Third, these results cannot be extended to patients treated with mechanical CPR (because of the low prevalence in the study sample) or for those treated with novel invasive resuscitative techniques. Fourth, other characteristics of rescue personnel or patients not available for this analysis may have influenced the probability of both intra-arrest transport and outcomes. EMS personnel may have used certain patient characteristics to estimate benefit from intra-arrest transport (leading to confounding by indication). Intra-arrest transport may also have been associated with more aggressive resuscitative efforts by rescuers (intra-arrest transport patients had longer durations of resuscitation attempted in the out-of-hospital setting, in addition to further hospital-based efforts). Fifth, these results are subject to prognostication bias; patients with unfavorable phenotypes may have had resuscitation terminated early, without adequate opportunity to achieve ROSC. Sixth, the analysis design compared those transported at a certain time juncture with those not transported at that juncture. For this reason, 12% of patients in the unexposed group actually underwent intra-arrest transport at a later time point, which may have affected the ability to see the true association. Seventh, misclassification of time data may have affected the results. Eighth, in the full propensity-matched set, not all individual variables were aligned between groups; exposed patients demonstrated more favorable prognostic features (were younger, more with initial shockable rhythms in public locations and EMS witnessed), which may have biased the results toward intra-arrest transport. Ninth, 9 of the 10 site-based subgroups had point estimates suggesting a harmful association of intra-arrest transport; whereas 1 subgroup had point estimates in the direction of protection (although the low sample sizes for this subgroup may have made the result less reliable). It is possible that within certain system characteristics, intra-arrest transport may be of benefit. Tenth, it was assumed that missing data was missing at random, which may not have been the case. Eleventh, the data from this study were collected from 2011 to 2015, and it is uncertain whether these results are fully applicable to out-of-hospital resuscitation and in-hospital post cardiac arrest care in 2020.

Conclusions

Among patients experiencing out-of-hospital cardiac arrest, intra-arrest transport to hospital compared with continued on-scene treatment was associated with lower probability of survival to hospital discharge. Study findings are limited by potential confounding due to observational design.

ARTICLE INFORMATION

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Author Contributions: Drs Leroux and Kime had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Concept and design: Grunau, Kime, van Belle, Menegazzi, Kudenchuk, Vaillancourt, Morrison, Elmer, Austin, Richmond, Herren.
Acquisition, analysis, or interpretation of data: Grunau, Kime, Leroux, Rea, van Belle, Menegazzi, Kudenchuk, Vaillancourt, Morrison, Elmer, Le, Richmond, Herren, Christenson.
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Statistical analysis: Kime, Leroux, van Belle, Elmer.
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Supervision: Rea, Kudenchuk, Richmond, Christenson.

Conflict of Interest Disclosures: Dr Grunau is the principal investigator of a clinical trial investigating the benefit of intra-arrest transport to hospital for extracorporeal CPR initiation (NCT02832752). Dr Grunau has received speaking honorarium from Stryker Corp. Dr Menegazzi is supported by grant 1RO1HL117979 from the National Heart, Lung, and Blood Institute. In his laboratory, he uses a monitor/defibrillator loaned to him by Zoll Medical Corporation, and a mechanical chest compression device loaned to him by Stryker Corp. He has no financial interest in either of these 2 companies. Dr Morrison received salary support from the National Institutes of Health (NIH) for the duration of the Resuscitation Outcomes Consortium–funded network. She holds peer-reviewed grants in cardiac arrest resuscitation from the Canadian Institute of Health Research and the Heart and Stroke Foundation of Canada. Dr Elmer has support from the NIH through grants 5K12HL109068 and 1K23NS097629. Dr Kudenchuk is the primary investigator of the National Institute for Neurological Disorders and Stroke Strategies to Innovate Emergency Care Clinical Trials Network (NINDS-SIREN). No other disclosures were reported.

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FOR CONSIDERATION BY PMAC

DATE: November 16, 2020

TO: PMAC

FROM: Dustin Rascon, EMS Specialist

SUBJECT: Education / Policy Update

4000 Series Changelog

Additions:

- Adult dosing re-added to all treatment protocols
- Creation of 100 series, which includes:
  - Policy #101 – REMSA Approved Definitions (formerly Policy #9101)
  - Policy #102 – REMSA Approved Abbreviations
  - Policy #103 – Ready to Print Manual
- Creation of a weight conversion matrix – Policy #4103 (lbs to kgs and vice-versa)
- Creation of a Skills List for all certification levels in Riverside County – Policy #4104. Replaces all applicable skills listed in the Universal Patient Protocol as well as in all Performance Standards

Modifications:

- Complete change in treatment protocol format to reflect a more prescriptive, user-friendly and complete appearance
- Calculation chart changed from portrait to landscape view for better flow and ease of reading
- Categories realigned, and renamed, to better reflect the treatment protocols contained therein
  - Introduction of a General Medical category and an Environmental category (see updated Table of Contents below)
- Reviewed all verbiage to ensure consistency throughout and changed commonly used abbreviations and medical shorthand as necessary
- Modified the verbiage in 4103 (*4102*), specifically for pediatric Ketamine admin, from “None” to “Not permitted” to provide further clarity
- Moved Policy #9101 - Definitions to new the 100 series (Policy #101) and modified / updated it as needed
- Modified all instances of the term “endotracheal intubation” and replaced it with “orotracheal intubation” to ensure accurate terminology
- Clarified and re-enforced the use of colormetrics in airway management and orotracheal intubation
- Clarified verbiage regarding when EMTs can perform glucometry and when they can subsequently administer oral glucose
- Clarified appropriate routes for $CaCL_2$ administration in toxic exposures
- Clarified appropriate routes for Atropine administration in OPP exposures
- Clarified the correct amount of NS to infuse Mag into in Pre-eclampsia and Eclampsia

Removals:

FOR CONSIDERATION BY PMAC

- 4102 - Universal Patient Protocol (incorporated all necessary aspects into the protocol directly, the Skills List or both)
- 7201 – Purpose Statement (Intro to Performance Standards)
- Policies 7301 through 7602 – Performance Standards (to better align with REMSA's stance that the policy manual be more prescriptive and less educational)
- 9102 - References
- Removal of verbiage "*May repeat with a base hospital order (BHO)*" in policies 4301 and 4302 regarding repetition of TXA after the initial dose
- Removed further instances of the term "Broselow Tape" that were found
- Removed further references to King Airway that were found
- Removed conflicting indications regarding the use of orotracheal intubation ("when required for emergency stabilization" vs "When BLS airway management is ineffective and / or inadequate"

UPDATED Table of Contents
4000 – Treatment Protocols
4100 - Key ~~Protocols~~ Policies
4101 - Introduction to Treatment Protocols (rewritten to reflect new format)
4102 – Calculation Chart
4103 – Skills List
4104 – Weight Conversion Matrix
4105 – Skills List
~~4200 - Patient Disposition~~
~~4201~~ 4106 - On Scene Physician Wishing to Assume Responsibility
~~4202~~ 4107 - Refusal of Treatment and/or Transport
~~4203~~ 4108 - Do Not Attempt / Discontinue Resuscitation
~~4204~~ 4109 - Ambulance Patient Offload Delay
~~4205~~ 4110 - End of Life Care

4200 – General Medical
~~4501~~ 4201 - Hypoglycemia with Altered Mental Status
~~4401~~ 4202 - Shock Unrelated to Trauma
~~4504~~ 4203 - Nausea and / or Vomiting
~~4505~~ 4204 - Pain Management

4300 - Trauma
4301 Shock Due to Trauma
4302 Traumatic Injuries

4400 - Cardiovascular / Pulmonary
~~4402~~ 4401 - Suspected Acute Coronary Syndrome (ACS)
~~4403~~ 4402 - Ventricular Assist Devices
~~4404~~ 4403 - Symptomatic Tachycardia with Pulses
~~4405~~ 4404 - Symptomatic Bradycardia with Pulses
~~4406~~ 4405 - Cardiac Arrest
~~4408~~ 4406 - Respiratory Distress

FOR CONSIDERATION BY PMAC

4500 - Neurological
~~4502~~ 4501 - Seizures
~~4503~~ 4502 - Suspected Stroke

4600 - Toxicological
~~4602~~ 4601 - Overdose / Adverse Reaction
~~4603~~ 4602 - Behavioral Emergency with Suspected Excited Delirium
~~4604~~ 4603 - Toxic Exposure, Inhalation, or Ingestion
~~4605~~ 4604 - Exposure to Nerve Agents, Organophosphates, and Carbamates

4700 – Environmental
~~4601~~ 4701 - Allergy and/or Anaphylaxis
~~4606~~ 4702 - Snakebite
~~4304~~ 4703 - Heat Illness / Hyperthermia
~~4305~~ 4704 - Frostbite / Hypothermia
~~4303~~ 4705 - Burns
4800 - ~~OB/GYN~~ Pregnancy and Childbirth
~~4701~~ 4801 - Pre-Eclampsia and Eclampsia
~~4702~~ 4802 - Labor and Delivery
~~4407~~ 4803 - Neonatal Resuscitation

ACTION: Informational sharing with PMAC, after review please provide any feedback to REMSA.

FOR CONSIDERATION BY PMAC

DATE: November 1, 2020

TO: PMAC

FROM: Misty Plumley, Senior EMS Specialist

SUBJECT: COVID-19 Update

Riverside County is continuing our COVID-19 response via the Medical Health Department Operations Center (MH DOC). The MH DOC currently releases Situation Summaries weekly on Thursdays.

Current Riverside County statistics, including the county's Blueprint for a Safer Economy Tier assignment can be found here: https://rivcoph.org/coronavirus

Riverside County continues our testing efforts with partnerships including our RUHS Health System, Health system partners, and CA Testing Task Force partners. Testing is open through drive thru and walk up testing sites, is available at no cost and can be scheduled electronically here: https://gettested.ruhealth.org/

EMS System providers should be engaging annual Fit testing procedures starting this month per Cal/OSHA standards, as the extension offered for annual Fit testing ends November 2020. Resource: https://www.dir.ca.gov/dosh/coronavirus/Cal-OSHA-Guidance-for-respirator-shortages.pdf

EMS System providers should also be monitoring their PPE inventory, and PPE burn rates to establish par levels and maintain inventory with a forward-thinking approach for possible surge.

ACTION: Informational only.

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OCT. 2020

New "Kobe Bryant Privacy Law" Bans Accident Scene Photography by First Responders

Author: Maurice Sinsley

In the wake of the tragic helicopter crash that claimed the life of Kobe Bryant and eight other victims, the Legislature passed AB 2655, making it a misdemeanor for first responders to take unauthorized photographs of deceased persons at accident or crime scenes. AB 2655 adds Section 647.9 to the Penal Code and amends Penal Code section 1524.)

Known as the Kobe Bryant Law, AB2655 was enacted after media reports that public safety personnel who responded to the crash scene may have shared photographs of the deceased victims. The Legislature sought to protect the privacy and dignity of the deceased, and penalize public officials who breach the public trust by using their unique access and authority to document tragic events for personal fulfillment.

The new law makes it a crime for any first responder who responds to the scene of an accident or crime and to take photographs of a deceased person by any means, including either a personal electronic device or one belonging to the employing agency, unless the picture is taken for an official law enforcement purpose or to advance a genuine public interest.

This law defines a "first responder" as a state or local peace officer, firefighter, paramedic, emergency medical technician, rescue service personnel, emergency manager, coroner, or employee of a coroner.

The new law also allows law enforcement to obtain a search warrant to seize first responder's personal electronic devices that may contain evidence that a violation of the new law has occurred. The law limits a search warrant to a criminal investigation under this law and other public offenses and excludes evidence of department policy violations.

The bill requires first responder agencies to notify their employees of this new law by January 1, 2021.

Paramedics and EMTs should also know that violation of this new law could subject them to discipline by their Local EMS Agency or the State EMS Authority that could result in having their license suspended or revoked.

The takeaway for all first responders is that taking photos of deceased persons in the line of duty without a law enforcement purpose or to advance a genuine public interest could result in criminal charges being filed against them. Stay Professional.

Stay Safe and Healthy!

MAURICE SINSLEY is an associate attorney with Stone Busailah, LLP., who has 30-years of fire service experience in Southern California.

FOR CONSIDERATION BY PMAC

DATE: November 12, 2020

TO: PMAC

FROM: REMSA

SUBJECT: PMAC 2021 Schedule

Proposed 2021 PMAC Schedule:

Monday, February 22, 2021 - 0900-1100 Virtual Session via Zoom

Monday, May 17, 2021 – 0900-1100 Virtual Session via Zoom

Monday, August 23, 2021 – 0900-1100 Virtual Session via Zoom

Monday, November 12, 2021 – 0900-1100 Virtual Session via Zoom

ACTION: PMAC should be prepared to receive the information and provide feedback to approve or modify the proposed schedule for 2021 to the EMS Agency.