Center for
Resuscitation Medicine

UNIVERSITY OF MINNESOTA

Driven to Discover℠

The New Frontier of Resuscitation

Disclosure

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Program Manager at the Center for Resuscitation Medicine, Cardiovascular Division, UMN Medical School
Minnesota Mobile Resuscitation Consortium Board

No relevant disclosures

Discussion Points

1. History of the Center for Resuscitation Medicine
2. Data Collection on Cardiac Arrest
3. ECMO Program in Minnesota
4. The mobile ECMO Project
5. ARREST Trial
6. The Minnesota Mobile ECMO Consortium – first four-month results
7. The Next Horizon

History of the Center for Resuscitation Medicine

2010-2016	The MN Resuscitation Consortium started with a grant from Medtronic Philanthropy to increase survival from Sudden Cardiac Arrest
2011-now	Implementation of CARES - Registry of Cardiac Arrest Data
2016	ECMO in CCL at MHealth/Fairview University
2017-2019	ACCESS Trial
2018-now	Mobile ECMO Project Grant
2018	Transition to the Ctr for Resuscitation Med and Establishment of the MN Mobile ECMO Consortium
2019-2020	ARREST Trial
2020	Mobile ECMO Program Clinical Phase

Goal: to improve survival from sudden cardiac death in Minnesota through partnerships and initiatives

MN Resuscitation Consortium

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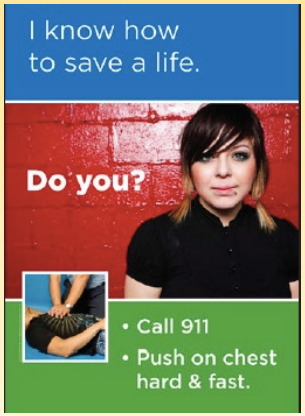
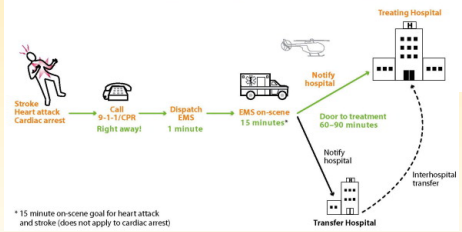
LEARN CPR



FIRE/EMS 911 POLICE DISPATCH

Minnesota Resuscitation Academy



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Data collection

If you don't measure it - you can't improve it

HeartRescue PROJECT

HeartRescue Data Partner - CARES

CARES in MN 2010 to 2021

- Created format for EMS/hospitals to come together
- Allowed unprecedented collaboration and transparency through data sharing
- Provided base line data for communities to grow from
  - -early on a community discovered poor bystander CPR through CARES data
  - -community "solved" low survival rate (no AED's) with data
  - -serious charting/protocol issues remedied within agencies (especially helpful to rural communities)
  - -survival celebrations and pride in survival rates common now
- Provided base line data to inform research directions and opportunities
- Helps local agencies with funding opportunities (helped a group of local fire dept heat map OHCA calls and AED deserts for a grant)
- Mobile ECMO grew from the realization that a pocket of survivable patients wasn't surviving- not possible without CARES.
- Now looking at PEA patients as the next horizon

What the data tells us about 2020 OHCA in MN

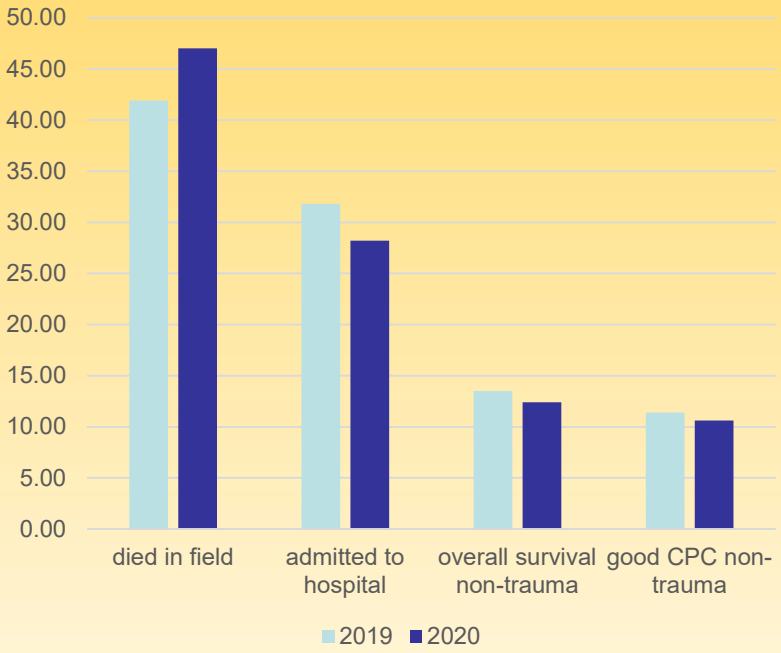
- 526 more cases than 2019
- 320 of those came from the 7 county metro area
- 206 from outstate
- Arrests occurring at home increase by 7% (75%)
- Bystander CPR decreased by 2% (39%)
- Initial shockable rhythms decreased by 16% (21%)
- Field termination increase by 12% (47%)
- Hospital admission from OHCA decreased by 11% (38%)

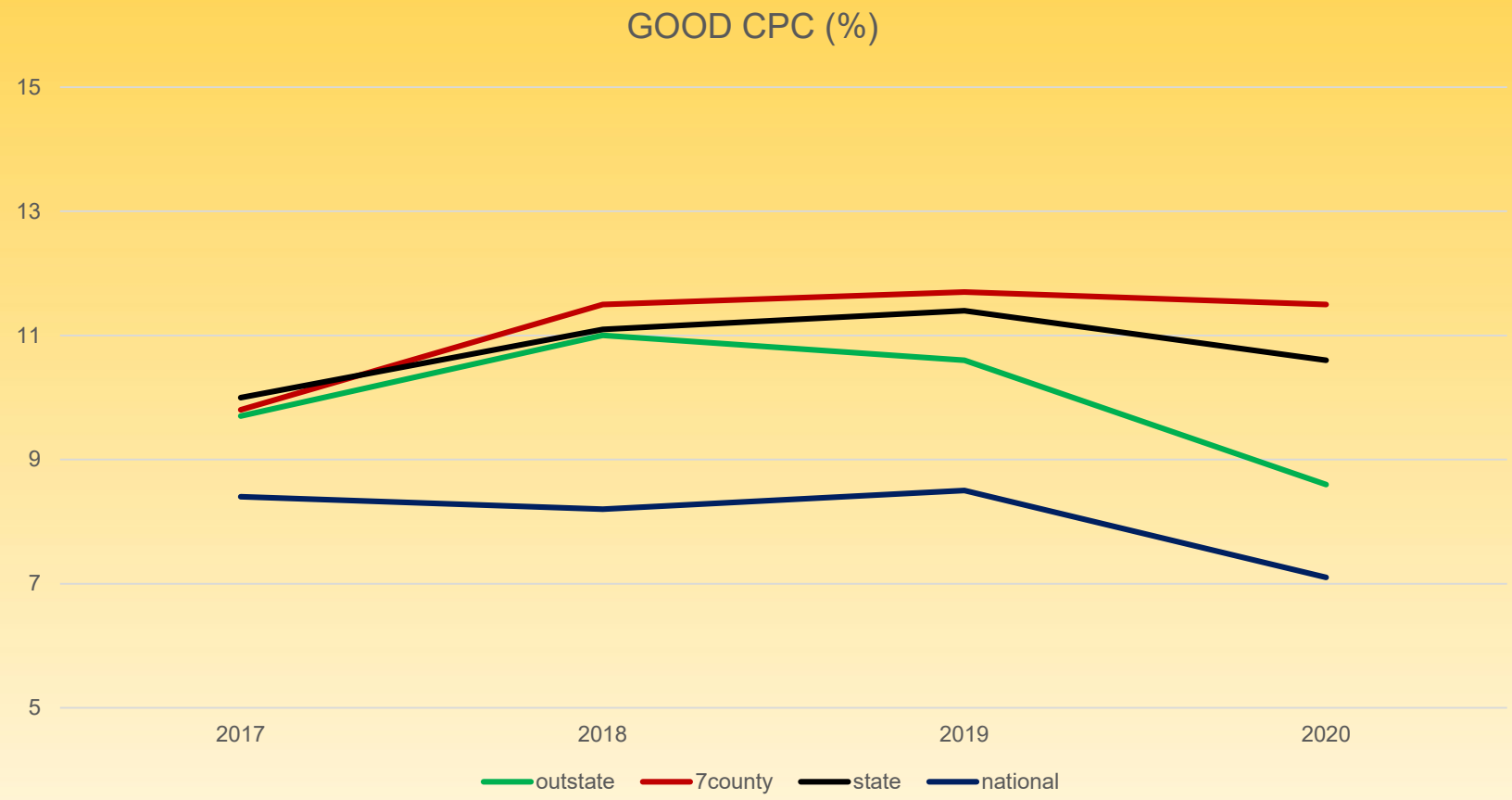
Some interesting facts for 2020 (MN)…

- 3063 Non-Traumatic CARES cases
- 35% female
- 75% occurred at home
- 8% occurred in NH
- 39% bystander witnessed (37% national)
- **37% rec'd bystander CPR (41% national)**
- 10% bystander AED (22%)
- 1% bystander shock (1%)
- 21% VF/VT/shockable (16.5%)
- 47% died in field (42%)
- 38% admitted (24%)
- **11% dc with good cpc (7%)**
- **32% Utstein survival (29%)**
- **38% Utstein Bystander survival (33%)**

Survival rates in MN 2020

- Overall survival: 12%
- Survival with good CPC: 11%
- These are lower that the previous year (consistent with the national trend)
- First time we had multiple agencies with 0% survival
- First time for 36% overall survival at an agency!




GOOD CPC (%)
15
13
11
9
7
5
2017
2018
2019
2020
outstate
7county
state
national

Coronary Artery Disease in Patients With Out-of-Hospital Refractory Ventricular Fibrillation Cardiac Arrest

JACC 2017;70:1109–17

Demetris Yannopoulos, MD,[a] Jason A. Bartos, MD, PhD,[a] Ganesh Raveendran, MD,[a] Marc Conterato, MD,[b] Ralph J. Frascone, MD,[c] Alexander Trembley, BS,[b] Ranjit John, MD, PhD,[d] John Connett, PhD,[e] David G. Benditt, MD,[a] Keith G. Lurie, MD,[a] Robert F. Wilson, MD,[a] Tom P. Aufderheide, MD[f]

ABSTRACT

BACKGROUND The prevalence of coronary artery disease (CAD) among patients with refractory out-of-hospital (OH) ventricular fibrillation (VF)/ventricular tachycardia (VT) cardiac arrest is unknown.

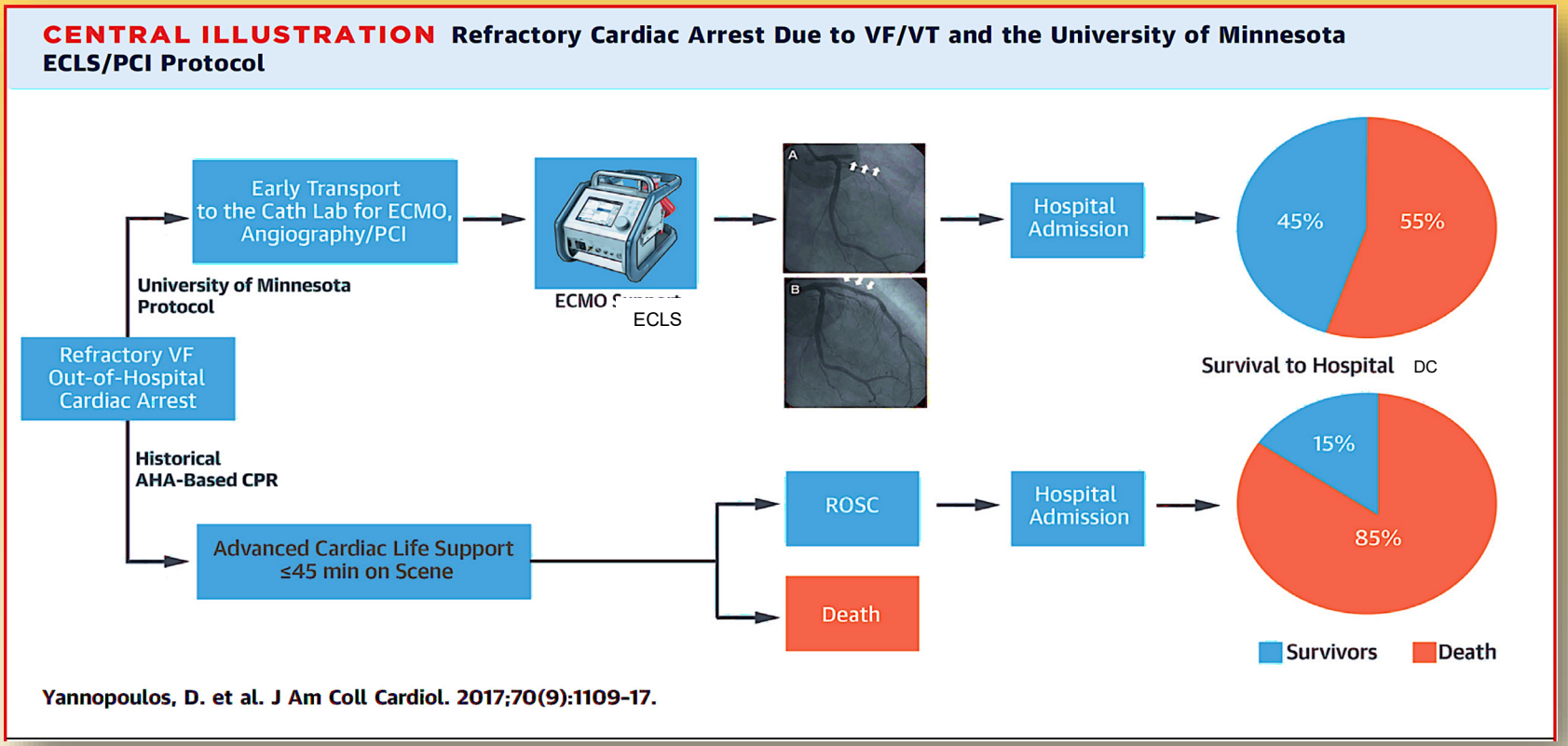
OBJECTIVES The goal of this study was to describe the prevalence and complexity of CAD and report survival to hospital discharge in patients experiencing refractory VF/VT cardiac arrest treated with a novel protocol of early transport to a cardiac catheterization laboratory (CCL) for extracorporeal life support (ECLS) and revascularization.

METHODS Between December 1, 2015, and December 1, 2016, consecutive adult patients with refractory OH VF/VT cardiac arrest requiring ongoing cardiopulmonary resuscitation were transported by emergency medical services to the CCL. ECLS, coronary angiography, and percutaneous coronary intervention were performed, as appropriate. Functionally favorable survival to hospital discharge (Cerebral Performance Category 1 or 2) was determined. Outcomes in a historical comparison group were also evaluated.

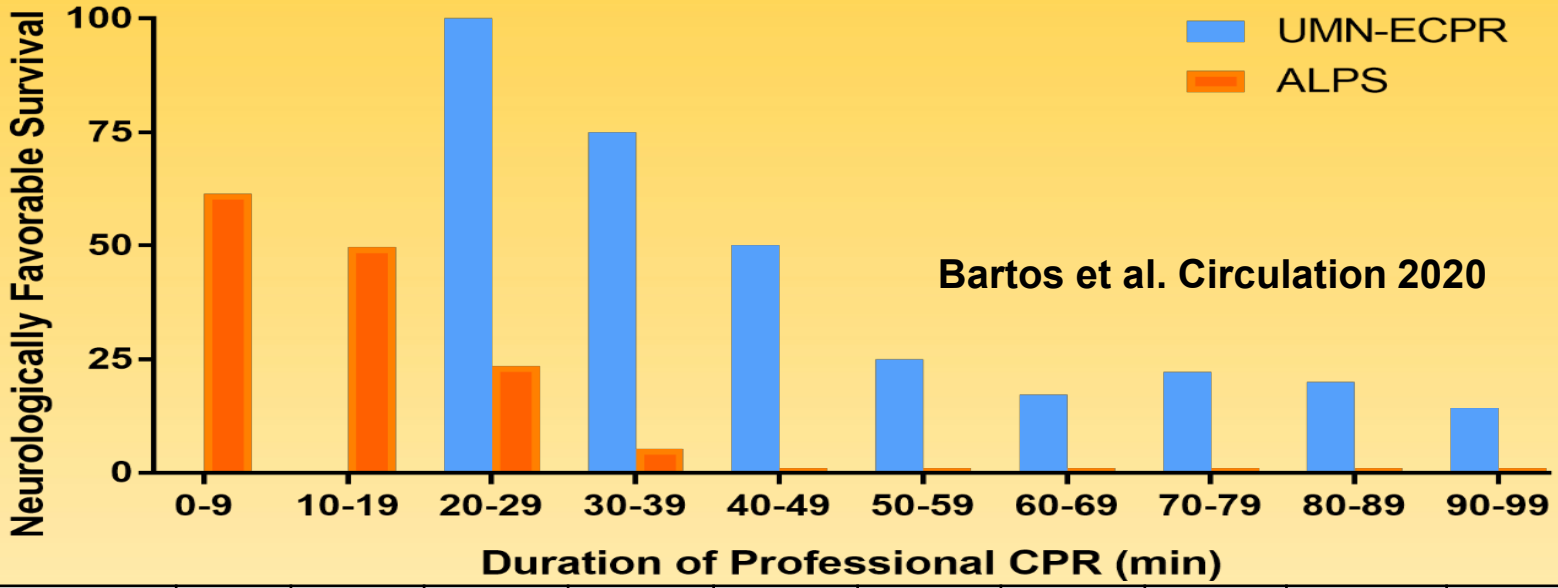
RESULTS Sixty-two (86%) of 72 transported patients met emergency medical services transport criteria. Fifty-five (89%) of the 62 patients met criteria for continuing resuscitation on CCL arrival; 5 had return of spontaneous circulation, 50 received ECLS, and all 55 received coronary angiography. Forty-six (84%) of 55 patients had significant CAD, 35 (64%) of 55 had acute thrombotic lesions, and 46 (84%) of 55 had percutaneous coronary intervention with 2.7 ± 2.0 stents deployed per patient. The mean SYNTAX score was 29.4 ± 13.9. Twenty-six (42%) of 62 patients were discharged alive with Cerebral Performance Category 1 or 2 versus 26 (15.3%) of 170 in the historical comparison group (odds ratio: 4.0; 95% confidence interval: 2.08 to 7.7; $p < 0.0001$).

CONCLUSIONS Complex but treatable CAD was prevalent in patients with refractory OH VF/VT cardiac arrest who also met criteria for continuing resuscitation in the CCL. A systems approach using ECLS and reperfusion seemed to improve functionally favorable survival. (J Am Coll Cardiol 2017;70:1109–17) © 2017 by the American College of Cardiology Foundation.

Refractory VF OHCA patients **have high CAD burden** compared to resuscitated patients. The University of Minnesota initiated an ECMO-based protocol to facilitate resuscitation, access to the CCL and identify the cause of the arrest.



Relationship of CPR Duration and Survival



Time (min)	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	Total
UMN-ECPR	0	0	8	12	20	36	35	27	15	7	**160**
ALPS	70	151	102	95	99	69	29	11	3	7	**636**

Patients at Risk

Innovation

Early experience identified the four most important issues to be considered for optimal patient care:

- Good CPR perfusion during resuscitation and transport
- Early delivery for implementation of complete circulatory support (ECLS)
- Emergent identification and treatment of reversible causes
- Specialized care to treat the metabolic effects of circulatory arrest

Mobile Resuscitation Project

- The project proposed to unifies these four principles in a shared community resource.
- When the patient cannot be delivered to an ECLS hospital site in a timely fashion, the ECLS capability will be delivered to them. By utilizing advanced models that receive real-time input including geographic location of the arrest, emergency department availability, advanced ambulance station location, nearest ECMO capable facility and current road and traffic conditions; the program will dynamically expedite ECLS delivery to patients.

Project Goals

- Place the majority of patients with refractory VF/VT cardiac arrest on ECLS in < 30-40 minutes from 911 call.
- Develop partnerships with healthcare systems to deliver a shared resource.
- Create a business model for a 501C3 that will be sustainable.
- Develop an operational model that delivers timely and optimal care to patients.

Helmsley Charitable Trust

Grant to provide support for design, implementation, and operations of clinical program.

1. Establish an organization to clinically implement a community-wide 24/7 mobile ECMO program –the MN Mobile Resuscitation Consortium (MMRC)
2. Design, build, and operationalize chase vehicles in the hub and spoke model and a mobile unit that can function as a mobile emergency department.
3. Develop telemedicine and technology tools that will optimize the delivery of care.
4. Provide highly trained, specialized critical care teams to deliver optimal patient care.

Center for Resuscitation Medicine

A multi-disciplinary center at the UMN Medical School with a mission to provide oversight and advance research, education and community engagement in the field of resuscitation medicine.

1. Collaborative forum for resuscitation science and research at UMN
2. Cardiac arrest data collection, quality improvement, and reporting
3. Community engagement in resuscitation education
4. Hub for grants to support resuscitation efforts

Vision - 24/7 mobile ECMO Program

Create an independent 24/7 mobile ECMO program that serves all participating health care systems and metro hospitals in Minneapolis by deploying a team of experts, in some cases with a specialized mobile unit, trained to intervene in cardiac arrest cases to improve survival and outcomes.

The Model

A highly-specialized critical care consisting of MDs, Nurse Practitioners, and paramedics from all participating health care systems that will deploy teams to hospital emergency departments across the metro region, or will deploy a mobile unit to intercept the 911 ambulance, to intensively intervene in cardiac arrest cases by beginning ECMO and other critical care services with a target of 911- call to ECMO support <40 minutes.

Patients who meet specific clinical criteria will be transferred to preselected ECMO/resuscitation centers for ongoing critical care and management.

The Care Team

A care team comprised of highly specialized critical care clinicians will work in 12 or 24 hour shifts, deploying across the metro market and staffing a mobile unit that will be staged at satellite facilities and deployed to areas outside the metro area.

Physician :

1. Interventional cardiologists
2. Emergency Medicine MDs
3. Critical Care MDs

Nurse/NP/PA or Critical Care Paramedics (2)

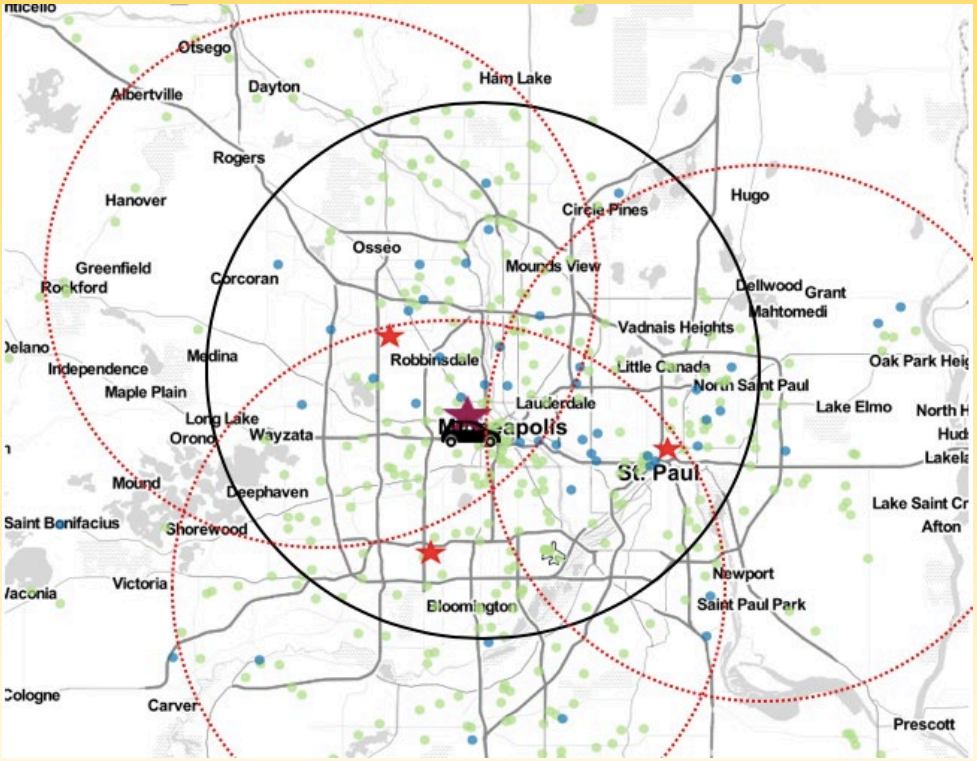
Vision – Tiered Implementation

Initial development of the 501C3; contracts with healthcare systems; and other organizations is currently in progress. A tiered process will clarify the ideal process model; allow for HC system growth to manage patients, and solidify the billing process for sustainability and growth.

Tier 1 – Hub/Spoke

A highly-specialized critical care team consisting of MDs and one paramedic will be deployed to specific hospital emergency departments across the metro region\to intensively intervene in cardiac arrest cases by beginning ECMO and other critical care services with a target of 911- call to ECMO support <40 minutes.

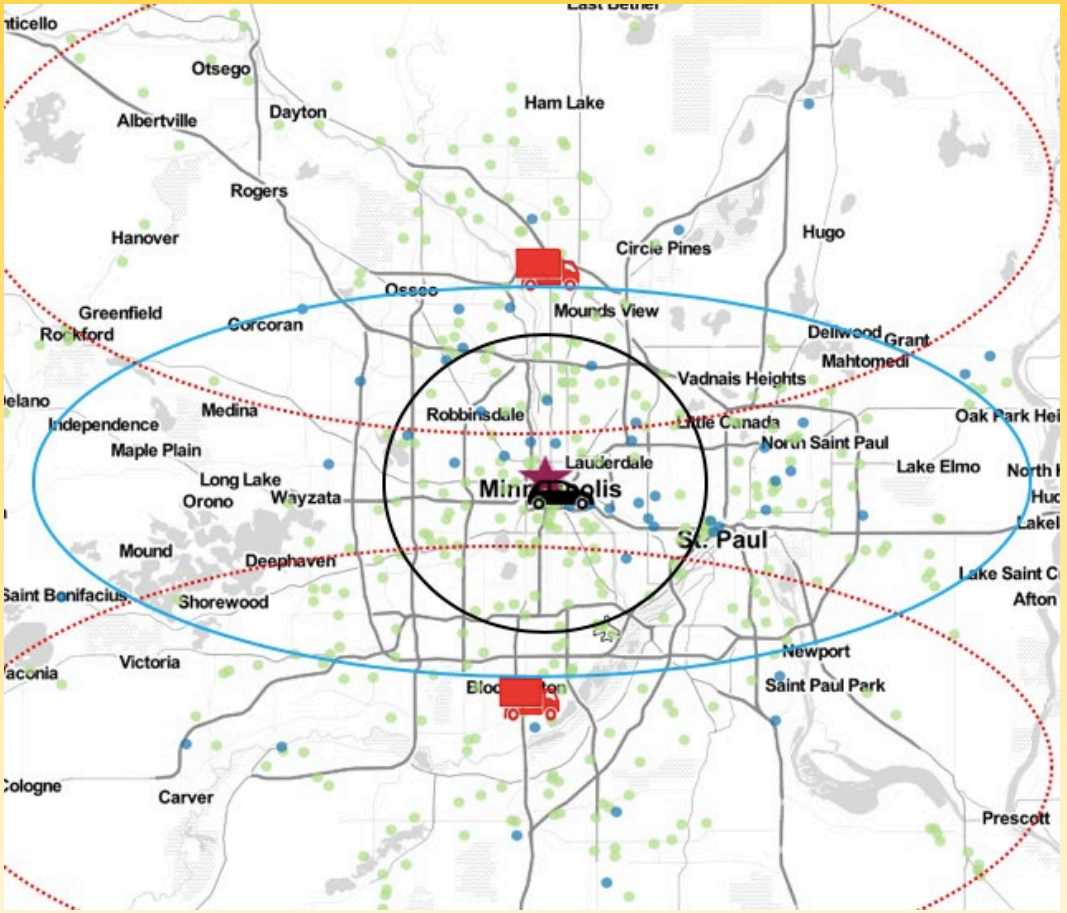
Patients who meet specific clinical criteria will be transferred to preselected ECMO/resuscitation centers for ongoing critical care and management.



Tier 2 – Mobile Unit

A highly-specialized critical care team consisting of MDs and paramedics that will be deployed with a mobile unit to intercept the 911 ambulance at specific healthcare center locations, to intensively intervene in cardiac arrest cases by beginning ECMO and other critical care services with a target of 911- call to ECMO support <40 minutes.

Patients who meet specific clinical criteria will be transferred to preselected ECMO/resuscitation centers for ongoing critical care and management.



Advanced reperfusion strategies for patients with out-of-hospital cardiac arrest and refractory ventricular fibrillation (ARREST): a phase 2, single centre, open-label, randomised controlled trial

Demetris Yannopoulos, Jason Bartos, Ganesh Raveendran, Emily Walser, John Connett, Thomas A Murray, Gary Collins, Lin Zhang, Rajat Kalra, Marinos Kosmopoulos, Ranjit John, Andrew Shaffer, R J Frascone, Keith Wesley, Marc Conterato, Michelle Biros, Jakub Tolar, Tom P Aufderheide

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***Lancet*. 2020;396:1807-1816**

The ARREST TRIAL

Study Design and Oversight.

The ARREST trial was:

1. Randomized phase II
2. Single center with multiple EMS
3. Intention-to-treat; safety and efficacy clinical trial
4. Performed in the metropolitan area of Minneapolis, St Paul

The ARREST trial was:

- Funded by the National Heart, Lung, and Blood Institute (NHLBI).
- It qualified for exception from informed consent under emergency circumstances (21 CFR 50.24)
- Oversight by the Food and Drug Administration (FDA), under Investigational Device Exemption
- Approved by the Institutional Review Board of the University of Minnesota,
- Monitored by an independent NHLBI appointed Data and Safety Monitoring Board (DSMB).

Inclusion Criteria

- Age: 18-75 with OHCA
- Initial shockable rhythm VT/VF,
- No return of spontaneous circulation following 3 shocks,
- Body morphology to accommodate automated cardiopulmonary resuscitation with a Lund University Cardiac Arrest System (LUCAS™),
- Estimated transfer time of < 30 minutes to the University of Minnesota Medical Center.

Exclusion Criteria

- Valid do not resuscitate orders (DNR),
- blunt, penetrating, or burn related injury, drowning
- known: overdose, prisoners, pregnancy, nursing home residents,
- presence of an “opt-out” study bracelet,
- terminal cancer,
- or absolute contraindications to emergent angiography, contrast allergies or active gastrointestinal or internal bleeding.

THE ARREST TRIAL - STUDY ALGORITHM FLOW CHART

Out-of-Hospital

Determine early EMS transport criteria:

- OHCA of presumed cardiac etiology, VT/VF as first presenting rhythm, 18-75 years of age (estimated if not known)
- Receive three DC shocks without achieving ROSC
- Body morphology able to accommodate LUCAS – automated CPR device
- Estimated transfer time to ED <30 minutes
- **Activate the University of Minnesota ECMO resuscitation line per standard EMS practice.**

Mobilize patient per standard EMS protocol with ongoing mechanical CPR to the University of Minnesota Medical Center.

Upon arrival to the ED:

verify eligibility criteria and RANDOMIZE.

Treatment 1	**Treatment 2**
Early ECMO facilitated resuscitation	**Standard ACLS resuscitation**

Primary Outcome (Posterior Probability = 0.9861)				
Survival to Hospital Discharge	14	6/14 (42.9%)	15	1/15 (6.7%)

Survival at 3 and 6 months : ECMO 6/14 (43%) versus ACLS 0/15 (0%); p=0.0063

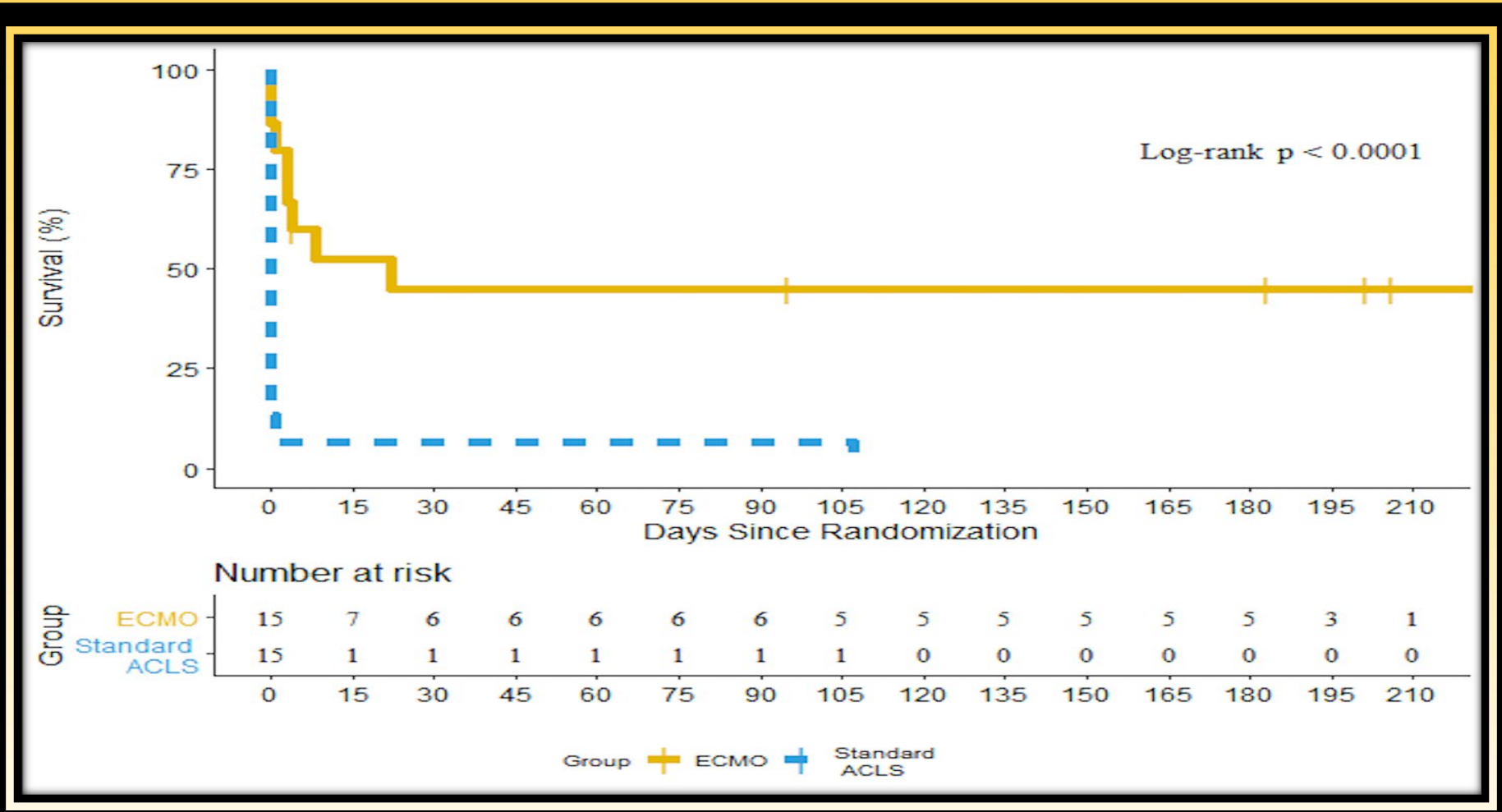
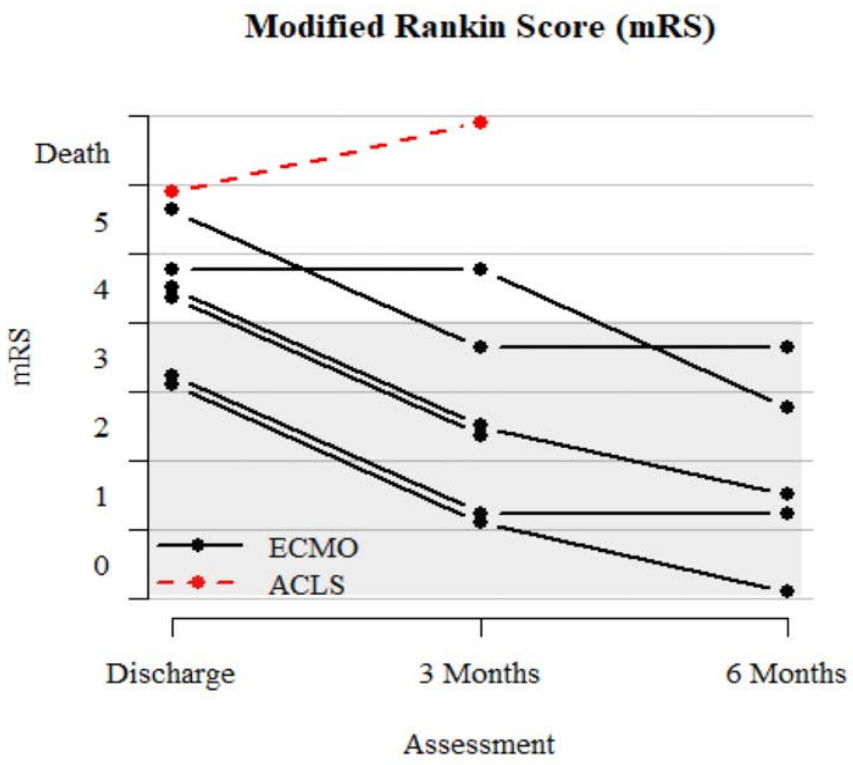
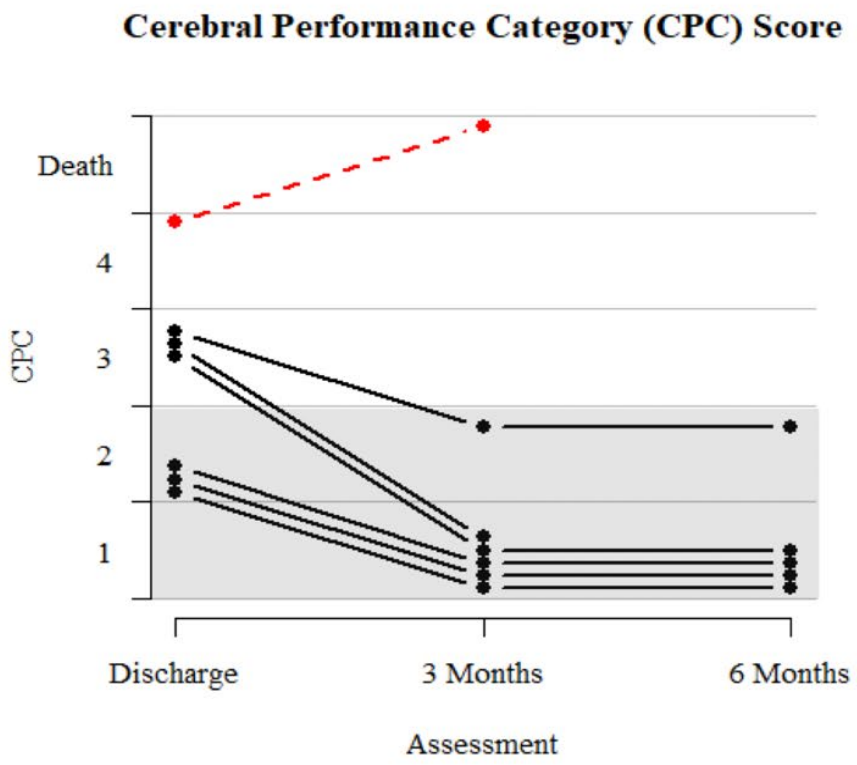


Figure 2A. Cumulative survival after randomization.

Figure 2B: Blinded **Modified Rankin** Scale Scores in all survivors at hospital discharge, 3- and 6-months post discharge.

Figure 2C: Blinded **Cerebral Performance Category** in all survivors at hospital discharge, 3- and 6-months post discharge





Limitations

- The results of the ARREST trial reflect local emergency health care delivery characteristics and a highly experienced interventional critical care cardiology team providing continuity of care for all patients.
- Such expertise and resources may or may not be available in other places.
- Generalization needs to be evaluation in other communities.
- The ARREST trial does not address ECMO initiation alone but the comprehensive chain of care provided to these patients from pre hospital protocols, early CCL access and critical care established practice.

Conclusions

- **Early ECMO-facilitated resuscitation for refractory VF OHCA significantly improved survival to hospital discharge compared to standard ACLS treatment.**

- **Functional status of survivors at 3- and 6-months post discharge was favorable; consistent with our prior published work.**

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Research Paper

The Minnesota mobile extracorporeal cardiopulmonary resuscitation consortium for treatment of out-of-hospital refractory ventricular fibrillation: Program description, performance, and outcomes

Jason A. Bartos[a,b], R.J. Frascone[b,c], Marc Conterato[b,d], Keith Wesley[e], Charles Lick[f], Kevin Sipprell[g], Nik Vuljaj[e], Aaron Burnett[h], Bjorn K Peterson[i], Nicholas Simpson[j], Kealy Ham[k], Charles Bruen[k], Casey Woster[k], Kari B Haley[k], Joanna Moore[j], Brandon Trigger[l], Lucinda Hodgson[b], Kim Harkins[b], Marinos Kosmopoulos[b], Tom P. Aufderheide[m], Jakub Tolar[n], Demetris Yannopoulos[a,b,*]

MN Mobile Resuscitation Consortium

- A community resource covering entire metropolitan area
- ECMO, PCI, clinical care 24/7/365
- Manage EMS, ECMO supplies, equipment
- Training for EMS, Mobile ECMO teams, ED cannulation site
- Manage cost sharing and reimbursement
- Manage SOPs, hospital privileges, certifications, training, contracts
- Community-wide data collection
- Organizational and economic sustainability

ECMO at a Hospital Near You

A

Minnesota Mobile Resuscitation Consortium

- A community resource covering entire metropolitan area
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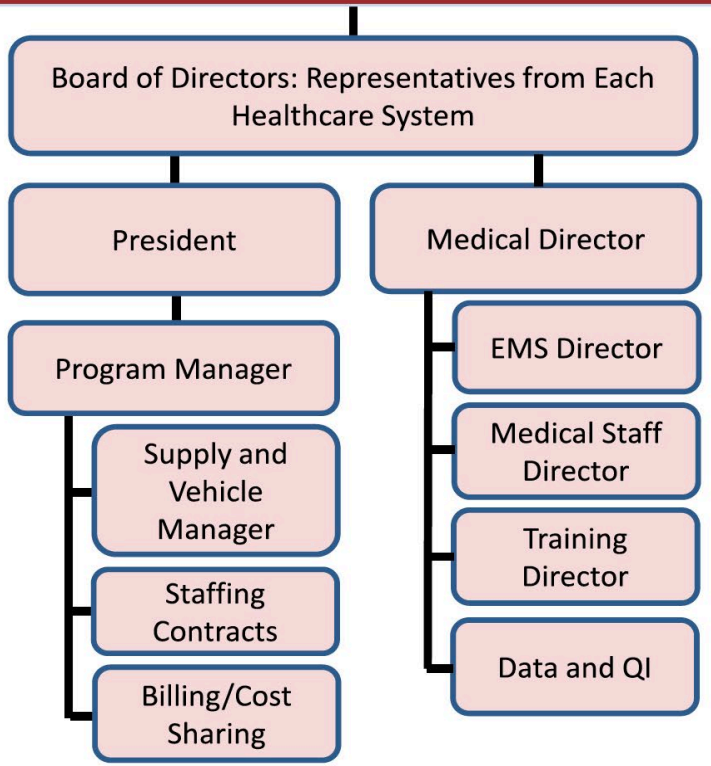

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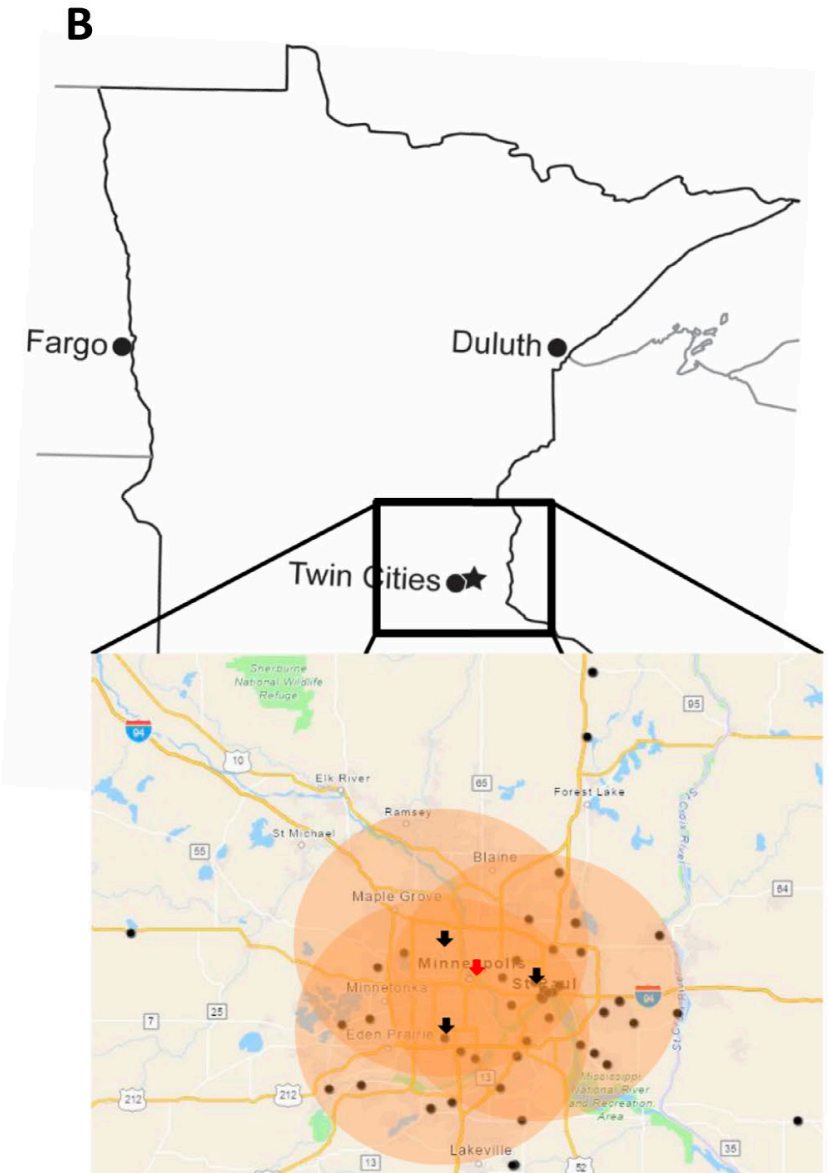
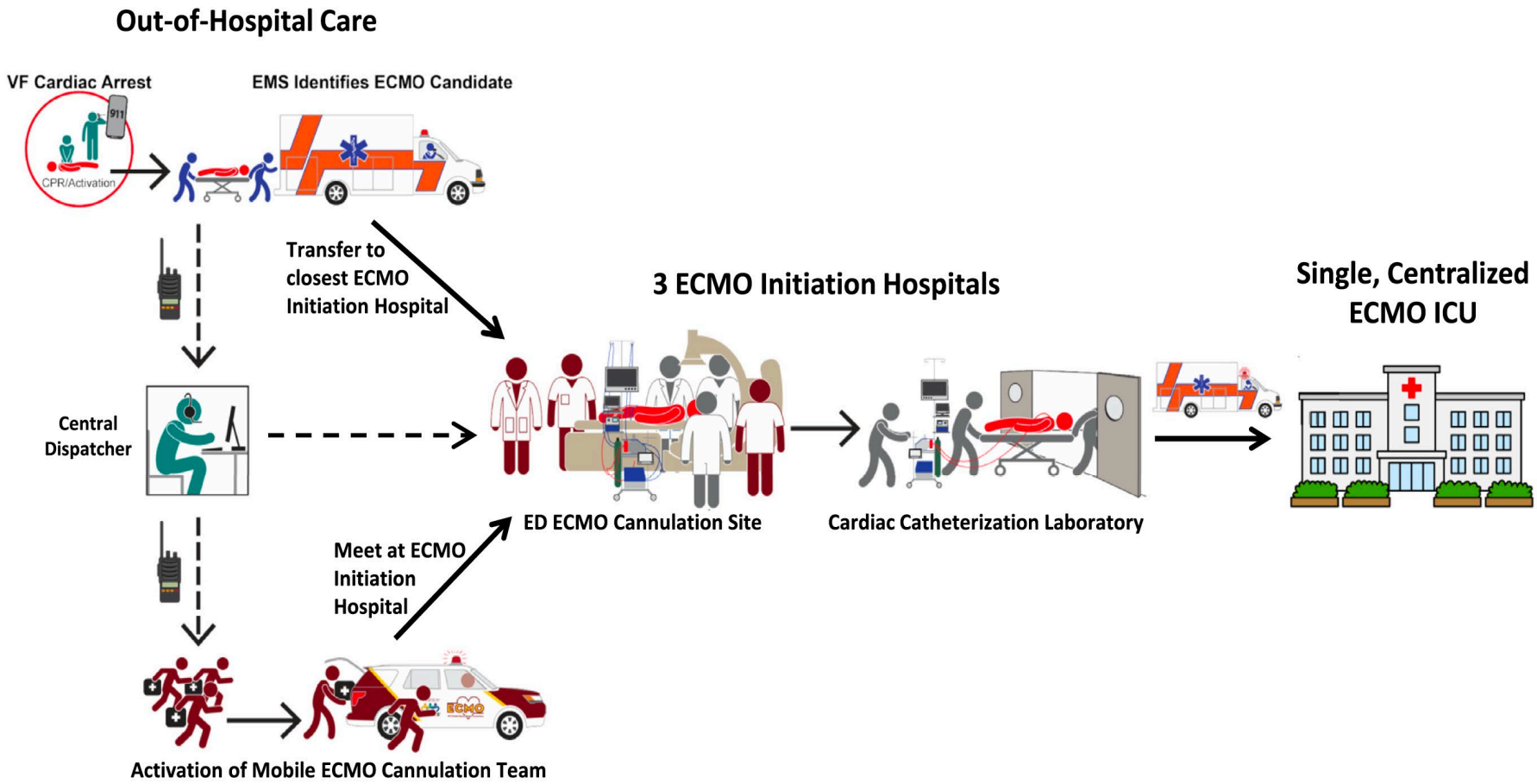


The Cannulation Team

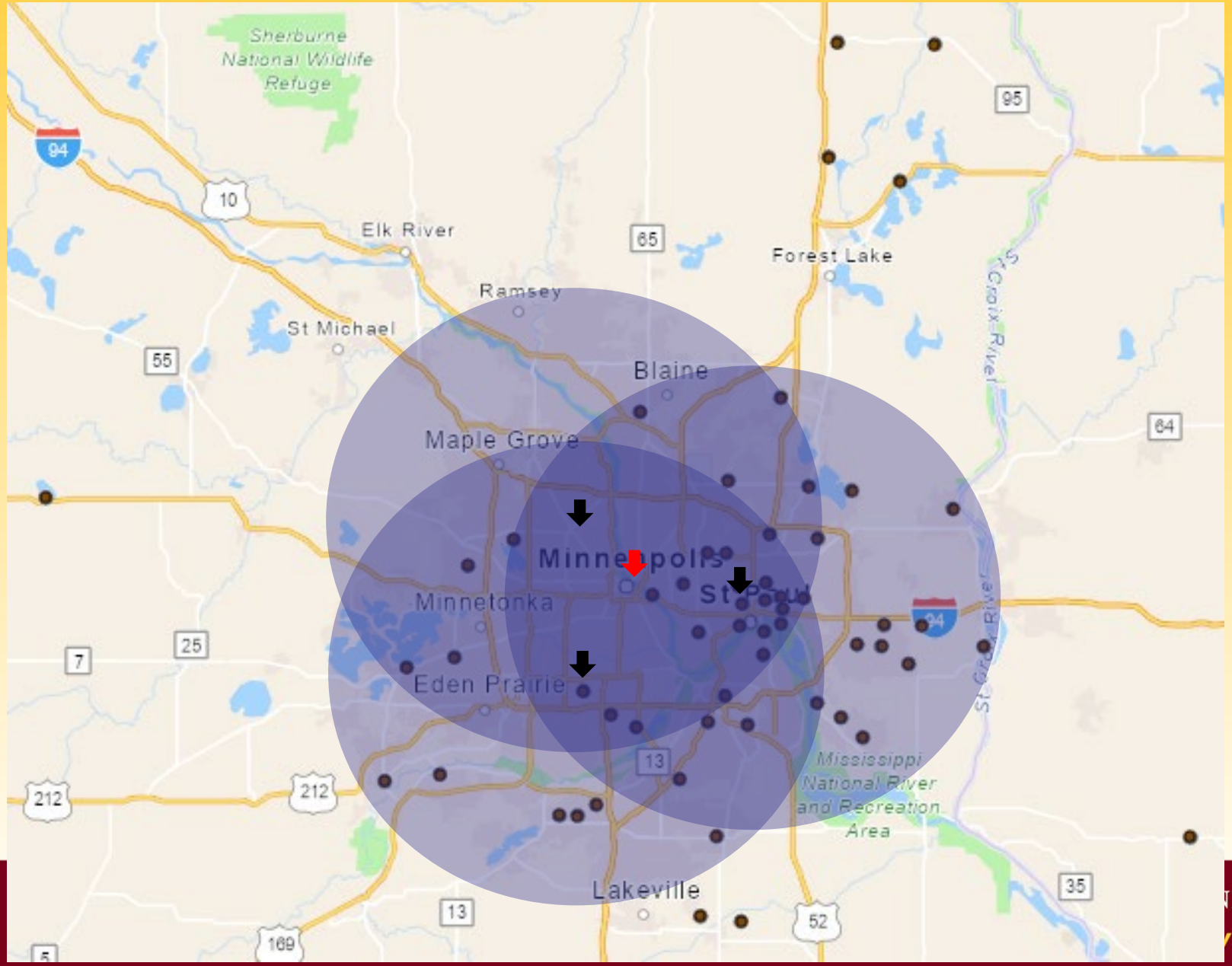
- 15 physicians representing all healthcare systems in the Twin Cities
- 10 flight paramedics and nurses
- Training includes online equipment and programmatic modules, didactic, lab work, team drills, proctored cases and telemedicine support, continuing education

- Mobile Team
  - 2 physicians and 1 flight medic/nurse
  - Acting as cannulator, scrub tech, ECMO specialist, perfusionist, respiratory therapist, nurse, physician

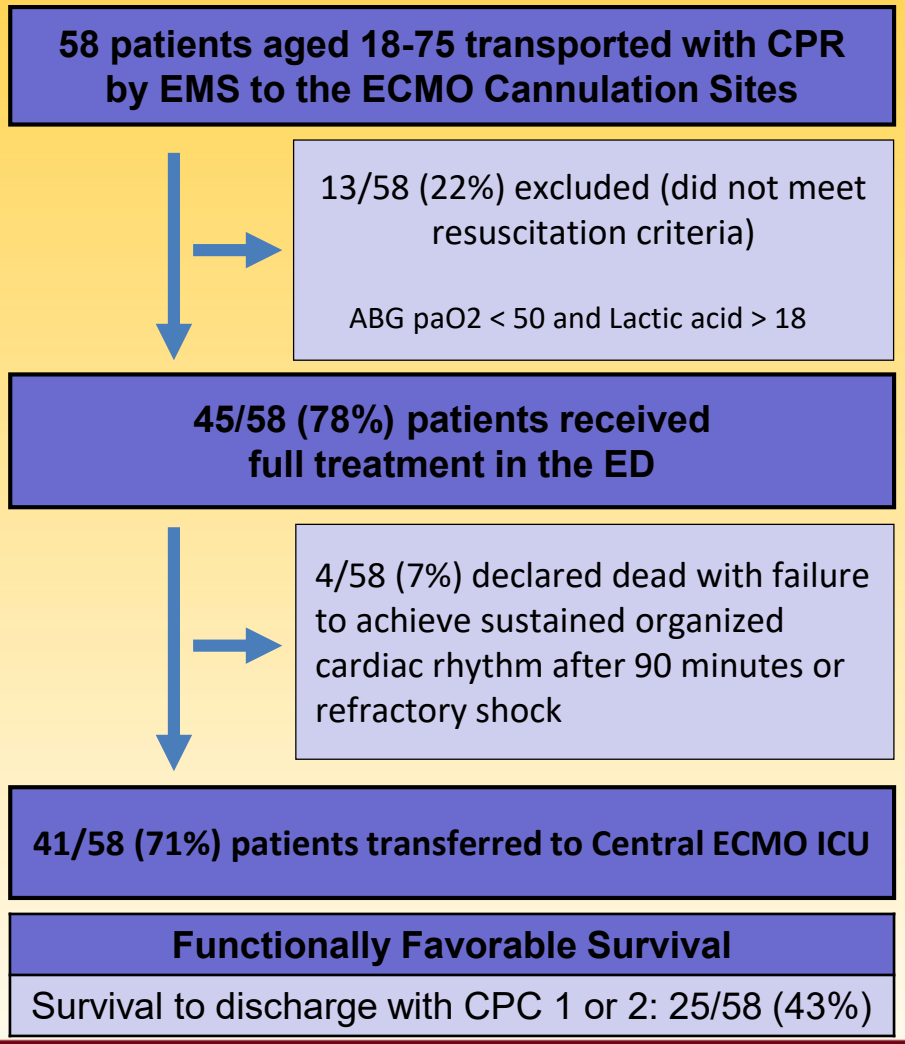
Transporting to the Cannulation Site


Out-of-Hospital Care
VF Cardiac Arrest
EMS Identifies ECMO Candidate
911
CPR/Activation
Transfer to closest ECMO Initiation Hospital
3 ECMO Initiation Hospitals
Single, Centralized ECMO ICU
Central Dispatcher
ED ECMO Cannulation Site
Cardiac Catheterization Laboratory
Meet at ECMO Initiation Hospital
ECMO
Activation of Mobile ECMO Cannulation Team

First Four Months: 12/2019 – 3/2020



First Four Months: 12/2019 – 3/2020



Comparison of Two ECMO Delivery Strategies

Patient and Cardiac Arrest Characteristics		
	UMN-ECPR (n = 160)	Mobile ECMO (n = 58)
Age, yrs	57 ± 1.0	57 ± 1.8
Sex		
Male	126 (79%)	46 (79%)
Female	34 (21%)	12 (21%)
Race		
White	124 (78%)	49 (84%)
Black	22 (14%)	4 (7%)
Other	14 (9%)	5 (9%)
Witnessed Arrest	121 (76%)	42 (72%)
Bystander CPR performed	105 (66%)	32 (55%)
Arrest in public location	56 (35%)	18 (31%)
Time from arrival to ECMO, min	8.0 ± 0.5	14.4 ± 6.1
Duration of professional CPR, min	60 ± 1 *	52 ± 2 *

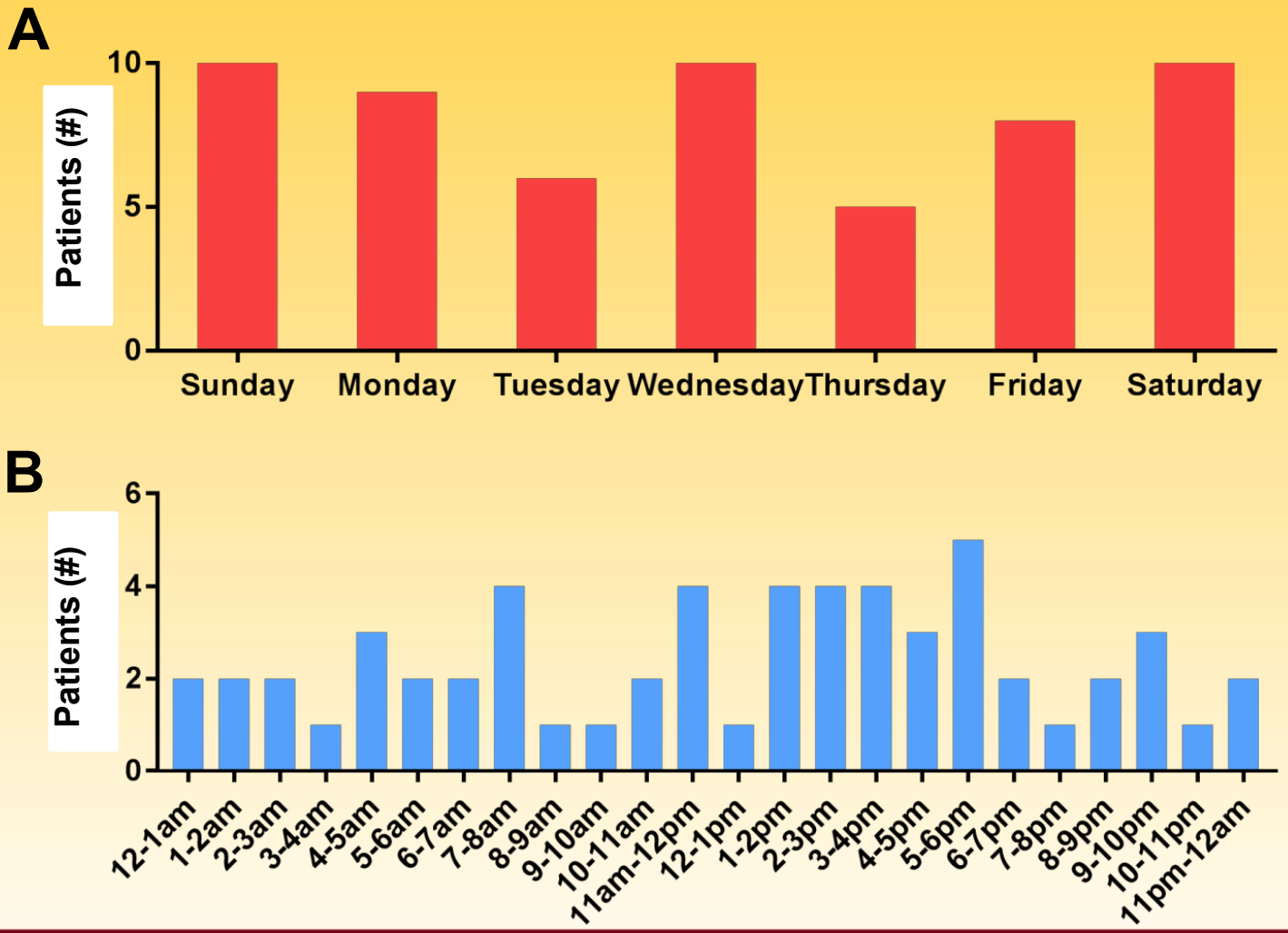
Mobile ECMO Process Characteristics, Performance Metrics, and Benchmarks	
Target Times	
Paramedic On-scene Time (goal < 15 min)	22.0 ± 8.9
ECMO Team Time to ED (goal < 15 min)	14.9 ± 5.7
Patient Arrival to ECMO Initiation (goal < 15 min)	14.4 ± 6.1
Arrest to Cardiac Cath Lab (goal < 120 min)	121 ± 56
Laboratory Studies	
Lactic acid on initial ABG (mmol/L)	12.5 ± 4.2
pH on initial ABG	6.98 ± 0.21
paO2 on initial ABG (mmHg)	87 ± 109
Cardiac Catheterization Laboratory	
Angiography performed	45/45 (100%)
Presence of severe coronary artery disease	29/45 (64%)
Percutaneous coronary intervention performed	22/29 (85%)
Transport to ECMO ICU	
Number of transports without adverse events	41/41 (100%)
Central ECMO ICU	
Therapeutic hypothermia provided	41/41 (100%)
Tracheostomy	5/41 (12%)
ECMO-Related Complications	
Access site bleeding requiring > 3 units PRBCs	4/45 (9%)
Circuit failure	1/45 (2%)
Ischemic limb requiring intervention	0/45 (0%)

Mobile ECMO Characteristics	
EMS Times	
911 to first responder arrival (min)	7.2 ± 3.6
911 to patient arrival at ED (min)	46.9 ± 12.3
Airway Management	
BVM only	6/58 (10%)
Supraglottic Airway	22/58 (38%)
Endotracheal Intubation	30/58 (52%)
Pre-hospital Management	
Epinephrine doses (1 mg)	3.4 ± 0.7
Amiodarone	387 ± 75
Number of shocks	5.3 ± 2.1
Intermittent ROSC prior to ED arrival	16/58 (28%)
Cannulation	
Cannulation Success/ECMO Initiation	45/45 (100%)
Cardiac Catheterization Laboratory (CCL)	
Presence of severe coronary artery disease	29/45 (64%)
Percutaneous coronary intervention performed (N, %)	22/29 (85%)
Left main coronary artery	2/45 (4%)
Left anterior descending artery	12/45 (27%)
Left circumflex artery	0/45 (0%)
Right circumflex artery	8/45 (18%)

Mobile ECMO Recovery Characteristics

Time to ECMO Decannulation, days	
Survivors	4.2 ± 1.5
Non-survivors	--
Time to Extubation, days	
Survivors	10.2 ± 7.5
Non-survivors	--
ICU Length of Stay, days	
Survivors	15.1 ± 8.1
Non-survivors	7.0 ± 13
Hospital Length of Stay, days	
Survivors	18.9 ± 8.6
Non-survivors	7.0 ± 13

24/7 Coverage is Necessary



Program Performance Metrics

Characteristic/Performance Metric/Benchmark	Value
10 EMS Agencies	
911 to first responder arrival (minutes)	7.2 ± 3.6
EMS On-Scene time (minutes; benchmark < 15 minutes)	22.0 ± 8.9
911 to patient arrival at ED (minutes)	46.9 ± 12.3
Public Location [N, (%)]	18/58 (31%)
Bystander witnessed [N, (%)]	42/58 (72%)
Bystander /Dispatched Assisted CPR [N, (%)]	32/58 (55%)
Epinephrine doses (1 mg)	3.4 ± 0.7
Amiodarone (mg dose)	387 ± 75
Number of shocks by EMS	5.3 ± 2.1
Intermittent ROSC prior to ED arrival [N, (%)]	16/58 (28%)
Perfusion Discontinuation Criteria on ECMO Initiation Hospital Arrival	
Initial lactic Acid (mmol/L)	12.5 ± 4.2
Initial pH	6.98 ± 0.21
Initial arterial oxygen, PaO2, (mm Hg)	87 ± 109
End Tidal CO2 (%)	35 ± 16
Proportion of patients meeting discontinuation criteria [N, (%)]	13/58 (22%)
Mobile ECMO Cannulation Team	
Response time to ED (mean, minutes; benchmark < 15 minutes)	14.9 ± 5.7
Patient ED Arrival to ECMO Cannulation (mean, minutes; benchmark < 15 min)	14.4 ± 6.1
Duration of Patient Professional CPR (minutes; benchmark < 60 min)	52.2 ± 17.0
Cannulation success rate [N, (%)]	45/45 (100%)

Cardiac Catheterization Laboratory (CCL)	
911 to Cardiac Catheterization Lab Time (mean; min; benchmark < 120 min)	121 ± 56
Angiography performed [N, (%)]	45/58 (78%)
Presence of severe coronary artery disease [N, (%)]	29/45 (64%)
Percutaneous coronary intervention performed [N, (%)]	22/29 (85%)
Culprit vessel [Number, (%) of Patients]	
Left main coronary artery	2/45 (4%)
Left anterior descending	12/45 (27%)
Left circumflex	0/45 (0%)
Right coronary artery	8/45 (18%)
Chronic total occlusions	10/45 (22%)
Total stents placed in all vessels (mean)	1.8 ± 1.2
Centralized ECMO Intensive Care Unit	
Therapeutic Hypothermia Provided (24 hours; goal temperature 34°C) [N, (%)]	41/41 (100%)
24-hour LVEF on echocardiogram in ICU (%)	13 ± 13
LVEF on hospital discharge (%)	51 ± 14
Tracheostomy [N, (%)]	5/41 (12%)
ECMO-Related Complications	
Circuit thrombosis [N, (%)]	0/45 (0%)
Air-embolism [N, (%)]	0/45 (0%)
Access site bleeding requiring >3 units PRBCs [N, (%)]	4/45 (9%)
Ischemic Limb requiring intervention (fasciotomy, amputation) [N, (%)]	0/45 (0%)

Summary of Conclusions

- The first community-wide ECMO-facilitated resuscitation program in the United States demonstrated 100% successful cannulation, 43% functionally favorable survival rates at hospital discharge and 3 months, and safety.
- This program provides a model of this approach for other communities.
- The paramedic scene time remains the primary delay compared to prior benchmarks. Further education and quality improvement efforts are underway.

ECMO
MN Mobile Resuscitation Consortium

Center for Resuscitation Medicine
University of Minnesota
Driven to Discover℠

University of Minnesota
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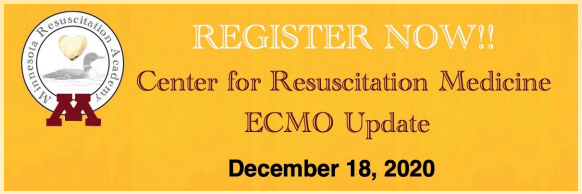
Areas of Need / Focus for the Future

- COVID Impact
  - Bed availability
  - Cost vs Cases
  - Retraining needs
- Publications to support ECPR more broadly
  - Discussions with legal, insurance teams
  - Implementation of mobile ECMO unit
- Ongoing training / ECMO Updates
  - Reducing on-scene time and notification
  - Medical review and case presentations
  - Bringing the expertise to the patient



Next Steps

- Implementation plan for the Mobile ECMO Truck
  - Final set up of equipment, telemedicine, and operations
  - Partnership and response area
- Training to use the MET
  - Operations
  - Simulations
  - Interactions with EMS

- Possible trial with MET and ED response options

Coming Soon - The Cath Lab at Your Door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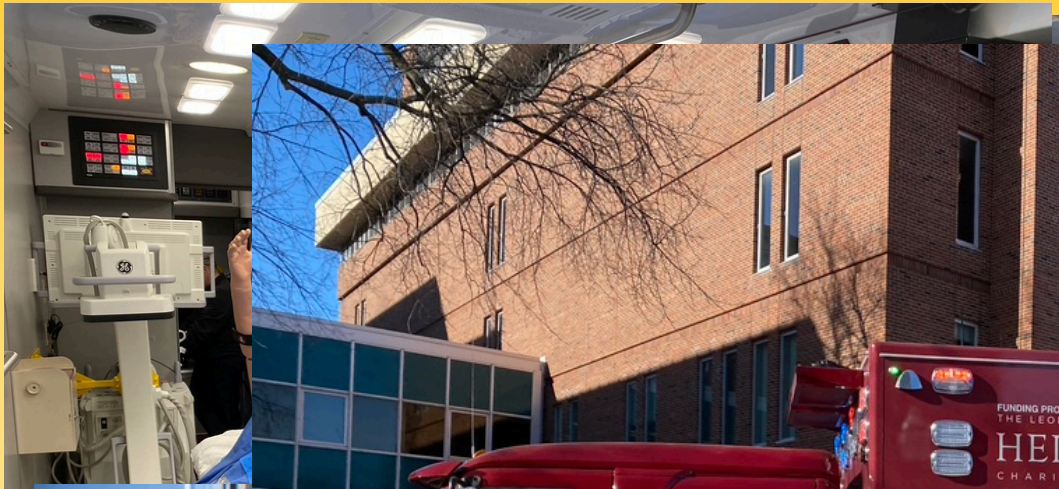

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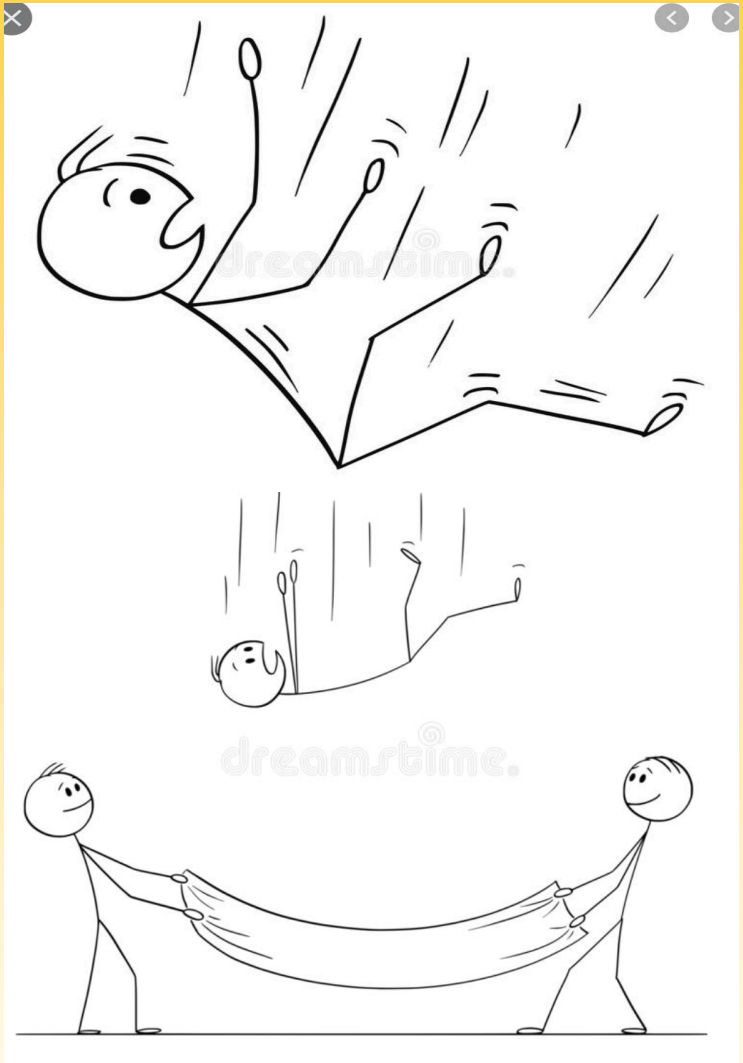

On going CPR and ACLS is like free falling…..

the longer you fall the higher the likelihood of dying……

especially if there is no one to catch you.

NOW WE HAVE ECLS !!!