

ECMO Activation Process Improvement Project

Michelle Smith MD^{1,2}, Kerrin Fair MSN, RN, CCRN¹, Elizabeth Harris RN, BSN, CCRN¹, Lauren Coressel MSN, RN, CNOR¹, Ladonna Bingham MD^{2,3}, Katie Fitzpatrick MS, PMP, PMI-ACP³, Andrew Smith MD^{1,2}, Arabela Stock MD^{1,2}

¹ Heart Center, ²Critical Care Medicine, ³Simulation Center, Johns Hopkins All Children's Hospital, St. Petersburg FL

Special thanks to the members of the Heart Center, Critical Care Medicine, Simulation Center, Transfer Center and Tracy Lambert for their help and participation during this project

Define: Background

Emergent cardiac Extracorporeal Membrane Oxygenation (ECMO) is an infrequent, high-stakes procedure. Optimal outcomes are dependent on an efficient system that utilizes well-defined protocols to minimize time to cannulation.

In May of 2021 we experienced an activation failure that contributed to an undesirable outcome. The case was reviewed in the Heart Institute MM&I and in an ACA. Gaps were identified in the activation process. The system was dependent on an on call individual to notify the team without close loop communication. There were also no defined metrics around the time from activation to cannulation.

ELSO suggests that institutions have local protocols that guide their decision-making. The process was redesigned to align with ELSO guidelines and the institutional pillars "Make Johns Hopkins All Children's Easy" and "Purse Excellence Regular".

Objective/Goal

Smart Aim: Time from activation to full ECMO flows ≤ 30 min for in-house ECMO team, and ≤ 60 min for time when ECMO team is not in-house.

Secondary Aim:

- Restructure the process for activation of ECMO in the cardiac ICU.
- Develop a process that clearly defines roles and responsibilities from the initial activation through cannulation.

Scope

This project is limited to emergent ECMO activation within the Heart Center (cath lab and cardiac OR) and CVICU. This is a multi-phase project that addresses emergent ECMO activation through cannulation. The initial phase refined the process of activation and room set up. The next phase is rolling out an expanded process map outlining individual roles/tasks.

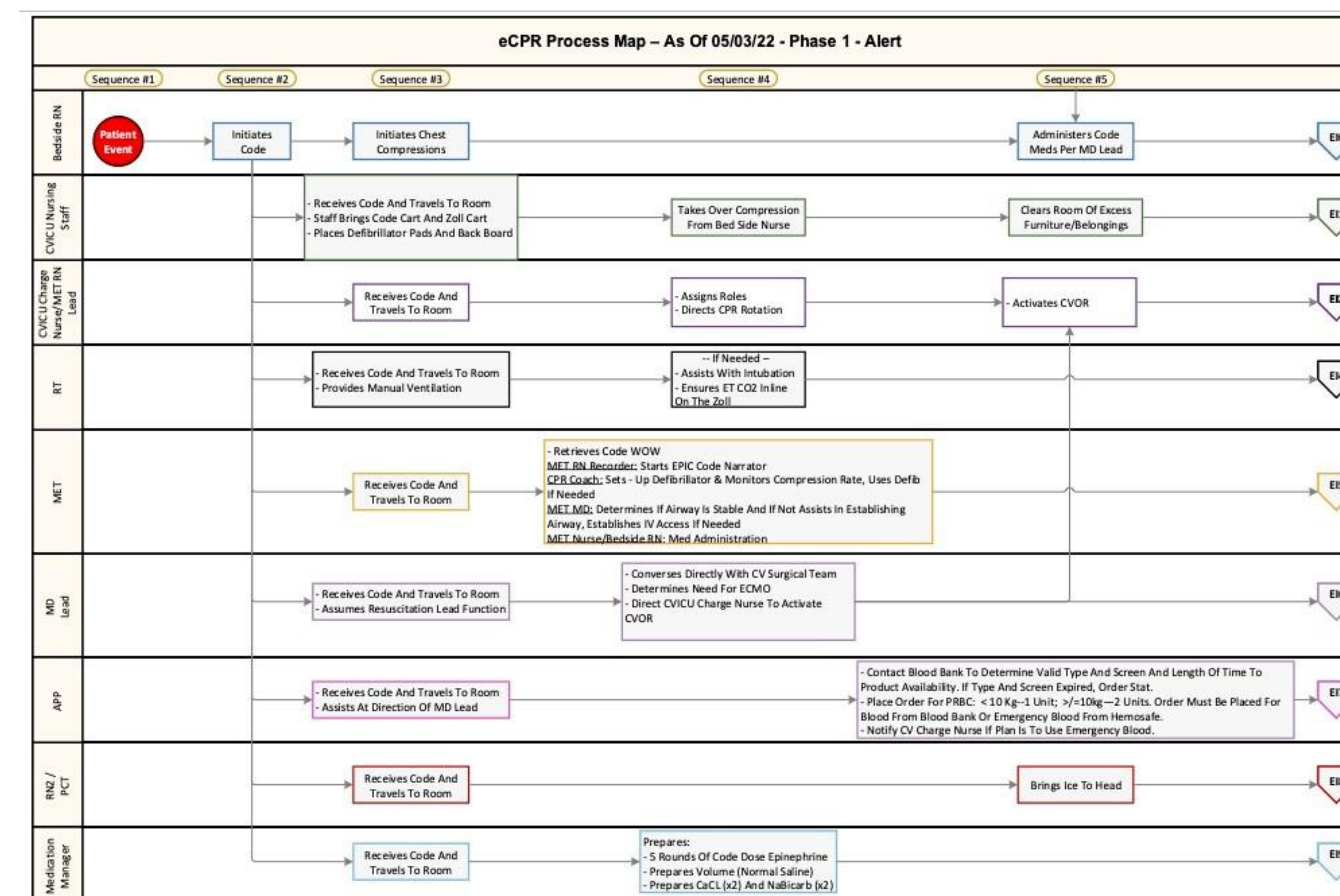
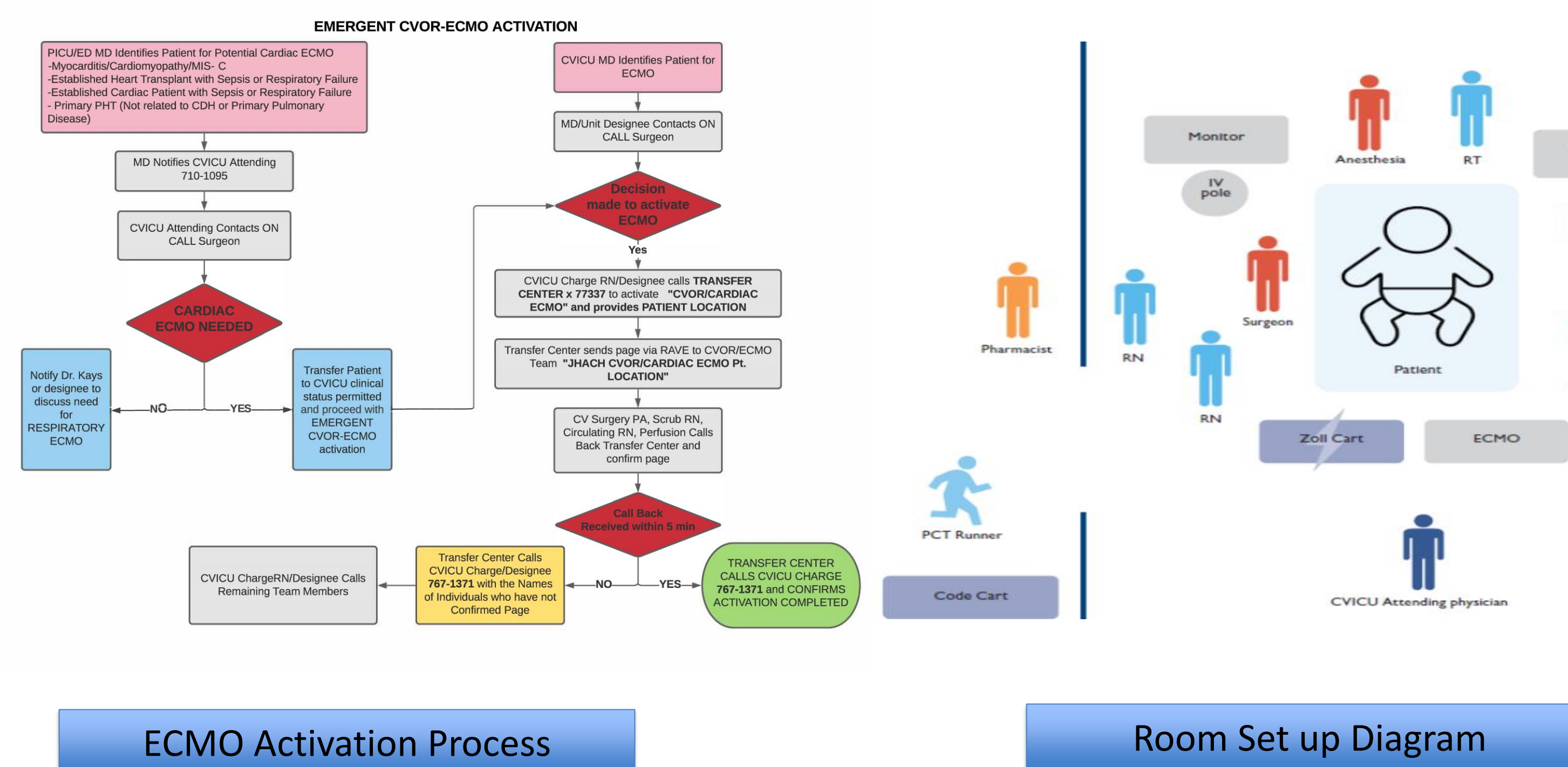
Measure

- Outcome measures: Patient Outcome defined as survived ECLS and survived at discharge.
- Process measures: Time from activation to close loop with CVICU; Time from activation to cannulation/full flows.
- Balancing measures: Delays/failure in the activation process; Adverse events.

Analyze

- May 2021- June 2021:** Multidisciplinary group was formed to redesign ECMO activation process to include room set up and diagram. Process was then tested in simulation using a standard case. The simulations were critical in identifying additional gaps including room setup, supplies, equipment and resources.
- November 2021:** Project manager assigned to assist in design of process map.
- February 2022-April 2022:** Process map redesign was completed and tested utilizing a tabletop simulation with a multidisciplinary team consisting of frontline staff and leadership level stakeholders.
- May 2022:** Completion of process map with defined roles and responsibilities for ECMO activation to cannulation.
all we do all for kids

Analyze



Process Map with Role Delineation

Improve

Date	Time Requested	Connexall Sent	Close Loop w/ CVICU	Time Requested to Close Loop	Time of Cannulation	Time from Activation to Cannulation
6/23/2021	14:25	14:27	14:33	8 minutes	15:03	38 minutes
7/18/2021	22:19	22:20	22:26	7 minutes	23:27	68 minutes
7/25/2021	0:10	0:11	0:16	6 minutes	1:00	50 minutes
8/27/2021	9:40	9:41	9:49	9 minutes	10:07	27 minutes
3/14/2022	22:02	22:03	22:13	11 minutes	23:40	1 hour 38 minutes
4/3/2022	6:28	6:29	6:37	9 minutes	7:19	51 minutes
9/14/2022	10:04	10:06	10:11	7 minutes	10:29	25 minutes
Team out of hospital						

Outcomes since June 2021:

- 7 Emergent cannulations
- Time from activation to cannulation when team is out of house: average of 59 min
- Time from activation to cannulation when team is in house: average of 31 min
- Time from activation to close loop with CVICU: average of 8 min
- 2/7 ECMO runs on the same patient
- 1/7 Team called emergently however the cannulation became elective hence the time ≥ 60 min
- 5/7 Survived ECMO
- 2/7 Survived at Discharge; 1/7 still in house
- No adverse events since implementation
- No delays in activation

Control/Sustainability

- Ongoing education and simulation
 - Hot and cold debriefs of actual events as well as in situ simulation
- Next Step:
- Roll out the process map and educate the multidisciplinary staff to the roles and responsibilities of the individual team members.
 - Expand to PICU given that team resources are shared (OR, Perfusion, Primers) thus creating a shared mental model utilizing education and simulation within the core ECMO team.