ECLS Registry Report

International Summary

April, 2022

Report data through 2021

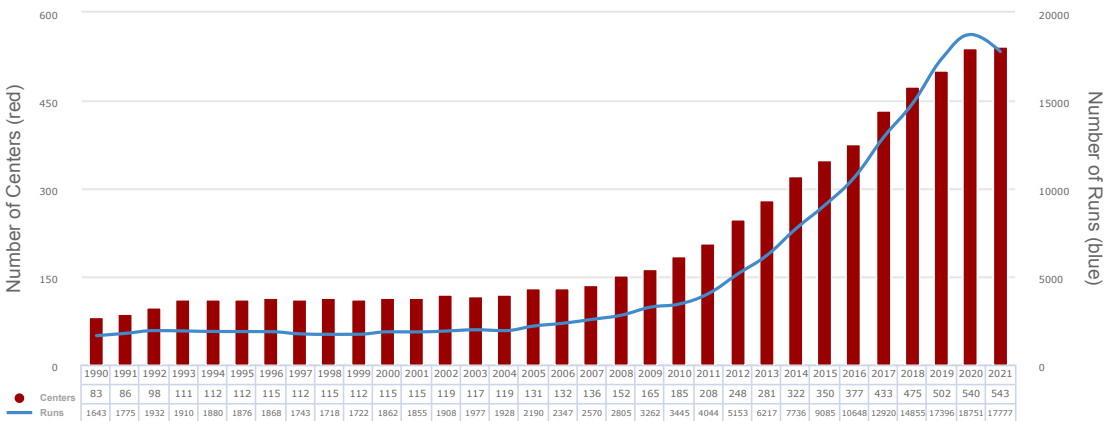
Extracorporeal Life Support Organization
3001 Miller Rd
Ann Arbor, MI 48103 USA

Overall Outcomes

	Total Runs	Survived ECLS		Survived to DC or Transfer	
Adult					
Pulmonary	42,702	28,419	66%	25,047	58%
Cardiac	38,610	23,086	59%	17,472	45%
ECPR	11,761	4,934	41%	3,560	30%
Pediatric					
Pulmonary	11,850	8,621	72%	7,235	61%
Cardiac	15,083	10,949	72%	8,202	54%
ECPR	6,131	3,614	58%	2,596	42%
Neonatal					
Pulmonary	34,151	29,899	87%	24,949	73%
Cardiac	10,127	7,000	69%	4,487	44%
ECPR	2,420	1,685	69%	1,031	42%
Total	172,835	118,207	68%	94,579	54%

Centers

Centers by year

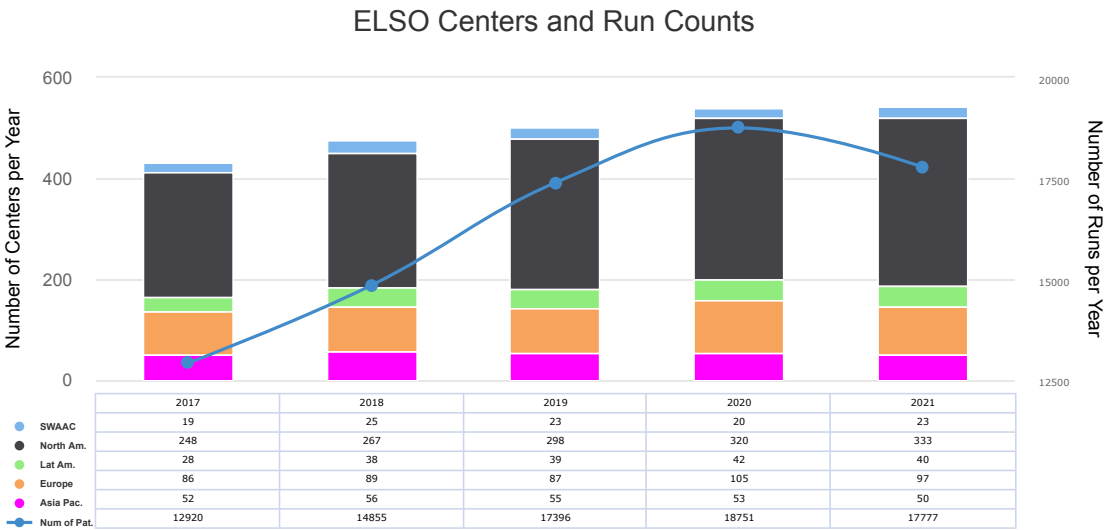


	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Centers	83	86	98	111	112	112	115	112	115	112	115	115	119	117	119	131	132	136	152	165	185	208	248	281	322	350	377	433	475	502	540	543
Runs	1643	1775	1932	1910	1880	1876	1868	1743	1718	1722	1862	1855	1908	1977	1928	2190	2347	2570	2805	3262	3445	4044	5153	6217	7736	9085	10648	12920	14855	17396	18751	17777

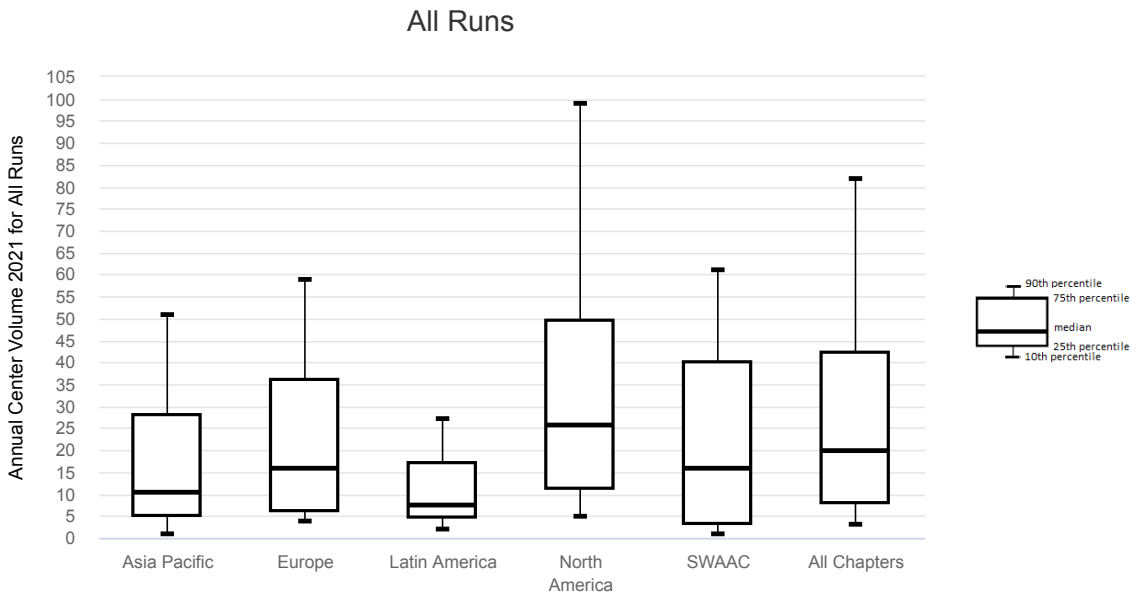
Overall Outcomes from 2017 to 2021

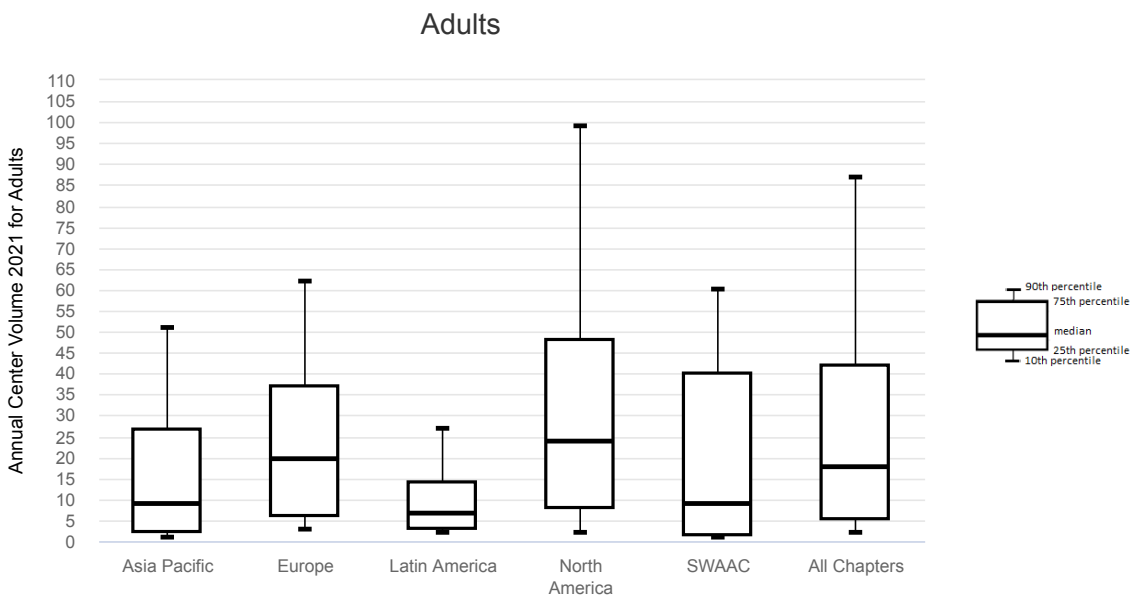
	Total Runs	Survived ECLS		Survived to DC or Transfer	
Adult					
Pulmonary	28,974	18,886	65%	17,038	58%
Cardiac	25,936	15,341	59%	12,160	46%
ECPR	7,858	3,253	41%	2,438	31%
Pediatric					
Pulmonary	3,558	2,725	76%	2,464	69%
Cardiac	5,346	4,002	74%	3,211	60%
ECPR	2,573	1,443	56%	1,107	43%
Neonatal					
Pulmonary	3,887	3,215	82%	2,768	71%
Cardiac	2,745	1,945	70%	1,439	52%
ECPR	822	534	64%	368	44%
Total	81,699	51,344	62%	42,993	52%

Centers by region

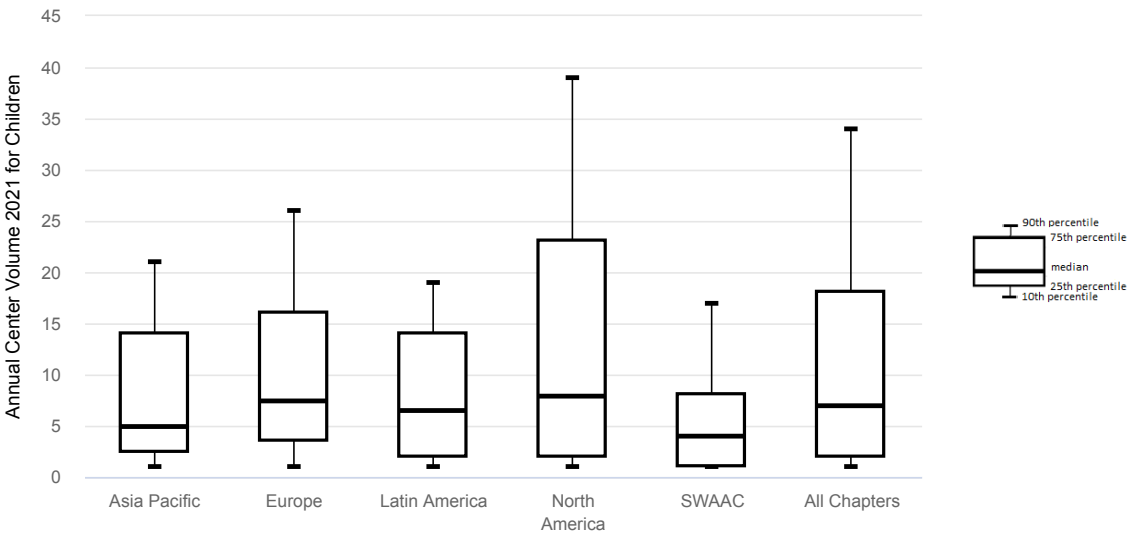


Annual Center Volume in 2022

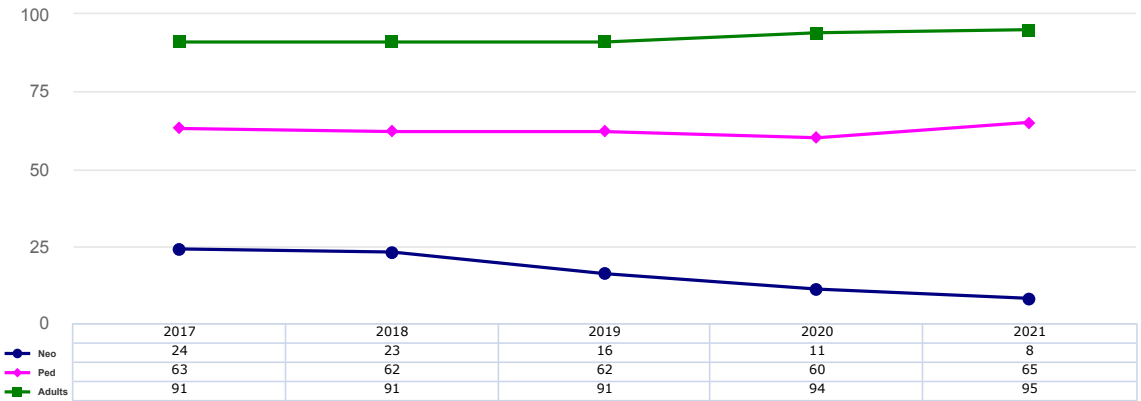




Children (Neonatal and Pediatric)

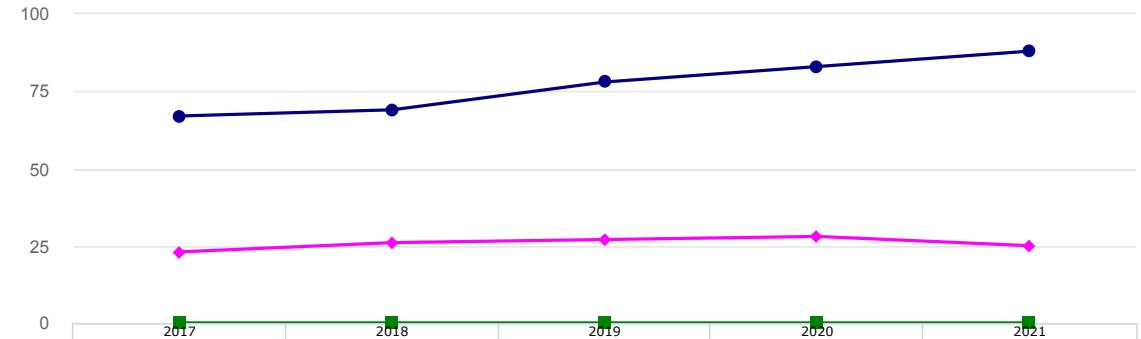


Proportion of VV Cannulation (Respiratory only)



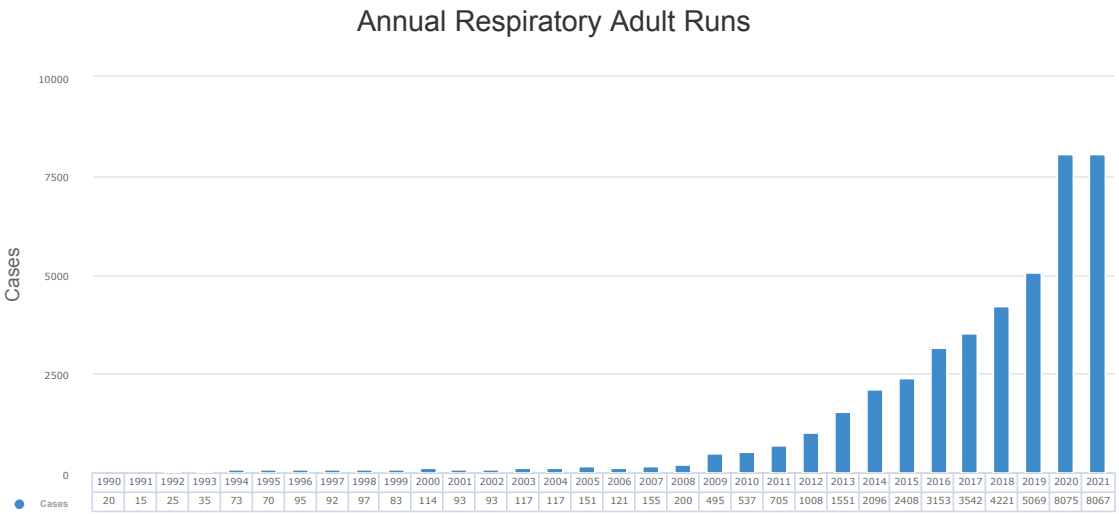
	2017	2018	2019	2020	2021
Neo	24	23	16	11	8
Ped	63	62	62	60	65
Adults	91	91	91	94	95

Proportion of respiratory ECMO support with carotid artery cannulation



	2017	2018	2019	2020	2021
Neo	67	69	78	83	88
Ped	23	26	27	28	25
Adults	0	0	0	0	0

Adult Respiratory (18 years and over)



Adult Respiratory Runs by Year

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
<=1986	1	1	16	16	0	0%
1987	1	2	300	300	1	100%
1988	5	7	189	330	1	20%
1989	2	9	234	379	1	50%
1990	20	29	197	671	10	50%
1991	15	44	387	1,246	5	33%
1992	25	69	260	1,083	14	56%
1993	35	104	299	1,326	19	54%
1994	73	177	242	788	35	47%
1995	70	247	199	1,357	40	57%
1996	95	342	178	826	44	46%
1997	92	434	242	981	41	44%
1998	97	531	212	1,238	46	47%
1999	83	614	206	803	39	46%
2000	114	728	208	1,308	62	54%
2001	93	821	231	1,417	55	59%
2002	93	914	195	1,942	52	55%
2003	117	1,031	214	2,035	70	59%
2004	117	1,148	208	1,142	61	52%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2005	151	1,299	197	1,220	74	49%
2006	121	1,420	255	5,014	48	39%
2007	155	1,575	226	2,750	80	51%
2008	200	1,775	196	1,596	104	52%
2009	495	2,270	259	3,018	288	58%
2010	537	2,807	250	2,004	315	58%
2011	705	3,512	258	2,959	409	58%
2012	1,008	4,520	275	6,248	564	55%
2013	1,551	6,071	295	6,745	934	60%
2014	2,096	8,167	298	3,288	1,260	60%
2015	2,408	10,575	279	7,576	1,354	56%
2016	3,153	13,728	309	5,355	1,983	62%
2017	3,542	17,270	277	5,199	2,155	60%
2018	4,221	21,491	281	6,479	2,615	61%
2019	5,069	26,560	291	6,380	3,279	64%
2020	8,075	34,635	449	9,259	4,488	55%
2021	8,067	42,702	583	7,613	4,501	55%

Adult Respiratory Runs by Diagnosis from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Viral pneumonia	655	513	4,150	371	56%
Bacterial pneumonia	830	317	3,985	536	64%
Aspiration pneumonia	196	232	1,575	160	81%
ARDS, postop/trauma	10	149	361	6	60%
ARDS, not postop/trauma	4,810	402	9,259	2,882	59%
Acute resp failure, non-ARDS	753	294	4,180	461	61%
Other	20,427	426	7,613	11,833	57%

Note some runs are missing primary diagnoses

Initial Adult Respiratory Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	27,055	425	9,259	15,876	58%
VA	1,451	188	5,009	956	65%
VVA	255	313	2,538	99	38%
Other	79	422	2,609	35	44%
VP	134	632	5,161	72	53%

Runs with Conversions - Adult Respiratory Support Mode Details from 2017 to 2021

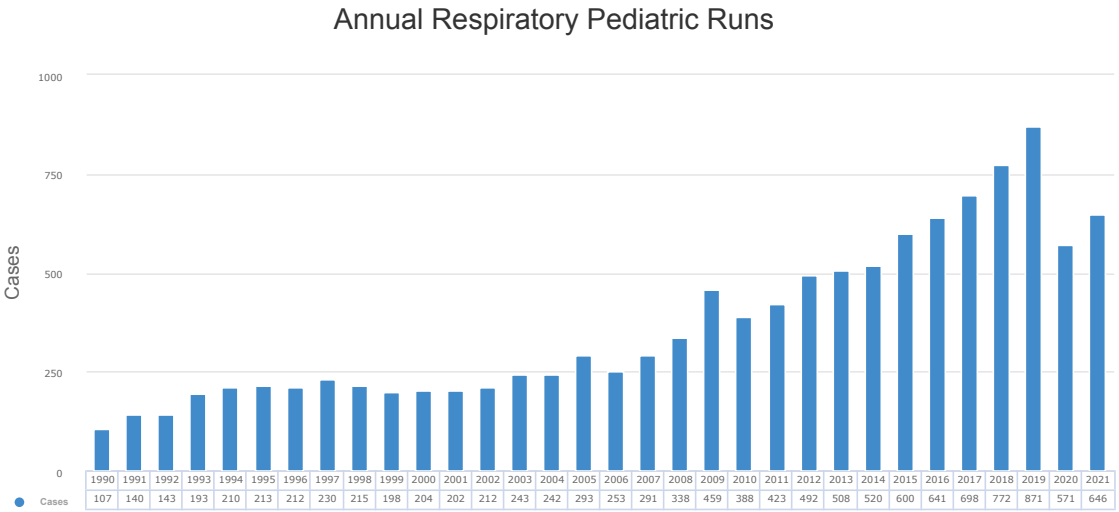
	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV to VA	361	587	5,311	127	35%
VA to VV	153	374	2,750	90	58%
Other	807	678	9,259	342	42%

Adult Respiratory Complications from 2017 to 2021

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	4,885	16.9%	2,631	54%
Mechanical: Raceway rupture	2	0%	1	50%
Mechanical: Other tubing rupture	44	0.2%	20	45%
Mechanical: Pump Failure	401	1.4%	190	47%
Mechanical: Temperature Regulation Device Malfunction	24	0.1%	10	42%
Mechanical: Clots: hemofilter	308	1.1%	149	48%
Mechanical: Air in circuit	325	1.1%	164	50%
Mechanical: Cracks in pigtail connectors	11	0%	4	36%
Mechanical: Cannula problems	1,850	6.4%	868	47%
Mechanical: Circuit change	3,276	11.3%	1,762	54%
Mechanical: Clots and Air Emboli	67	0.2%	20	30%
Mechanical: Thrombosis/Clots: circuit component	1,359	4.7%	731	54%
Hemorrhagic: GI hemorrhage	1,714	5.9%	658	38%
Hemorrhagic: Cannulation site bleeding	328	1.1%	181	55%
Hemorrhagic: Surgical site bleeding	1,889	6.5%	925	49%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	368	1.3%	202	55%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	51	0.2%	17	33%
Hemorrhagic: Peripheral cannulation site bleeding	1,115	3.8%	522	47%
Hemorrhagic: Mediastinal cannulation site bleeding	105	0.4%	41	39%
Neurologic: Brain death	320	1.1%	0	0%
Neurologic: Seizures: clinically determined	173	0.6%	73	42%
Neurologic: Seizures Confirmed by EEG	84	0.3%	29	35%
Neurologic: CNS Infarction (US or CT or MRI)	392	1.4%	98	25%
Neurologic: CNS hemorrhage by US/CT	282	1%	83	29%

	No Reported	% Reported	Survived	% Survived
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	315	1.1%	25	8%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	768	2.7%	144	19%
Neurologic: CNS diffuse ischemia (CT/MRI)	159	0.5%	25	16%
Neurologic: Neurosurgical intervention performed	48	0.2%	13	27%
Renal: Creatinine 1.5 - 3.0	3,062	10.6%	1,485	48%
Renal: Creatinine > 3.0	1,394	4.8%	632	45%
Renal: Renal Replacement Therapy Required	7,423	25.6%	3,134	42%
Cardiovascular: Inotropes on ECLS	715	2.5%	370	52%
Cardiovascular: CPR required	1,573	5.4%	361	23%
Cardiovascular: Myocardial stun by echo	21	0.1%	10	48%
Cardiovascular: Cardiac arrhythmia	2,660	9.2%	1,029	39%
Cardiovascular: Hypertension requiring vasodilators	82	0.3%	51	62%
Cardiovascular: PDA: L->R	1	0%	1	100%
Cardiovascular: Tamponade (blood)	261	0.9%	104	40%
Cardiovascular: Tamponade (not blood)	44	0.2%	16	36%
Pulmonary: Pneumothorax requiring treatment	2,986	10.3%	1,187	40%
Pulmonary: Pulmonary hemorrhage	996	3.4%	353	35%
Infectious: Culture proven infection (see Infections)	337	1.2%	186	55%
Infectious: WBC < 1,500	437	1.5%	149	34%
Metabolic: Glucose < 40	38	0.1%	11	29%
Metabolic: Glucose > 240	223	0.8%	122	55%
Metabolic: pH < 7.20	189	0.7%	57	30%
Metabolic: pH > 7.60	39	0.1%	25	64%
Metabolic: Hyperbilirubinemia	1,299	4.5%	355	27%
Metabolic: Moderate hemolysis	937	3.2%	486	52%
Metabolic: Severe hemolysis	645	2.2%	248	38%
Limb: Ischemia	259	0.9%	86	33%
Limb: Compartment Syndrome	58	0.2%	16	28%
Limb: Fasciotomy	137	0.5%	52	38%
Limb: Amputation	53	0.2%	27	51%

Pediatric Respiratory (>28 days and <18 years)



Pediatric Respiratory Runs by Year

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
<=1986	20	20	182	450	6	30%
1987	14	34	204	595	6	42%
1988	38	72	245	648	13	34%
1989	50	122	215	612	29	58%
1990	107	229	270	853	49	45%
1991	140	369	293	1,256	73	52%
1992	143	512	298	933	70	48%
1993	193	705	286	1,144	102	52%
1994	210	915	286	1,156	122	58%
1995	213	1,128	290	1,440	111	52%
1996	212	1,340	296	1,483	126	59%
1997	230	1,570	280	1,258	139	60%
1998	215	1,785	252	1,015	127	59%
1999	198	1,983	247	1,332	120	60%
2000	204	2,187	263	2,437	110	53%
2001	202	2,389	240	2,239	96	47%
2002	212	2,601	230	1,108	130	61%
2003	243	2,844	226	881	145	59%
2004	242	3,086	237	1,222	141	58%
2005	293	3,379	243	1,280	156	53%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2006	253	3,632	272	1,326	132	52%
2007	291	3,923	258	1,309	164	56%
2008	338	4,261	256	1,987	178	52%
2009	459	4,720	288	2,968	258	56%
2010	388	5,108	269	2,140	230	59%
2011	423	5,531	276	2,465	252	59%
2012	492	6,023	254	2,781	306	62%
2013	508	6,531	305	6,862	315	62%
2014	520	7,051	259	1,932	321	61%
2015	600	7,651	308	7,503	362	60%
2016	641	8,292	303	4,286	382	59%
2017	698	8,990	313	4,557	471	67%
2018	772	9,762	317	6,011	520	67%
2019	871	10,633	290	2,670	632	72%
2020	571	11,204	304	4,564	379	66%
2021	646	11,850	306	3,903	462	71%

Pediatric Respiratory Runs by Diagnosis from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Viral pneumonia	155	314	1,385	119	76%
Bacterial pneumonia	150	384	3,903	108	72%
Pneumocystis pneumonia	6	763	1,493	3	50%
Aspiration pneumonia	38	210	1,724	28	73%
ARDS, postop/trauma	13	278	711	11	84%
ARDS, not postop/trauma	392	373	4,379	275	70%
Acute resp failure, non-ARDS	176	288	2,717	126	71%
Other	2,553	293	6,011	1,747	68%

Note some runs are missing primary diagnoses

Initial Pediatric Respiratory Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	2,261	332	6,011	1,646	72%
VA	1,252	256	4,564	802	64%
VVA	33	341	1,333	12	36%
Other	11	316	772	4	36%
VP	1	1	1	0	0%

Runs with Conversions - Pediatric Respiratory Support Mode Details from 2017 to 2021

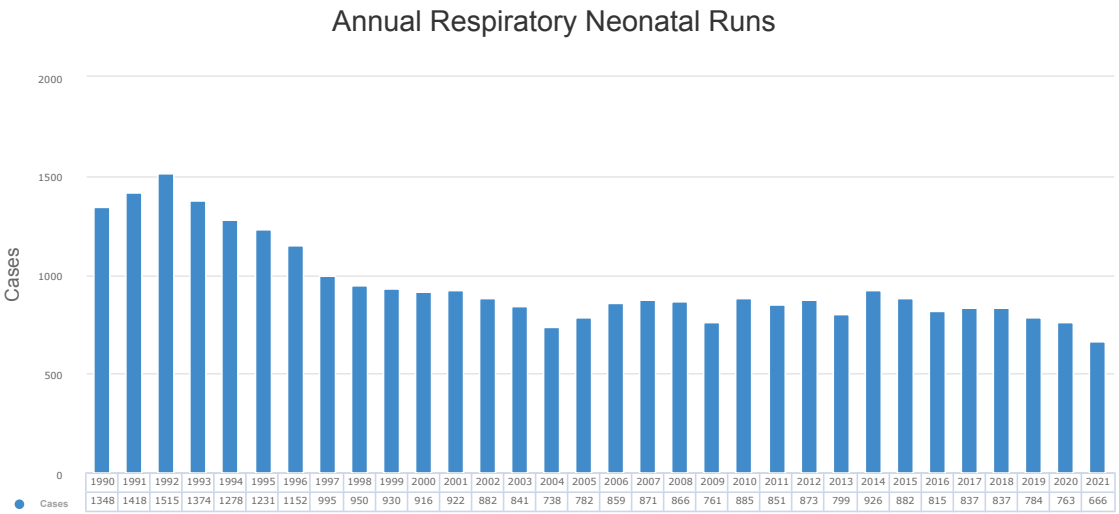
	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV to VA	109	498	3,903	56	51%
VA to VV	47	672	4,564	32	68%
Other	86	637	6,011	45	52%

Pediatric Respiratory Complications from 2017 to 2021

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	294	8.3%	163	55%
Mechanical: Raceway rupture	4	0.1%	1	25%
Mechanical: Other tubing rupture	10	0.3%	3	30%
Mechanical: Pump Failure	37	1%	24	65%
Mechanical: Temperature Regulation Device Malfunction	10	0.3%	7	70%
Mechanical: Clots: hemofilter	196	5.5%	118	60%
Mechanical: Air in circuit	165	4.6%	97	59%
Mechanical: Cracks in pigtail connectors	17	0.5%	7	41%
Mechanical: Cannula problems	576	16.2%	373	65%
Mechanical: Circuit change	689	19.4%	449	65%
Mechanical: Clots and Air Emboli	27	0.8%	12	44%
Mechanical: Thrombosis/Clots: circuit component	679	19.1%	425	63%
Hemorrhagic: GI hemorrhage	136	3.8%	52	38%
Hemorrhagic: Cannulation site bleeding	153	4.3%	100	65%
Hemorrhagic: Surgical site bleeding	258	7.3%	148	57%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	367	10.3%	211	57%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	17	0.5%	5	29%
Hemorrhagic: Peripheral cannulation site bleeding	189	5.3%	122	65%
Hemorrhagic: Mediastinal cannulation site bleeding	63	1.8%	43	68%
Neurologic: Brain death	62	1.7%	0	0%
Neurologic: Seizures: clinically determined	59	1.7%	22	37%
Neurologic: Seizures Confirmed by EEG	92	2.6%	42	46%
Neurologic: CNS Infarction (US or CT or MRI)	115	3.2%	38	33%
Neurologic: CNS hemorrhage by US/CT	108	3%	36	33%

	No Reported	% Reported	Survived	% Survived
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	31	0.9%	7	23%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	67	1.9%	20	30%
Neurologic: CNS diffuse ischemia (CT/MRI)	51	1.4%	12	24%
Neurologic: Neurosurgical intervention performed	12	0.3%	5	42%
Renal: Creatinine 1.5 - 3.0	187	5.3%	97	52%
Renal: Creatinine > 3.0	57	1.6%	27	47%
Renal: Renal Replacement Therapy Required	1,006	28.3%	522	52%
Cardiovascular: Inotropes on ECLS	168	4.7%	102	61%
Cardiovascular: CPR required	219	6.2%	85	39%
Cardiovascular: Myocardial stun by echo	6	0.2%	4	67%
Cardiovascular: Cardiac arrhythmia	106	3%	48	45%
Cardiovascular: Hypertension requiring vasodilators	93	2.6%	73	78%
Cardiovascular: PDA: L->R	1	0%	0	0%
Cardiovascular: Tamponade (blood)	66	1.9%	44	67%
Cardiovascular: Tamponade (not blood)	7	0.2%	5	71%
Pulmonary: Pneumothorax requiring treatment	285	8%	147	52%
Pulmonary: Pulmonary hemorrhage	141	4%	57	40%
Infectious: Culture proven infection (see Infections)	73	2.1%	43	59%
Infectious: WBC < 1,500	60	1.7%	23	38%
Metabolic: Glucose < 40	5	0.1%	2	40%
Metabolic: Glucose > 240	56	1.6%	38	68%
Metabolic: pH < 7.20	58	1.6%	28	48%
Metabolic: pH > 7.60	13	0.4%	12	92%
Metabolic: Hyperbilirubinemia	184	5.2%	50	27%
Metabolic: Moderate hemolysis	477	13.4%	281	59%
Metabolic: Severe hemolysis	324	9.1%	170	52%
Limb: Ischemia	23	0.6%	10	43%
Limb: Compartment Syndrome	11	0.3%	4	36%
Limb: Fasciotomy	24	0.7%	15	63%
Limb: Amputation	12	0.3%	6	50%

Neonatal Respiratory (0-28 days)



Neonatal Respiratory Runs by Year

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
<=1986	819	819	118	840	658	80%
1987	651	1,470	121	411	558	85%
1988	1,015	2,485	131	601	841	82%
1989	1,119	3,604	134	500	917	81%
1990	1,348	4,952	144	672	1,095	81%
1991	1,418	6,370	153	827	1,141	80%
1992	1,515	7,885	155	2,832	1,180	77%
1993	1,374	9,259	158	959	1,093	79%
1994	1,278	10,537	161	936	972	76%
1995	1,231	11,768	163	794	930	75%
1996	1,152	12,920	167	1,176	841	73%
1997	995	13,915	173	1,131	742	74%
1998	950	14,865	187	1,093	681	71%
1999	930	15,795	183	812	672	72%
2000	916	16,711	188	936	692	75%
2001	922	17,633	190	949	655	71%
2002	882	18,515	189	944	624	70%
2003	841	19,356	195	1,001	554	65%
2004	738	20,094	196	956	481	65%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2005	782	20,876	204	1,006	531	67%
2006	859	21,735	207	1,033	576	67%
2007	871	22,606	198	1,229	583	66%
2008	866	23,472	212	1,133	580	66%
2009	761	24,233	211	1,327	522	68%
2010	885	25,118	204	2,549	612	69%
2011	851	25,969	223	2,745	562	66%
2012	873	26,842	227	3,435	611	69%
2013	799	27,641	213	1,908	535	66%
2014	926	28,567	221	2,305	644	69%
2015	882	29,449	214	1,662	563	63%
2016	815	30,264	227	1,733	535	65%
2017	837	31,101	212	2,286	593	70%
2018	837	31,938	228	2,693	607	72%
2019	784	32,722	217	2,197	552	70%
2020	763	33,485	227	2,235	538	70%
2021	666	34,151	208	1,810	478	71%

Neonatal Respiratory Runs by Diagnosis from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
CDH	1,222	322	2,235	715	58%
MAS	586	152	2,286	535	91%
PPHN/PFC	272	155	937	199	73%
RDS	30	192	522	23	76%
Sepsis	79	161	686	41	51%
Pneumonia	12	339	982	7	58%
Air Leak Syndrome	5	179	282	4	80%
Other	1,642	179	2,693	1,213	73%

Note some runs are missing primary diagnoses

Initial Neonatal Respiratory Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	676	173	1,017	533	78%
VA	3,192	229	2,693	2,220	69%
VVA	14	215	937	11	78%
Other	5	175	341	4	80%

Runs with Conversions - Neonatal Respiratory Support Mode Details from 2017 to 2021

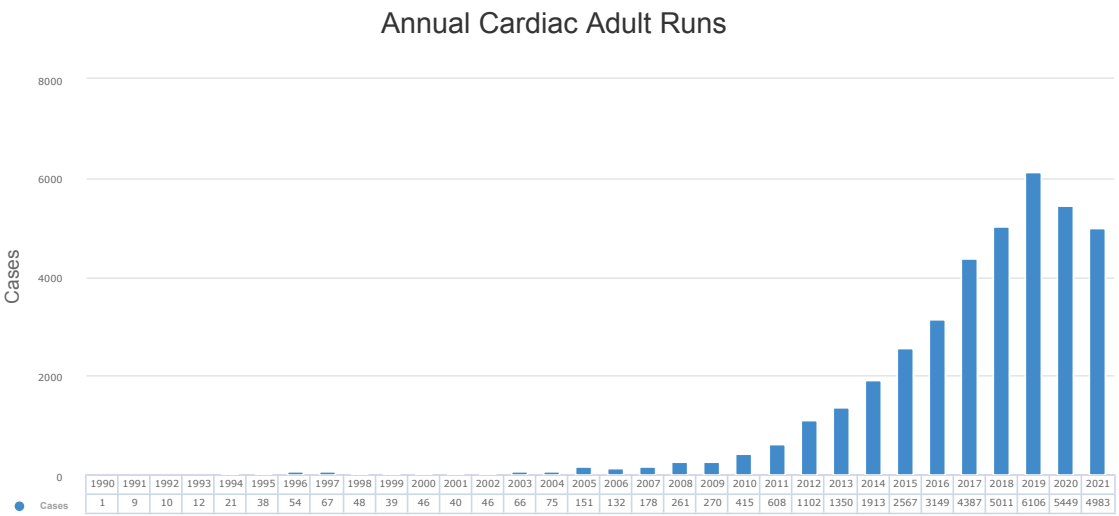
	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV to VA	57	249	887	26	45%
VA to VV	15	710	2,693	8	53%
Other	13	299	982	5	38%

Neonatal Respiratory Complications from 2017 to 2021

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	234	6%	119	51%
Mechanical: Raceway rupture	2	0.1%	2	100%
Mechanical: Other tubing rupture	7	0.2%	5	71%
Mechanical: Pump Failure	32	0.8%	11	34%
Mechanical: Temperature Regulation Device Malfunction	12	0.3%	6	50%
Mechanical: Clots: hemofilter	194	5%	80	41%
Mechanical: Air in circuit	123	3.2%	65	53%
Mechanical: Cracks in pigtail connectors	7	0.2%	4	57%
Mechanical: Cannula problems	568	14.6%	343	60%
Mechanical: Circuit change	732	18.8%	331	45%
Mechanical: Clots and Air Emboli	63	1.6%	42	67%
Mechanical: Thrombosis/Clots: circuit component	1,136	29.2%	615	54%
Hemorrhagic: GI hemorrhage	56	1.4%	23	41%
Hemorrhagic: Cannulation site bleeding	141	3.6%	96	68%
Hemorrhagic: Surgical site bleeding	245	6.3%	107	44%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	389	10%	216	56%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	29	0.7%	16	55%
Hemorrhagic: Peripheral cannulation site bleeding	169	4.3%	118	70%
Hemorrhagic: Mediastinal cannulation site bleeding	23	0.6%	9	39%
Neurologic: Brain death	4	0.1%	0	0%
Neurologic: Seizures: clinically determined	81	2.1%	41	51%
Neurologic: Seizures Confirmed by EEG	204	5.2%	107	52%
Neurologic: CNS Infarction (US or CT or MRI)	96	2.5%	39	41%
Neurologic: CNS hemorrhage by US/CT	190	4.9%	83	44%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	113	2.9%	48	42%

	No Reported	% Reported	Survived	% Survived
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	130	3.3%	47	36%
Neurologic: CNS diffuse ischemia (CT/MRI)	17	0.4%	3	18%
Neurologic: Neurosurgical intervention performed	1	0%	1	100%
Renal: Creatinine 1.5 - 3.0	106	2.7%	43	41%
Renal: Creatinine > 3.0	9	0.2%	2	22%
Renal: Renal Replacement Therapy Required	796	20.5%	400	50%
Cardiovascular: Inotropes on ECLS	258	6.6%	147	57%
Cardiovascular: CPR required	85	2.2%	26	31%
Cardiovascular: Myocardial stun by echo	9	0.2%	3	33%
Cardiovascular: Cardiac arrhythmia	143	3.7%	78	55%
Cardiovascular: Hypertension requiring vasodilators	60	1.5%	36	60%
Cardiovascular: PDA: R->L	21	0.5%	11	52%
Cardiovascular: PDA: L->R	22	0.6%	14	64%
Cardiovascular: PDA: bidirectional	28	0.7%	14	50%
Cardiovascular: PDA: unknown	1	0%	0	0%
Cardiovascular: Tamponade (blood)	45	1.2%	24	53%
Cardiovascular: Tamponade (not blood)	15	0.4%	5	33%
Pulmonary: Pneumothorax requiring treatment	149	3.8%	76	51%
Pulmonary: Pulmonary hemorrhage	133	3.4%	48	36%
Infectious: Culture proven infection (see Infections)	22	0.6%	8	36%
Infectious: WBC < 1,500	15	0.4%	6	40%
Metabolic: Glucose < 40	18	0.5%	12	67%
Metabolic: Glucose > 240	65	1.7%	48	74%
Metabolic: pH < 7.20	72	1.9%	36	50%
Metabolic: pH > 7.60	31	0.8%	20	65%
Metabolic: Hyperbilirubinemia	345	8.9%	164	48%
Metabolic: Moderate hemolysis	382	9.8%	219	57%
Metabolic: Severe hemolysis	227	5.8%	101	44%
Limb: Ischemia	13	0.3%	2	15%
Limb: Fasciotomy	1	0%	1	100%

Adult Cardiac (18 years and over)



Adult Cardiac Runs by Year

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
<=1986	1	1	136	136	0	0%
1988	3	4	231	370	0	0%
1989	2	6	63	102	1	50%
1990	1	7	147	147	0	0%
1991	9	16	134	382	1	11%
1992	10	26	82	303	2	20%
1993	12	38	95	214	2	16%
1994	21	59	117	622	6	28%
1995	38	97	101	438	18	47%
1996	54	151	93	564	16	29%
1997	67	218	85	900	28	41%
1998	48	266	115	786	12	25%
1999	39	305	105	256	13	33%
2000	46	351	102	431	17	36%
2001	40	391	85	259	14	35%
2002	46	437	102	404	17	36%
2003	66	503	130	576	23	34%
2004	75	578	106	733	28	37%
2005	151	729	116	663	48	31%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2006	132	861	142	965	63	47%
2007	178	1,039	116	761	70	39%
2008	261	1,300	126	1,296	123	47%
2009	270	1,570	127	871	111	41%
2010	415	1,985	138	2,105	182	43%
2011	608	2,593	139	4,570	225	37%
2012	1,102	3,695	150	2,950	455	41%
2013	1,350	5,045	159	3,066	548	40%
2014	1,913	6,958	161	6,539	811	42%
2015	2,567	9,525	152	2,849	1,094	42%
2016	3,149	12,674	154	2,941	1,384	43%
2017	4,387	17,061	160	6,359	1,910	43%
2018	5,011	22,072	159	4,085	2,266	45%
2019	6,106	28,178	161	4,783	2,954	48%
2020	5,449	33,627	160	2,029	2,594	47%
2021	4,983	38,610	167	2,561	2,436	48%

Adult Cardiac Runs by Diagnosis from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Congenital Defect	169	184	867	80	47%
Cardiac Arrest	463	123	1,253	183	39%
Cardiogenic Shock	8,759	173	4,783	3,999	45%
Cardiomyopathy	146	194	1,990	79	54%
Myocarditis	164	191	956	120	73%
Other	14,630	156	6,359	7,046	48%

Note some runs are missing primary diagnoses

Adult Cardiac Runs by Congenital Diagnosis from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Left to right shunt (ASD/VSD/PDA/AV canal/AVSD/ECD)	62	192	867	24	38%
Left-sided obstructive (aortic stenosis/mitral stenosis/coarctation)	43	181	618	20	46%
Hypoplastic left heart	5	331	553	3	60%
Right-sided obstructive (pulmonary stenosis/pulmonary or tricuspid atresia)	6	216	340	1	16%
Cyanotic incr. pulmonary flow (truncus asteriosis/TGA/TGV)	6	221	846	3	50%
Cyanotic decr. pulmonary flow (TOF/DORV/Ebsteins)	14	136	281	12	85%

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Other	33	156	840	17	51%

Note some runs are missing primary diagnoses

Initial Adult Cardiac Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	452	237	1,990	216	47%
VA	24,540	158	6,359	11,495	46%
VVA	516	203	1,787	220	42%
Other	342	194	3,384	192	56%
Unknown	3	154	230	1	33%
VP	83	192	1,291	36	43%

Runs with Conversions - Adult Cardiac Support Mode Details from 2017 to 2021

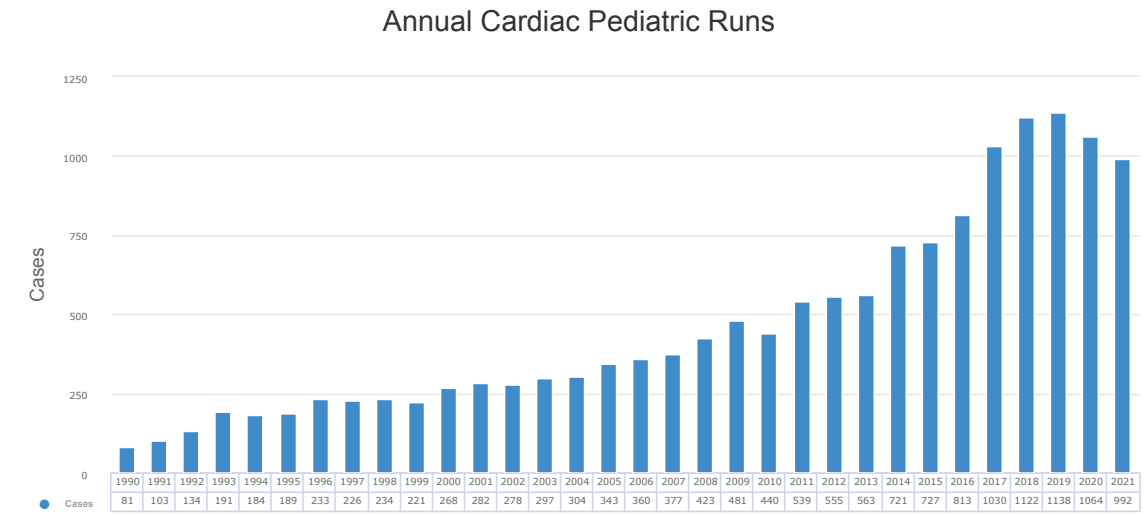
	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV to VA	37	317	1,724	11	29%
VA to VV	803	353	2,709	380	47%
Other	939	330	3,384	380	40%

Adult Cardiac Complications from 2017 to 2021

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	788	3%	310	39%
Mechanical: Raceway rupture	1	0%	0	0%
Mechanical: Other tubing rupture	15	0.1%	4	27%
Mechanical: Pump Failure	142	0.5%	49	35%
Mechanical: Temperature Regulation Device Malfunction	9	0%	5	56%
Mechanical: Clots: hemofilter	92	0.4%	38	41%
Mechanical: Air in circuit	213	0.8%	49	23%
Mechanical: Cracks in pigtail connectors	11	0%	5	45%
Mechanical: Cannula problems	816	3.1%	334	41%
Mechanical: Circuit change	761	2.9%	288	38%
Mechanical: Clots and Air Emboli	31	0.1%	13	42%
Mechanical: Thrombosis/Clots: circuit component	1,085	4.2%	442	41%
Hemorrhagic: GI hemorrhage	1,085	4.2%	289	27%
Hemorrhagic: Cannulation site bleeding	677	2.6%	248	37%
Hemorrhagic: Surgical site bleeding	3,495	13.5%	1,225	35%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	392	1.5%	115	29%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	66	0.3%	12	18%
Hemorrhagic: Peripheral cannulation site bleeding	1,605	6.2%	712	44%
Hemorrhagic: Mediastinal cannulation site bleeding	980	3.8%	335	34%
Neurologic: Brain death	314	1.2%	0	0%
Neurologic: Seizures: clinically determined	178	0.7%	52	29%
Neurologic: Seizures Confirmed by EEG	119	0.5%	32	27%
Neurologic: CNS Infarction (US or CT or MRI)	824	3.2%	182	22%

	No Reported	% Reported	Survived	% Survived
Neurologic: CNS hemorrhage by US/CT	193	0.7%	24	12%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	125	0.5%	13	10%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	303	1.2%	53	17%
Neurologic: CNS diffuse ischemia (CT/MRI)	299	1.2%	36	12%
Neurologic: Neurosurgical intervention performed	31	0.1%	5	16%
Renal: Creatinine 1.5 - 3.0	3,441	13.3%	1,332	39%
Renal: Creatinine > 3.0	1,870	7.2%	657	35%
Renal: Renal Replacement Therapy Required	7,042	27.2%	2,270	32%
Cardiovascular: Inotropes on ECLS	1,128	4.3%	450	40%
Cardiovascular: CPR required	539	2.1%	88	16%
Cardiovascular: Myocardial stun by echo	81	0.3%	24	30%
Cardiovascular: Cardiac arrhythmia	3,618	13.9%	1,278	35%
Cardiovascular: Hypertension requiring vasodilators	95	0.4%	57	60%
Cardiovascular: PDA: L->R	2	0%	0	0%
Cardiovascular: Tamponade (blood)	956	3.7%	335	35%
Cardiovascular: Tamponade (not blood)	83	0.3%	29	35%
Pulmonary: Pneumothorax requiring treatment	387	1.5%	136	35%
Pulmonary: Pulmonary hemorrhage	404	1.6%	102	25%
Infectious: Culture proven infection (see Infections)	284	1.1%	116	41%
Infectious: WBC < 1,500	313	1.2%	119	38%
Metabolic: Glucose < 40	42	0.2%	5	12%
Metabolic: Glucose > 240	300	1.2%	134	45%
Metabolic: pH < 7.20	247	1%	45	18%
Metabolic: pH > 7.60	89	0.3%	49	55%
Metabolic: Hyperbilirubinemia	1,683	6.5%	427	25%
Metabolic: Moderate hemolysis	416	1.6%	151	36%
Metabolic: Severe hemolysis	314	1.2%	85	27%
Limb: Ischemia	1,084	4.2%	336	31%
Limb: Compartment Syndrome	222	0.9%	54	24%
Limb: Fasciotomy	705	2.7%	229	32%
Limb: Amputation	190	0.7%	82	43%

Pediatric Cardiac (>28 days and <18 years)



Pediatric Cardiac Runs by Year

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
<=1986	33	33	87	196	14	42%
1987	34	67	100	312	18	52%
1988	42	109	113	353	15	35%
1989	61	170	125	293	27	44%
1990	81	251	129	544	31	38%
1991	103	354	115	432	47	45%
1992	134	488	138	547	45	33%
1993	191	679	143	1,080	81	42%
1994	184	863	136	720	64	34%
1995	189	1,052	151	984	67	35%
1996	233	1,285	135	721	91	39%
1997	226	1,511	159	864	92	40%
1998	234	1,745	163	1,183	97	41%
1999	221	1,966	149	1,029	93	42%
2000	268	2,234	140	871	128	47%
2001	282	2,516	156	1,490	121	42%
2002	278	2,794	162	1,246	131	47%
2003	297	3,091	165	987	152	51%
2004	304	3,395	163	1,157	139	45%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2005	343	3,738	165	1,207	187	54%
2006	360	4,098	147	1,260	191	53%
2007	377	4,475	170	963	193	51%
2008	423	4,898	150	910	217	51%
2009	481	5,379	169	3,456	313	65%
2010	440	5,819	146	1,259	227	51%
2011	539	6,358	159	3,605	304	56%
2012	555	6,913	162	2,452	316	56%
2013	563	7,476	200	6,798	310	55%
2014	721	8,197	171	3,506	390	54%
2015	727	8,924	181	2,564	420	57%
2016	813	9,737	174	2,977	470	57%
2017	1,030	10,767	184	3,408	638	61%
2018	1,122	11,889	186	6,194	660	58%
2019	1,138	13,027	165	3,572	669	58%
2020	1,064	14,091	158	4,941	651	61%
2021	992	15,083	168	2,936	593	59%

Pediatric Cardiac Runs by Diagnosis from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Congenital Defect	1,564	160	3,549	905	57%
Cardiac Arrest	109	133	898	58	53%
Cardiogenic Shock	648	167	3,199	380	58%
Cardiomyopathy	72	230	2,182	40	55%
Myocarditis	108	202	1,746	97	89%
Other	2,644	179	6,194	1,614	61%

Note some runs are missing primary diagnoses

Pediatric Cardiac Runs by Congenital Diagnosis from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Left to right shunt (ASD/VSD/PDA/AV canal/AVSD/ECD)	307	167	902	172	56%
Left-sided obstructive (aortic stenosis/mitral stenosis/coarctation)	139	150	2,538	90	64%
Hypoplastic left heart	231	167	3,379	111	48%
Right-sided obstructive (pulmonary stenosis/pulmonary or tricuspid atresia)	56	144	541	38	67%
Cyanotic incr. pulmonary flow (truncus asteriosis/TGA/TGV)	42	167	551	20	47%

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Cyanotic incr. pulm. congestion (TAP VR/P APVR)	53	157	693	20	37%
Cyanotic decr. pulmonary flow (TOF/DORV/Ebsteins)	274	152	1,752	160	58%
Other	462	163	3,549	294	63%

Note some runs are missing primary diagnoses

Initial Pediatric Cardiac Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	51	181	701	30	58%
VA	5,159	169	6,194	3,108	60%
VVA	93	228	1,548	55	59%
Other	41	364	3,242	17	41%
VP	2	192	268	1	50%

Runs with Conversions - Pediatric Cardiac Support Mode Details from 2017 to 2021

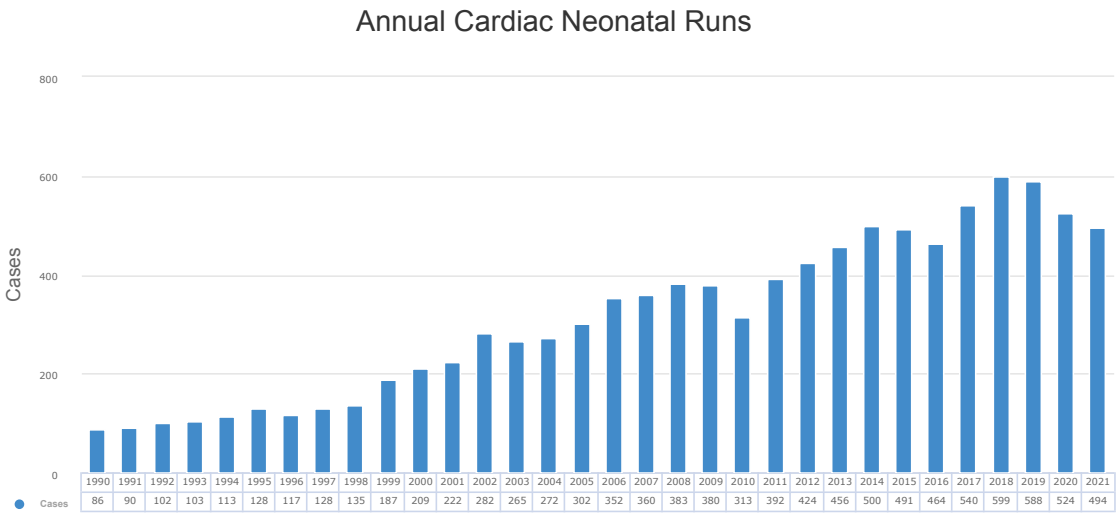
	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV to VA	10	122	307	7	70%
VA to VV	63	497	3,549	34	53%
Other	94	448	3,371	41	43%

Pediatric Cardiac Complications from 2017 to 2021

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	231	4.3%	102	44%
Mechanical: Other tubing rupture	7	0.1%	2	29%
Mechanical: Pump Failure	44	0.8%	29	66%
Mechanical: Temperature Regulation Device Malfunction	9	0.2%	7	78%
Mechanical: Clots: hemofilter	141	2.6%	69	49%
Mechanical: Air in circuit	151	2.8%	84	56%
Mechanical: Cracks in pigtail connectors	11	0.2%	5	45%
Mechanical: Cannula problems	410	7.7%	229	56%
Mechanical: Circuit change	542	10.1%	271	50%
Mechanical: Clots and Air Emboli	20	0.4%	10	50%
Mechanical: Thrombosis/Clots: circuit component	823	15.4%	432	52%
Hemorrhagic: GI hemorrhage	136	2.5%	52	38%
Hemorrhagic: Cannulation site bleeding	173	3.2%	93	54%
Hemorrhagic: Surgical site bleeding	877	16.4%	446	51%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	304	5.7%	115	38%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	24	0.4%	4	17%
Hemorrhagic: Peripheral cannulation site bleeding	206	3.9%	135	66%

	No Reported	% Reported	Survived	% Survived
Hemorrhagic: Mediastinal cannulation site bleeding	606	11.3%	301	50%
Neurologic: Brain death	99	1.9%	0	0%
Neurologic: Seizures: clinically determined	104	1.9%	45	43%
Neurologic: Seizures Confirmed by EEG	179	3.3%	75	42%
Neurologic: CNS Infarction (US or CT or MRI)	263	4.9%	102	39%
Neurologic: CNS hemorrhage by US/CT	125	2.3%	29	23%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	60	1.1%	18	30%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	135	2.5%	50	37%
Neurologic: CNS diffuse ischemia (CT/MRI)	115	2.2%	26	23%
Neurologic: Neurosurgical intervention performed	19	0.4%	6	32%
Renal: Creatinine 1.5 - 3.0	305	5.7%	138	45%
Renal: Creatinine > 3.0	99	1.9%	41	41%
Renal: Renal Replacement Therapy Required	1,485	27.8%	657	44%
Cardiovascular: Inotropes on ECLS	282	5.3%	144	51%
Cardiovascular: CPR required	104	1.9%	27	26%
Cardiovascular: Myocardial stun by echo	24	0.4%	8	33%
Cardiovascular: Cardiac arrhythmia	488	9.1%	268	55%
Cardiovascular: Hypertension requiring vasodilators	112	2.1%	69	62%
Cardiovascular: PDA: R->L	1	0%	0	0%
Cardiovascular: PDA: L->R	1	0%	1	100%
Cardiovascular: Tamponade (blood)	163	3%	86	53%
Cardiovascular: Tamponade (not blood)	19	0.4%	11	58%
Pulmonary: Pneumothorax requiring treatment	94	1.8%	38	40%
Pulmonary: Pulmonary hemorrhage	163	3%	64	39%
Infectious: Culture proven infection (see Infections)	55	1%	20	36%
Infectious: WBC < 1,500	59	1.1%	27	46%
Metabolic: Glucose < 40	13	0.2%	5	38%
Metabolic: Glucose > 240	87	1.6%	50	57%
Metabolic: pH < 7.20	63	1.2%	21	33%
Metabolic: pH > 7.60	20	0.4%	11	55%
Metabolic: Hyperbilirubinemia	309	5.8%	80	26%
Metabolic: Moderate hemolysis	332	6.2%	168	51%
Metabolic: Severe hemolysis	263	4.9%	63	24%
Limb: Ischemia	99	1.9%	38	38%
Limb: Compartment Syndrome	28	0.5%	15	54%
Limb: Fasciotomy	60	1.1%	28	47%
Limb: Amputation	24	0.4%	13	54%

Neonatal Cardiac (0-28 days)



Neonatal Cardiac Runs by Year

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
<=1986	27	27	145	453	19	70%
1987	16	43	96	217	8	50%
1988	30	73	127	336	16	53%
1989	53	126	129	344	30	56%
1990	86	212	124	348	39	45%
1991	90	302	144	600	36	40%
1992	102	404	167	696	42	41%
1993	103	507	173	831	40	38%
1994	113	620	179	667	39	34%
1995	128	748	155	701	43	33%
1996	117	865	136	767	42	35%
1997	128	993	157	1,126	42	32%
1998	135	1,128	150	765	50	37%
1999	187	1,315	152	1,258	64	34%
2000	209	1,524	134	645	65	31%
2001	222	1,746	147	1,198	80	36%
2002	282	2,028	138	907	100	35%
2003	265	2,293	162	954	102	38%
2004	272	2,565	147	989	112	41%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2005	302	2,867	156	1,871	103	34%
2006	352	3,219	141	726	126	35%
2007	360	3,579	153	952	147	40%
2008	383	3,962	149	721	155	40%
2009	380	4,342	158	1,524	161	42%
2010	313	4,655	149	1,099	147	46%
2011	392	5,047	159	3,141	172	43%
2012	424	5,471	149	1,196	198	46%
2013	456	5,927	155	1,400	206	45%
2014	500	6,427	149	1,481	226	45%
2015	491	6,918	158	4,053	220	44%
2016	464	7,382	161	1,676	218	46%
2017	540	7,922	148	1,082	294	54%
2018	599	8,521	154	3,566	311	51%
2019	588	9,109	165	2,109	292	49%
2020	524	9,633	151	1,614	271	51%
2021	494	10,127	159	1,848	271	54%

Neonatal Cardiac Runs by Diagnosis from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Congenital Defect	1,344	136	1,463	699	52%
Cardiac Arrest	15	146	417	5	33%
Cardiogenic Shock	174	156	1,746	78	44%
Cardiomyopathy	15	436	2,109	8	53%
Myocarditis	7	202	628	5	71%
Other	1,115	176	3,566	608	54%

Note some runs are missing primary diagnoses

Neonatal Cardiac Runs by Congenital Diagnosis from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Left to right shunt (ASD/VSD/PDA/AV canal/AVSD/ECD)	62	141	454	30	48%
Left-sided obstructive (aortic stenosis/mitral stenosis/coarctation)	77	130	430	44	57%
Hypoplastic left heart	368	130	782	167	45%
Right-sided obstructive (pulmonary stenosis/pulmonary or tricuspid atresia)	50	151	862	31	62%
Cyanotic incr. pulmonary flow (truncus asteriosis/TGA/TGV)	61	158	695	27	44%

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Cyanotic incr. pulm. congestion (TAP VR/P APVR)	177	123	1,046	89	50%
Cyanotic decr. pulmonary flow (TOF/DORV/Ebsteins)	350	157	1,463	187	53%
Other	199	113	515	124	62%

Note some runs are missing primary diagnoses

Initial Neonatal Cardiac Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	13	150	603	8	61%
VA	2,720	155	3,566	1,425	52%
VVA	10	271	881	4	40%
Other	2	99	104	2	100%

Runs with Conversions - Neonatal Cardiac Support Mode Details from 2017 to 2021

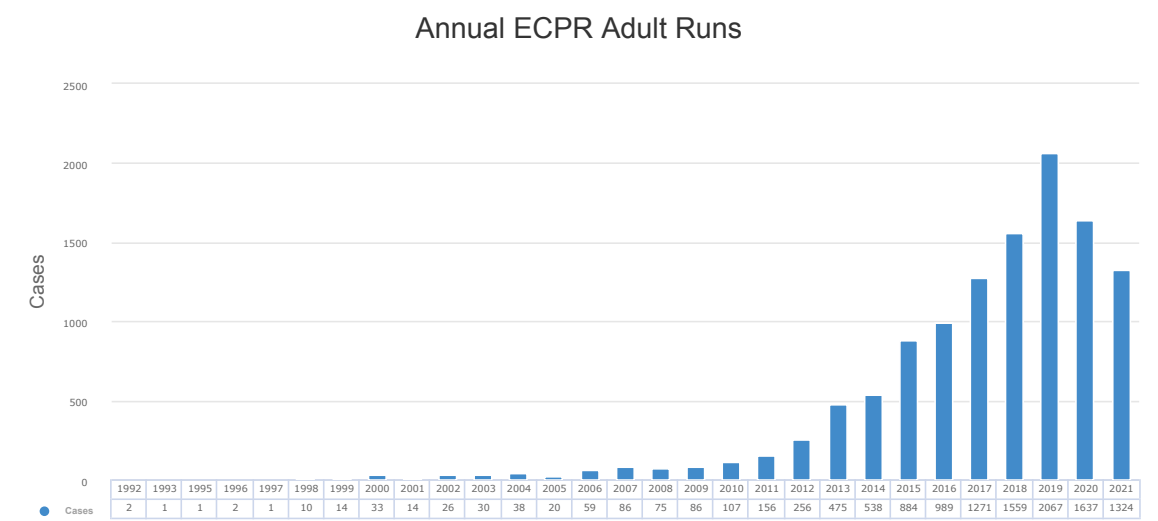
	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV to VA	2	84	163	0	0%
VA to VV	12	939	3,566	3	25%
Other	11	461	868	4	36%

Neonatal Cardiac Complications from 2017 to 2021

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	137	5%	39	28%
Mechanical: Other tubing rupture	2	0.1%	1	50%
Mechanical: Pump Failure	23	0.8%	10	43%
Mechanical: Temperature Regulation Device Malfunction	5	0.2%	1	20%
Mechanical: Clots: hemofilter	112	4.1%	35	31%
Mechanical: Air in circuit	80	2.9%	23	29%
Mechanical: Cracks in pigtail connectors	7	0.3%	4	57%
Mechanical: Cannula problems	237	8.6%	78	33%
Mechanical: Circuit change	299	10.9%	72	24%
Mechanical: Clots and Air Emboli	9	0.3%	2	22%
Mechanical: Thrombosis/Clots: circuit component	448	16.3%	189	42%
Hemorrhagic: GI hemorrhage	34	1.2%	6	18%
Hemorrhagic: Cannulation site bleeding	72	2.6%	25	35%
Hemorrhagic: Surgical site bleeding	405	14.8%	135	33%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	214	7.8%	61	29%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	16	0.6%	1	6%
Hemorrhagic: Peripheral cannulation site bleeding	43	1.6%	20	47%
Hemorrhagic: Mediastinal cannulation site bleeding	335	12.2%	105	31%

	No Reported	% Reported	Survived	% Survived
Neurologic: Brain death	16	0.6%	0	0%
Neurologic: Seizures: clinically determined	66	2.4%	24	36%
Neurologic: Seizures Confirmed by EEG	174	6.3%	59	34%
Neurologic: CNS Infarction (US or CT or MRI)	89	3.2%	29	33%
Neurologic: CNS hemorrhage by US/CT	129	4.7%	30	23%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	87	3.2%	20	23%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	106	3.9%	29	27%
Neurologic: CNS diffuse ischemia (CT/MRI)	27	1%	6	22%
Neurologic: Neurosurgical intervention performed	6	0.2%	2	33%
Renal: Creatinine 1.5 - 3.0	89	3.2%	16	18%
Renal: Creatinine > 3.0	14	0.5%	5	36%
Renal: Renal Replacement Therapy Required	789	28.7%	252	32%
Cardiovascular: Inotropes on ECLS	158	5.8%	62	39%
Cardiovascular: CPR required	69	2.5%	14	20%
Cardiovascular: Myocardial stun by echo	10	0.4%	1	10%
Cardiovascular: Cardiac arrhythmia	242	8.8%	81	33%
Cardiovascular: Hypertension requiring vasodilators	37	1.3%	21	57%
Cardiovascular: PDA: R->L	1	0%	1	100%
Cardiovascular: PDA: L->R	5	0.2%	5	100%
Cardiovascular: PDA: bidirectional	5	0.2%	2	40%
Cardiovascular: PDA: unknown	1	0%	0	0%
Cardiovascular: Tamponade (blood)	78	2.8%	33	42%
Cardiovascular: Tamponade (not blood)	13	0.5%	3	23%
Pulmonary: Pneumothorax requiring treatment	54	2%	19	35%
Pulmonary: Pulmonary hemorrhage	56	2%	12	21%
Infectious: Culture proven infection (see Infections)	16	0.6%	2	13%
Infectious: WBC < 1,500	20	0.7%	7	35%
Metabolic: Glucose < 40	10	0.4%	3	30%
Metabolic: Glucose > 240	42	1.5%	17	40%
Metabolic: pH < 7.20	45	1.6%	11	24%
Metabolic: pH > 7.60	22	0.8%	10	45%
Metabolic: Hyperbilirubinemia	172	6.3%	53	31%
Metabolic: Moderate hemolysis	179	6.5%	57	32%
Metabolic: Severe hemolysis	128	4.7%	30	23%
Limb: Ischemia	24	0.9%	7	29%
Limb: Compartment Syndrome	2	0.1%	0	0%
Limb: Amputation	1	0%	1	100%

Adult ECPR (18 years and over)



Adult ECPR Runs by Year

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
1992	2	2	11	22	1	50%
1993	1	3	2	2	0	0%
1995	1	4	1	1	0	0%
1996	2	6	69	71	1	50%
1997	1	7	70	70	0	0%
1998	10	17	61	167	4	40%
1999	14	31	79	215	1	7%
2000	33	64	71	335	11	33%
2001	14	78	113	273	8	57%
2002	26	104	62	197	7	26%
2003	30	134	91	302	16	53%
2004	38	172	118	842	7	18%
2005	20	192	95	261	8	40%
2006	59	251	83	1,421	8	13%
2007	86	337	108	627	21	24%
2008	75	412	76	459	22	29%
2009	86	498	78	833	26	30%
2010	107	605	102	893	35	32%
2011	156	761	106	2,209	40	25%
2012	256	1,017	104	718	64	25%
2013	475	1,492	106	1,368	147	30%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2014	538	2,030	115	1,662	173	32%
2015	884	2,914	111	1,513	261	29%
2016	989	3,903	109	1,865	261	26%
2017	1,271	5,174	99	2,874	372	29%
2018	1,559	6,733	102	2,892	487	31%
2019	2,067	8,800	104	3,208	659	31%
2020	1,637	10,437	108	1,947	502	30%
2021	1,324	11,761	129	7,217	418	31%

Initial Adult ECPR Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	119	184	7,217	29	24%
VA	7,611	106	6,692	2,372	31%
VVA	106	149	1,151	31	29%
Other	19	320	3,095	6	31%
Unknown	3	27	75	0	0%

Runs with Conversions - Adult ECPR Support Mode Details from 2017 to 2021

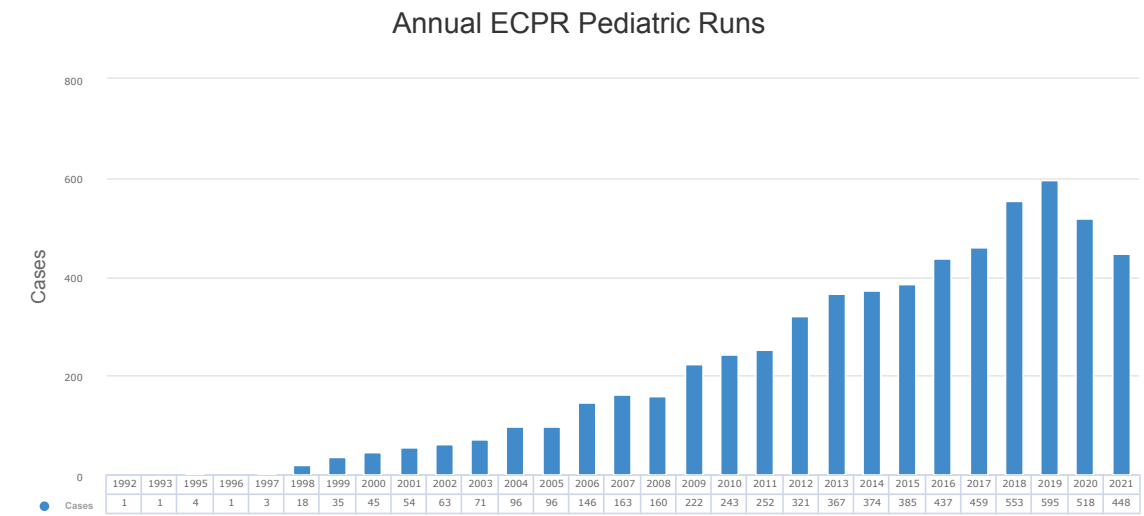
	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV to VA	11	110	365	3	27%
VA to VV	122	287	1,288	52	42%
Other	217	360	7,217	69	31%

Adult ECPR Complications from 2017 to 2021

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	185	2.4%	54	29%
Mechanical: Other tubing rupture	7	0.1%	1	14%
Mechanical: Pump Failure	31	0.4%	12	39%
Mechanical: Clots: hemofilter	22	0.3%	6	27%
Mechanical: Air in circuit	70	0.9%	15	21%
Mechanical: Cracks in pigtail connectors	1	0%	0	0%
Mechanical: Cannula problems	317	4%	66	21%
Mechanical: Circuit change	160	2%	48	30%
Mechanical: Clots and Air Emboli	15	0.2%	3	20%
Mechanical: Thrombosis/Clots: circuit component	287	3.7%	104	36%
Hemorrhagic: GI hemorrhage	328	4.2%	62	19%
Hemorrhagic: Cannulation site bleeding	258	3.3%	86	33%
Hemorrhagic: Surgical site bleeding	539	6.9%	146	27%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	94	1.2%	26	28%

	No Reported	% Reported	Survived	% Survived
Hemorrhagic: Disseminated intravascular coagulation (DIC)	19	0.2%	5	26%
Hemorrhagic: Peripheral cannulation site bleeding	610	7.8%	190	31%
Hemorrhagic: Mediastinal cannulation site bleeding	133	1.7%	24	18%
Neurologic: Brain death	394	5%	0	0%
Neurologic: Seizures: clinically determined	116	1.5%	26	22%
Neurologic: Seizures Confirmed by EEG	108	1.4%	18	17%
Neurologic: CNS Infarction (US or CT or MRI)	322	4.1%	71	22%
Neurologic: CNS hemorrhage by US/CT	82	1%	10	12%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	43	0.5%	7	16%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	101	1.3%	20	20%
Neurologic: CNS diffuse ischemia (CT/MRI)	374	4.8%	25	7%
Neurologic: Neurosurgical intervention performed	14	0.2%	6	43%
Renal: Creatinine 1.5 - 3.0	1,016	12.9%	282	28%
Renal: Creatinine > 3.0	499	6.4%	143	29%
Renal: Renal Replacement Therapy Required	1,718	21.9%	439	26%
Cardiovascular: Inotropes on ECLS	313	4%	82	26%
Cardiovascular: CPR required	323	4.1%	43	13%
Cardiovascular: Myocardial stun by echo	38	0.5%	9	24%
Cardiovascular: Cardiac arrhythmia	1,237	15.7%	314	25%
Cardiovascular: Hypertension requiring vasodilators	27	0.3%	12	44%
Cardiovascular: Tamponade (blood)	159	2%	38	24%
Cardiovascular: Tamponade (not blood)	17	0.2%	4	24%
Pulmonary: Pneumothorax requiring treatment	168	2.1%	48	29%
Pulmonary: Pulmonary hemorrhage	152	1.9%	39	26%
Infectious: Culture proven infection (see Infections)	71	0.9%	30	42%
Infectious: WBC < 1,500	48	0.6%	6	13%
Metabolic: Glucose < 40	12	0.2%	0	0%
Metabolic: Glucose > 240	159	2%	53	33%
Metabolic: pH < 7.20	148	1.9%	37	25%
Metabolic: pH > 7.60	18	0.2%	9	50%
Metabolic: Hyperbilirubinemia	255	3.2%	44	17%
Metabolic: Moderate hemolysis	104	1.3%	32	31%
Metabolic: Severe hemolysis	76	1%	17	22%
Limb: Ischemia	377	4.8%	95	25%
Limb: Compartment Syndrome	64	0.8%	18	28%
Limb: Fasciotomy	203	2.6%	56	28%
Limb: Amputation	51	0.6%	18	35%

Pediatric ECPR (>28 days and <18 years)



Pediatric ECPR Runs by Year

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
1992	1	1	180	180	0	0%
1993	1	2	137	137	0	0%
1995	4	6	130	320	1	25%
1996	1	7	24	24	0	0%
1997	3	10	23	43	0	0%
1998	18	28	90	500	4	22%
1999	35	63	87	380	17	48%
2000	45	108	108	720	19	42%
2001	54	162	109	457	15	27%
2002	63	225	149	916	29	46%
2003	71	296	97	535	32	45%
2004	96	392	125	832	39	40%
2005	96	488	120	751	33	34%
2006	146	634	106	719	57	39%
2007	163	797	120	736	68	41%
2008	160	957	108	751	61	38%
2009	222	1,179	121	1,410	86	38%
2010	243	1,422	130	2,900	105	43%
2011	252	1,674	112	944	119	47%
2012	321	1,995	149	4,755	142	44%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2013	367	2,362	136	2,320	155	42%
2014	374	2,736	131	1,537	171	45%
2015	385	3,121	127	1,422	153	39%
2016	437	3,558	123	1,511	183	41%
2017	459	4,017	129	4,281	226	49%
2018	553	4,570	133	3,010	237	42%
2019	595	5,165	125	1,273	242	40%
2020	518	5,683	115	1,210	224	43%
2021	448	6,131	107	1,189	178	39%

Initial Pediatric ECPR Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	24	133	762	10	41%
VA	2,499	122	4,281	1,080	43%
VVA	39	112	594	13	33%
Other	11	138	352	4	36%

Runs with Conversions - Pediatric ECPR Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV to VA	5	125	337	0	0%
VA to VV	18	543	1,227	9	50%
Other	44	325	2,063	18	40%

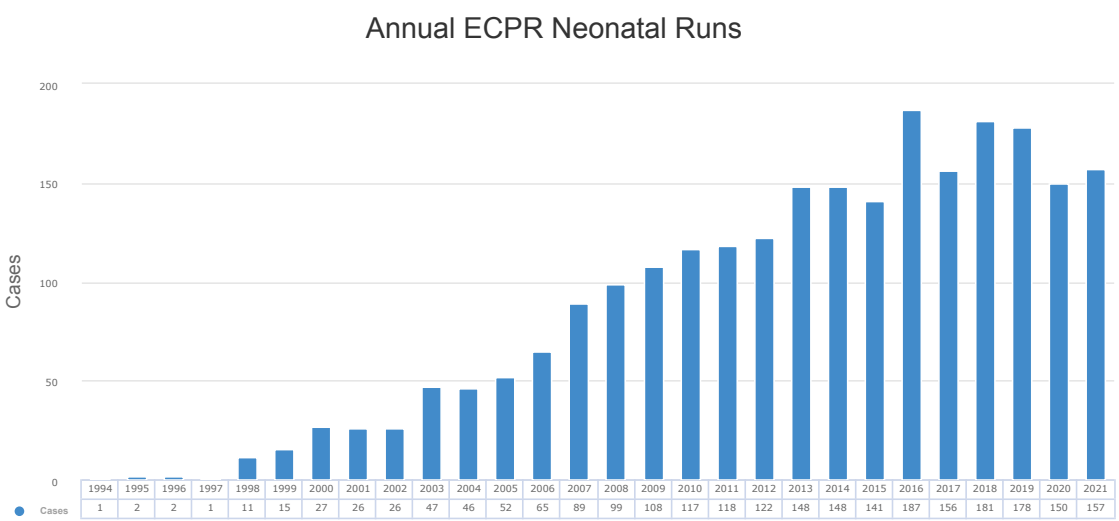
Pediatric ECPR Complications from 2017 to 2021

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	98	3.8%	39	40%
Mechanical: Raceway rupture	2	0.1%	2	100%
Mechanical: Other tubing rupture	3	0.1%	1	33%
Mechanical: Pump Failure	12	0.5%	4	33%
Mechanical: Temperature Regulation Device Malfunction	4	0.2%	3	75%
Mechanical: Clots: hemofilter	66	2.6%	20	30%
Mechanical: Air in circuit	64	2.5%	20	31%
Mechanical: Cracks in pigtail connectors	4	0.2%	2	50%
Mechanical: Cannula problems	220	8.6%	76	35%
Mechanical: Circuit change	165	6.4%	67	41%
Mechanical: Clots and Air Emboli	3	0.1%	1	33%
Mechanical: Thrombosis/Clots: circuit component	257	10%	126	49%
Hemorrhagic: GI hemorrhage	87	3.4%	16	18%
Hemorrhagic: Cannulation site bleeding	69	2.7%	25	36%

	No Reported	% Reported	Survived	% Survived
Hemorrhagic: Surgical site bleeding	220	8.6%	61	28%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	125	4.9%	46	37%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	20	0.8%	2	10%
Hemorrhagic: Peripheral cannulation site bleeding	106	4.1%	38	36%
Hemorrhagic: Mediastinal cannulation site bleeding	182	7.1%	73	40%
Neurologic: Brain death	154	6%	0	0%
Neurologic: Seizures: clinically determined	142	5.5%	45	32%
Neurologic: Seizures Confirmed by EEG	262	10.2%	103	39%
Neurologic: CNS Infarction (US or CT or MRI)	207	8%	66	32%
Neurologic: CNS hemorrhage by US/CT	95	3.7%	39	41%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	28	1.1%	7	25%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	82	3.2%	29	35%
Neurologic: CNS diffuse ischemia (CT/MRI)	184	7.2%	25	14%
Neurologic: Neurosurgical intervention performed	9	0.3%	3	33%
Renal: Creatinine 1.5 - 3.0	192	7.5%	66	34%
Renal: Creatinine > 3.0	66	2.6%	24	36%
Renal: Renal Replacement Therapy Required	657	25.5%	226	34%
Cardiovascular: Inotropes on ECLS	109	4.2%	41	38%
Cardiovascular: CPR required	85	3.3%	19	22%
Cardiovascular: Myocardial stun by echo	9	0.3%	2	22%
Cardiovascular: Cardiac arrhythmia	228	8.9%	96	42%
Cardiovascular: Hypertension requiring vasodilators	51	2%	29	57%
Cardiovascular: PDA: L->R	1	0%	1	100%
Cardiovascular: Tamponade (blood)	39	1.5%	22	56%
Cardiovascular: Tamponade (not blood)	10	0.4%	3	30%
Pulmonary: Pneumothorax requiring treatment	48	1.9%	17	35%
Pulmonary: Pulmonary hemorrhage	108	4.2%	23	21%
Infectious: Culture proven infection (see Infections)	21	0.8%	7	33%
Infectious: WBC < 1,500	10	0.4%	4	40%
Metabolic: Glucose < 40	5	0.2%	1	20%
Metabolic: Glucose > 240	46	1.8%	17	37%
Metabolic: pH < 7.20	40	1.6%	10	25%
Metabolic: pH > 7.60	7	0.3%	4	57%
Metabolic: Hyperbilirubinemia	85	3.3%	21	25%
Metabolic: Moderate hemolysis	111	4.3%	45	41%
Metabolic: Severe hemolysis	80	3.1%	21	26%
Limb: Ischemia	43	1.7%	14	33%
Limb: Compartment Syndrome	16	0.6%	7	44%
Limb: Fasciotomy	31	1.2%	14	45%

	No Reported	% Reported	Survived	% Survived
Limb: Amputation	5	0.2%	1	20%

Neonatal ECPR (0-28 days)



Neonatal ECPR Runs by Year

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
1994	1	1	61	61	1	100%
1995	2	3	126	133	1	50%
1996	2	5	136	152	2	100%
1997	1	6	159	159	1	100%
1998	11	17	96	337	5	45%
1999	15	32	82	297	4	26%
2000	27	59	166	857	10	37%
2001	26	85	127	403	9	34%
2002	26	111	111	246	10	38%
2003	47	158	159	902	20	42%
2004	46	204	119	653	19	41%
2005	52	256	152	1,079	16	30%
2006	65	321	124	474	27	41%
2007	89	410	113	700	34	38%
2008	99	509	161	1,082	35	35%
2009	108	617	120	701	46	42%
2010	117	734	127	856	54	46%
2011	118	852	132	924	43	36%
2012	122	974	114	1,041	51	41%
2013	148	1,122	157	3,096	72	48%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2014	148	1,270	144	3,839	64	43%
2015	141	1,411	136	1,010	63	44%
2016	187	1,598	149	747	76	40%
2017	156	1,754	177	1,488	54	34%
2018	181	1,935	125	2,380	95	52%
2019	178	2,113	132	752	88	49%
2020	150	2,263	137	634	61	40%
2021	157	2,420	136	577	70	44%

Initial Neonatal ECPR Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	1	3	3	0	0%
VA	821	141	2,380	368	44%

Runs with Conversions - Neonatal ECPR Support Mode Details from 2017 to 2021

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VA to VV	3	396	640	2	66%
Other	6	400	1,077	2	33%

Neonatal ECPR Complications from 2017 to 2021

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	37	4.5%	8	22%
Mechanical: Pump Failure	8	1%	3	38%
Mechanical: Temperature Regulation Device Malfunction	2	0.2%	0	0%
Mechanical: Clots: hemofilter	23	2.8%	6	26%
Mechanical: Air in circuit	26	3.2%	7	27%
Mechanical: Cracks in pigtail connectors	1	0.1%	0	0%
Mechanical: Cannula problems	80	9.7%	24	30%
Mechanical: Circuit change	86	10.5%	22	26%
Mechanical: Clots and Air Emboli	2	0.2%	2	100%
Mechanical: Thrombosis/Clots: circuit component	125	15.2%	40	32%
Hemorrhagic: GI hemorrhage	14	1.7%	2	14%
Hemorrhagic: Cannulation site bleeding	12	1.5%	1	8%
Hemorrhagic: Surgical site bleeding	94	11.4%	26	28%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	57	6.9%	20	35%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	13	1.6%	2	15%
Hemorrhagic: Peripheral cannulation site bleeding	13	1.6%	6	46%
Hemorrhagic: Mediastinal cannulation site bleeding	145	17.6%	57	39%
Neurologic: Brain death	7	0.9%	0	0%

	No Reported	% Reported	Survived	% Survived
Neurologic: Seizures: clinically determined	35	4.3%	14	40%
Neurologic: Seizures Confirmed by EEG	111	13.5%	42	38%
Neurologic: CNS Infarction (US or CT or MRI)	35	4.3%	12	34%
Neurologic: CNS hemorrhage by US/CT	48	5.8%	8	17%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	35	4.3%	6	17%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	40	4.9%	10	25%
Neurologic: CNS diffuse ischemia (CT/MRI)	31	3.8%	7	23%
Renal: Creatinine 1.5 - 3.0	30	3.6%	5	17%
Renal: Creatinine > 3.0	3	0.4%	1	33%
Renal: Renal Replacement Therapy Required	243	29.6%	63	26%
Cardiovascular: Inotropes on ECLS	49	6%	14	29%
Cardiovascular: CPR required	29	3.5%	4	14%
Cardiovascular: Myocardial stun by echo	3	0.4%	0	0%
Cardiovascular: Cardiac arrhythmia	67	8.2%	25	37%
Cardiovascular: Hypertension requiring vasodilators	21	2.6%	8	38%
Cardiovascular: PDA: R->L	1	0.1%	0	0%
Cardiovascular: PDA: L->R	1	0.1%	0	0%
Cardiovascular: Tamponade (blood)	22	2.7%	11	50%
Cardiovascular: Tamponade (not blood)	3	0.4%	1	33%
Pulmonary: Pneumothorax requiring treatment	16	1.9%	4	25%
Pulmonary: Pulmonary hemorrhage	16	1.9%	5	31%
Infectious: Culture proven infection (see Infections)	7	0.9%	0	0%
Infectious: WBC < 1,500	7	0.9%	2	29%
Metabolic: Glucose < 40	4	0.5%	2	50%
Metabolic: Glucose > 240	15	1.8%	6	40%
Metabolic: pH < 7.20	20	2.4%	7	35%
Metabolic: pH > 7.60	6	0.7%	0	0%
Metabolic: Hyperbilirubinemia	58	7.1%	16	28%
Metabolic: Moderate hemolysis	60	7.3%	24	40%
Metabolic: Severe hemolysis	69	8.4%	17	25%
Limb: Ischemia	3	0.4%	1	33%
Limb: Compartment Syndrome	2	0.2%	1	50%