

ECLS Registry Report

International Summary

January, 2019



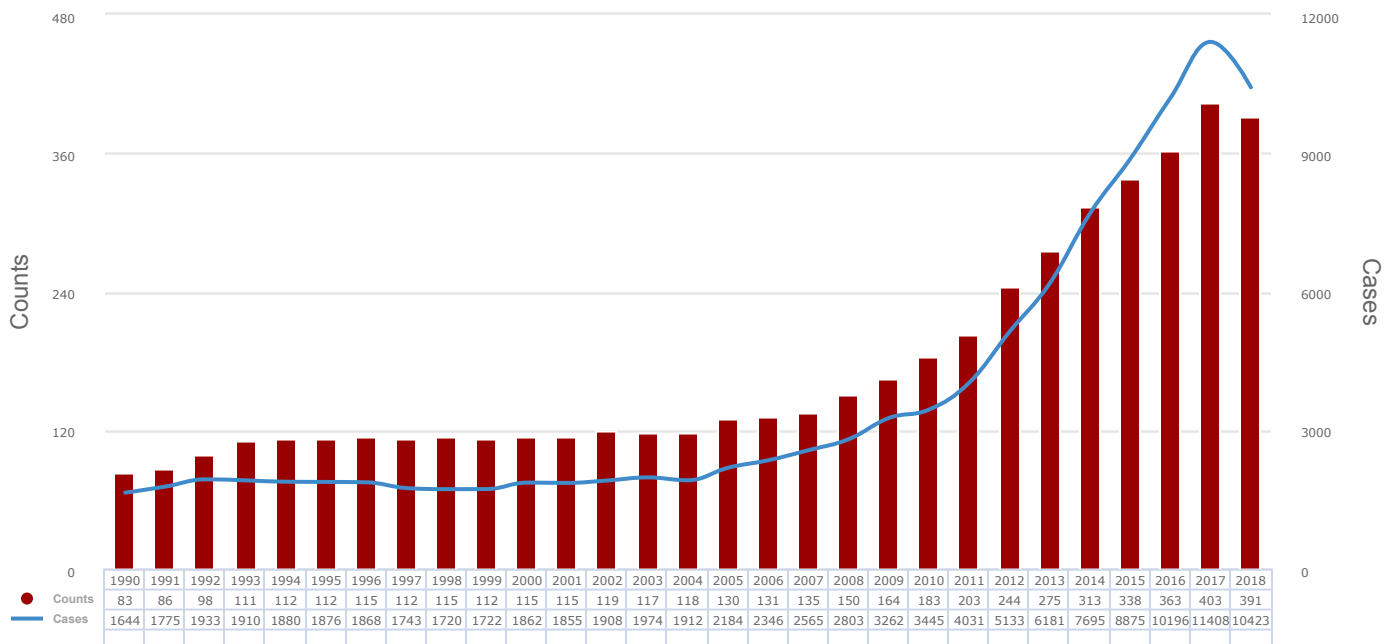
Extracorporeal Life Support Organization
 2800 Plymouth Road
 Building 300, Room 303
 Ann Arbor, MI 48109

Overall Outcomes

	Total Runs	Survived ECLS	Survived to DC or Transfer
Neonatal			
Pulmonary	31,591	27,779 87%	23,119 73%
Cardiac	8,252	5,684 68%	3,529 42%
ECPR	1,864	1,315 70%	775 41%
Pediatric			
Pulmonary	9,487	6,797 71%	5,573 58%
Cardiac	11,377	8,155 71%	5,980 52%
ECPR	4,361	2,628 60%	1,858 42%
Adult			
Pulmonary	19,482	13,453 69%	11,565 59%
Cardiac	19,627	11,628 59%	8,381 42%
ECPR	6,190	2,580 41%	1,827 29%
Total	112,231	80,019 71%	62,607 55%

Centers

Centers by year

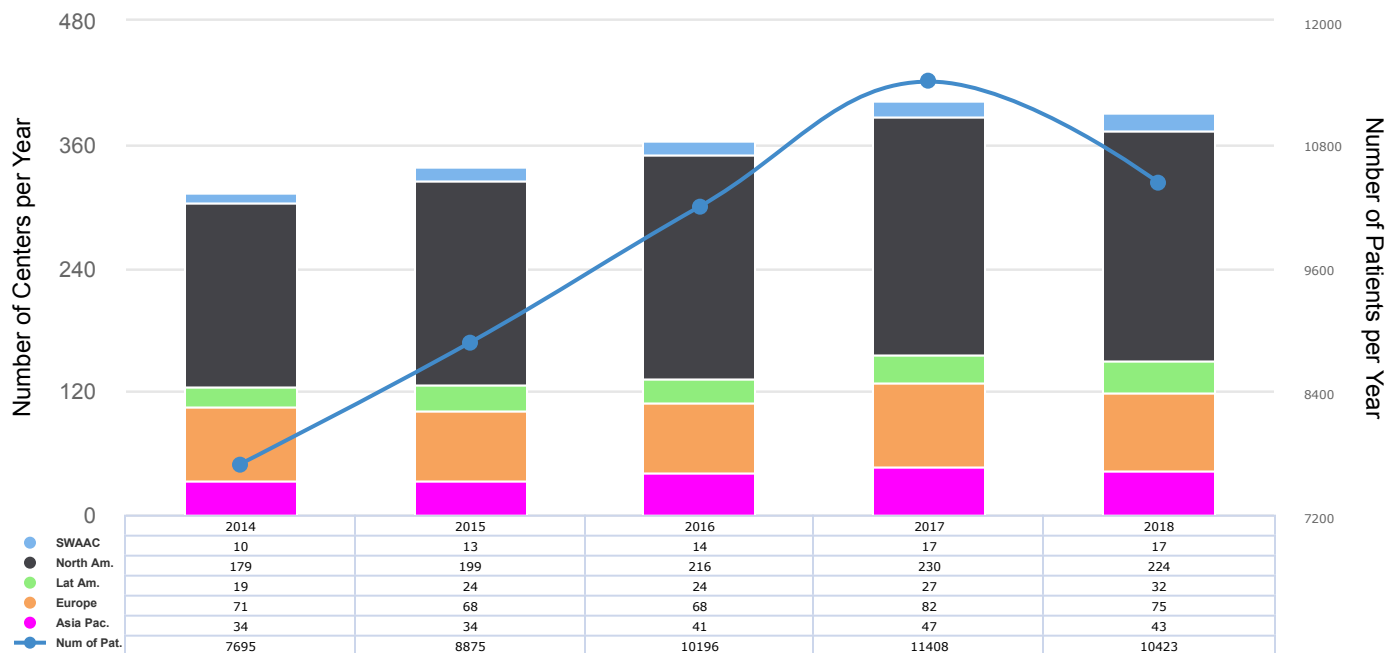


Overall Outcomes from 2014 to Present

	Total Runs	Survived ECLS	Survived to DC or Transfer	
Neonatal				
Pulmonary	3,956	3,295 83%	2,686 67%	
Cardiac	2,335	1,664 71%	1,150 49%	
ECPR	745	508 68%	315 42%	
Pediatric				
Pulmonary	2,960	2,210 74%	1,868 63%	
Cardiac	3,920	2,978 75%	2,277 58%	
ECPR	1,997	1,200 60%	877 43%	
Adult				
Pulmonary	13,413	9,325 69%	8,156 60%	
Cardiac	14,580	8,627 59%	6,366 43%	
ECPR	4,691	1,965 41%	1,399 29%	
Total	48,597	31,772 65%	25,094 51%	

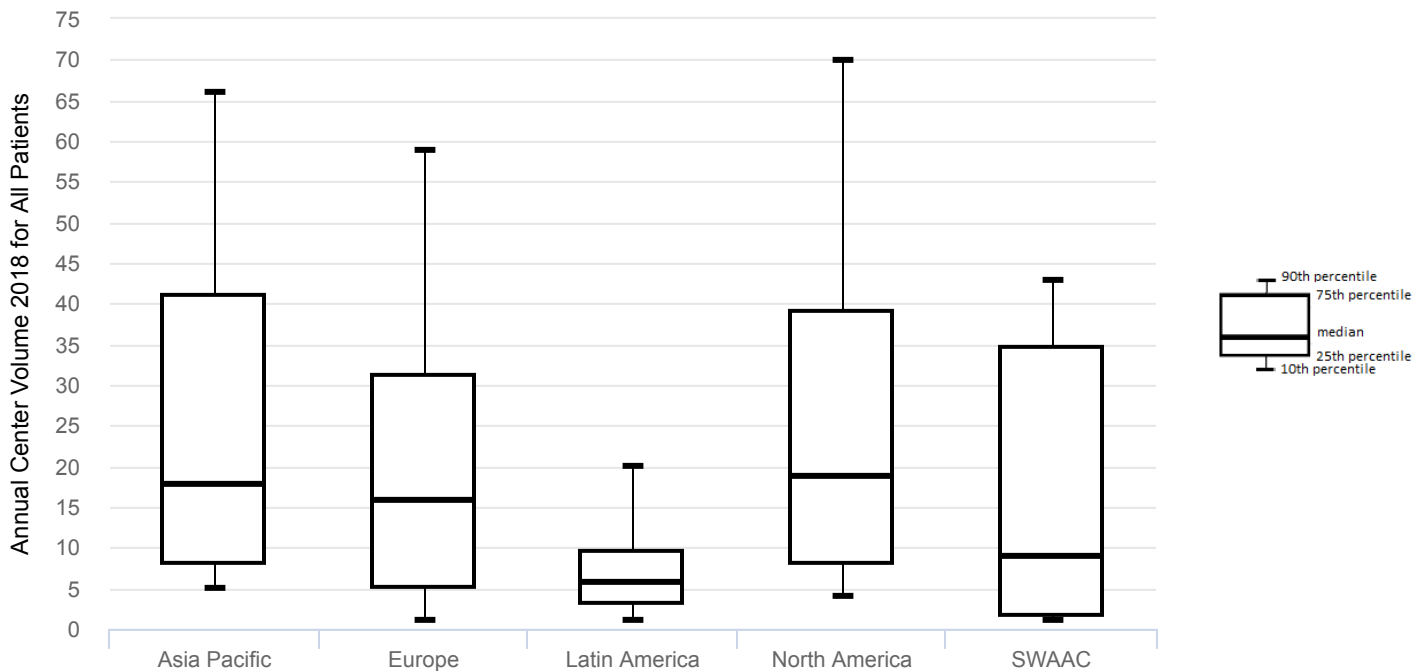
Centers by region

ELSO Centers and Patient Counts

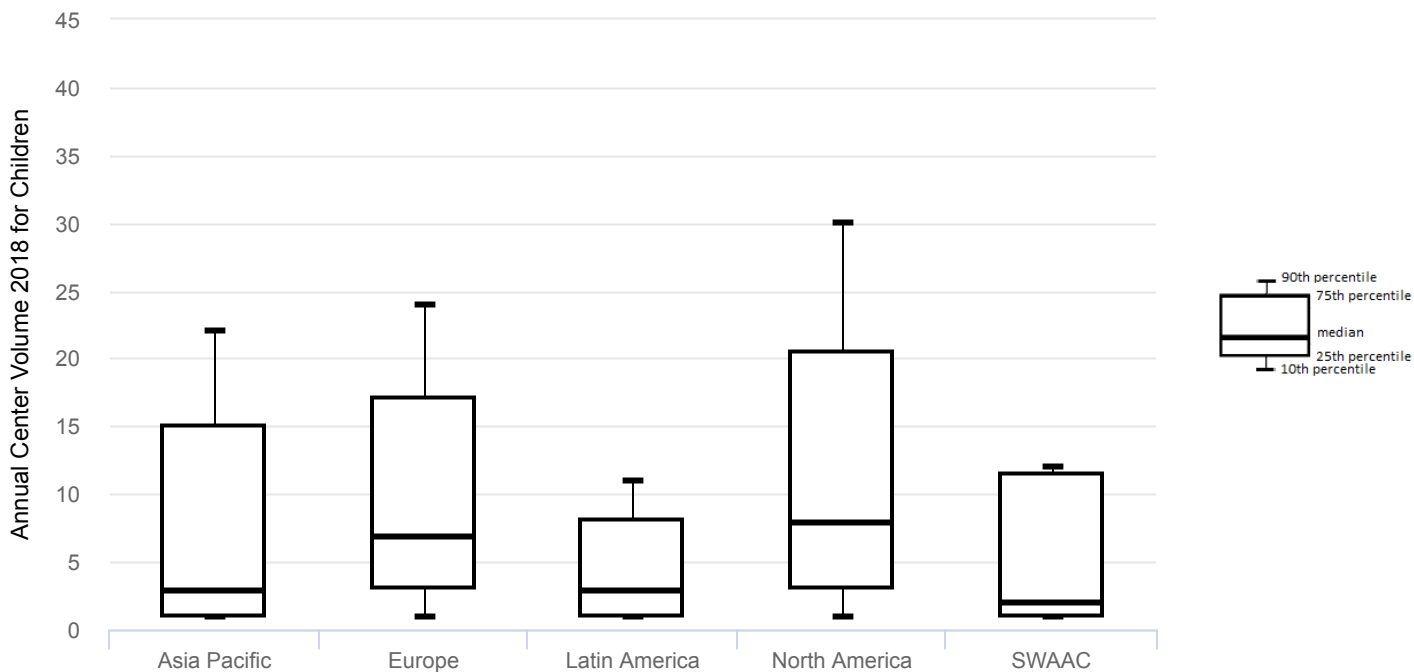


Annual Center Volume in 2018

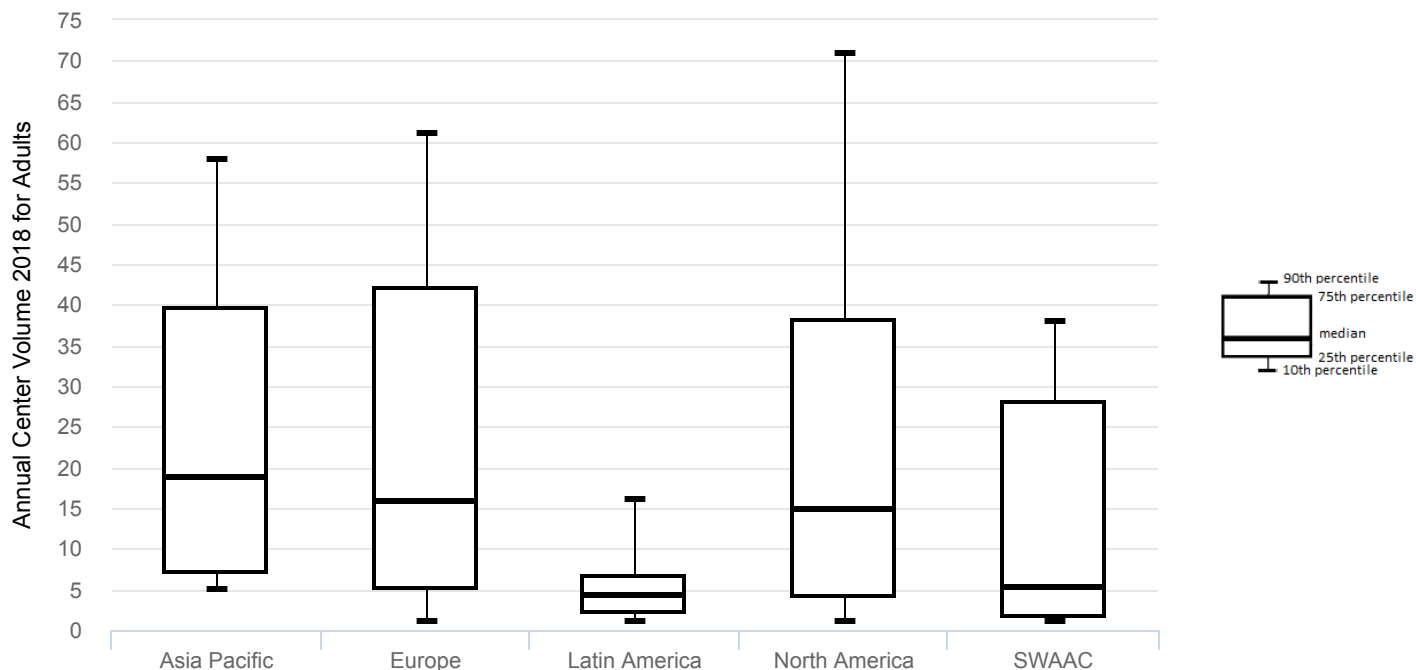
All Patients



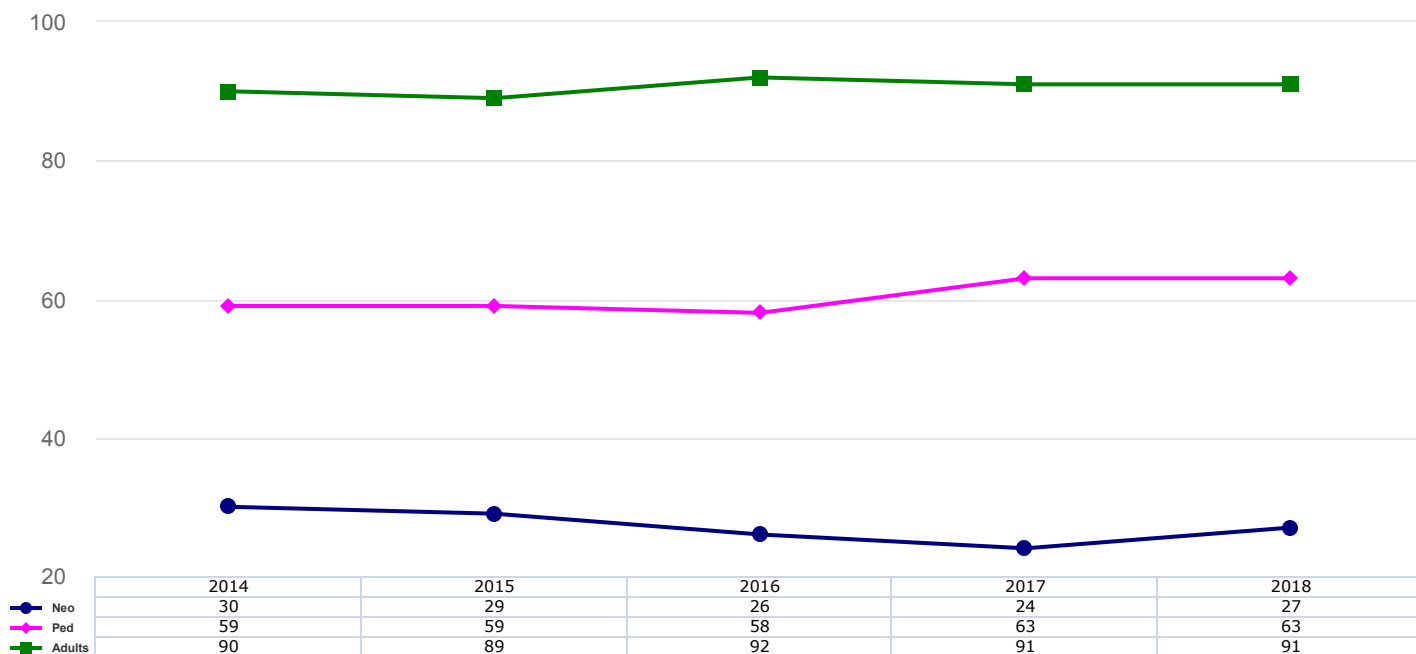
Children (Neonatal and Pediatric)



Adults

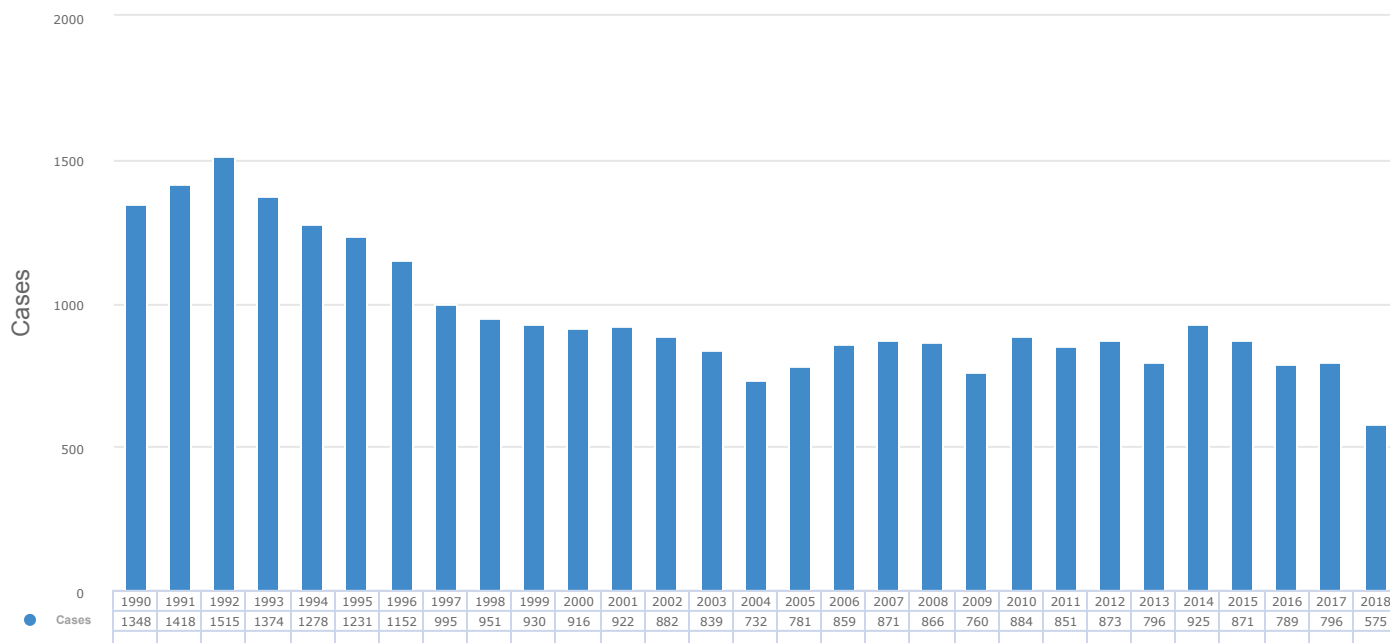


Proportion of VV Cannulation (Respiratory only)



Neonatal Respiratory (0-28 days)

Annual Respiratory Neonatal Runs



Neonatal Respiratory Runs by Year

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
<=1986	820	820	118	840	659	80%
1987	651	1,471	121	411	558	85%
1988	1,016	2,487	131	673	841	82%
1989	1,119	3,606	134	500	917	81%
1990	1,348	4,954	144	672	1,095	81%
1991	1,418	6,372	153	827	1,141	80%
1992	1,515	7,887	153	1,200	1,180	77%
1993	1,374	9,261	158	959	1,093	79%
1994	1,278	10,539	161	936	972	76%
1995	1,231	11,770	163	794	930	75%
1996	1,152	12,922	167	1,176	841	73%
1997	995	13,917	173	1,131	742	74%
1998	951	14,868	186	1,093	682	71%
1999	930	15,798	183	812	672	72%
2000	916	16,714	188	936	692	75%
2001	922	17,636	190	949	655	71%
2002	882	18,518	189	944	624	70%
2003	839	19,357	195	1,001	553	65%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2004	732	20,089	197	956	475	64%
2005	781	20,870	204	1,006	530	67%
2006	859	21,729	207	1,033	576	67%
2007	871	22,600	198	1,229	583	66%
2008	866	23,466	212	1,133	580	66%
2009	760	24,226	210	1,327	521	68%
2010	884	25,110	201	2,549	611	69%
2011	851	25,961	217	1,175	562	66%
2012	873	26,834	211	1,843	611	69%
2013	796	27,630	209	1,908	533	66%
2014	925	28,555	216	1,164	645	69%
2015	871	29,426	212	1,662	556	63%
2016	789	30,215	228	1,733	518	65%
2017	796	31,011	210	2,286	565	70%
2018	575	31,586	209	1,025	402	69%

Neonatal Respiratory Runs by Diagnosis from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
CDH	1,253	311	1,733	639	50%
MAS	718	146	2,286	664	92%
PPHN/PFC	679	168	1,154	499	73%
RDS	28	127	562	23	82%
Sepsis	118	182	1,155	59	50%
Pneumonia	32	364	982	17	53%
Air Leak Syndrome	9	130	282	8	88%
Other	1,065	182	1,558	740	69%

Note some runs are missing primary diagnoses

Neonatal Respiratory Support Mode Details from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VA	2,917	233	2,286	1,852	63%
VV	1,124	179	1,733	866	77%
VVA	22	234	982	13	59%
Unknown	14	169	276	7	50%
Other	3	174	254	2	66%

Includes conversions (VV-VA, VA-VV, etc) so counts are higher than number of runs

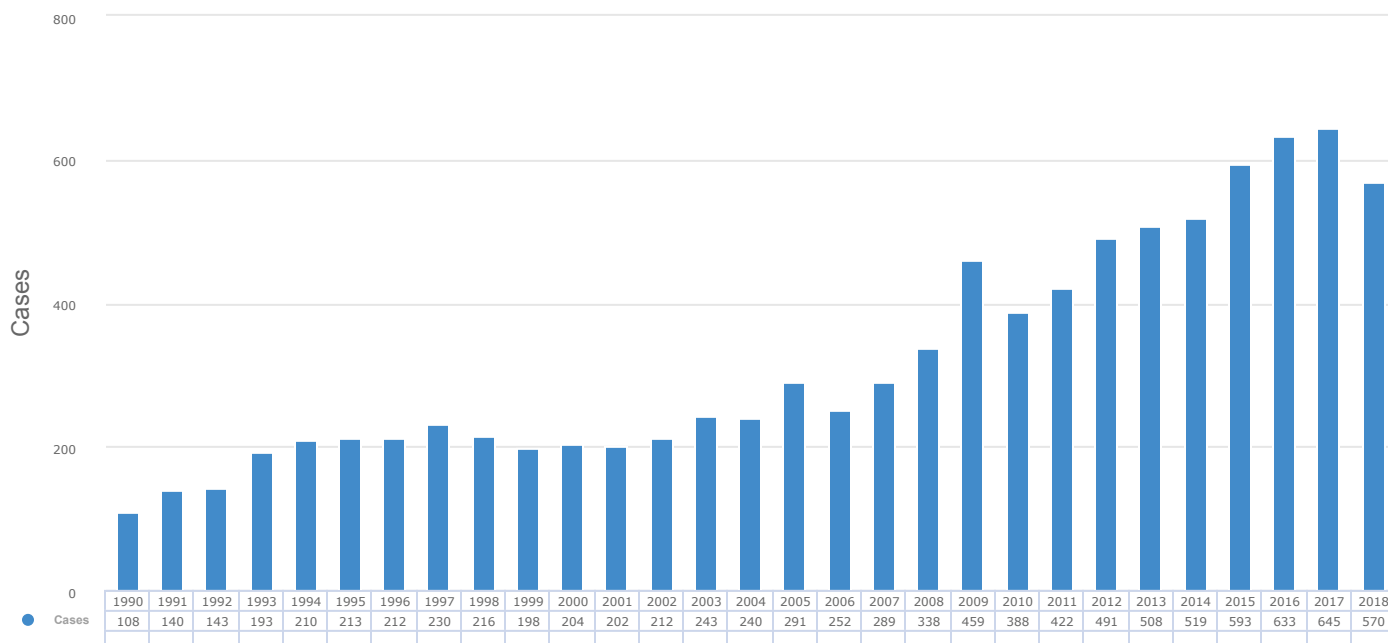
Neonatal Respiratory Complications from 2014 to Present

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	158	4%	81	51%
Mechanical: Raceway rupture	4	0.1%	4	100%
Mechanical: Other tubing rupture	13	0.3%	9	69%
Mechanical: Pump Failure	37	0.9%	16	43%
Mechanical: Heat exchanger malfunction	17	0.4%	8	47%
Mechanical: Clots: hemofilter	193	4.9%	74	38%
Mechanical: Clots: Circuit Component Clots	1,454	36.8%	787	54%
Mechanical: Air in circuit	157	4%	72	46%
Mechanical: Cracks in pigtail connectors	24	0.6%	9	38%
Mechanical: Cannula problems	506	12.8%	281	56%
Mechanical: Circuit change	158	4%	66	42%
Mechanical: Clots and Air Emboli	5	0.1%	4	80%
Mechanical: Thrombosis/Clots: circuit component	45	1.1%	21	47%
Hemorrhagic: GI hemorrhage	67	1.7%	24	36%
Hemorrhagic: Cannulation site bleeding	466	11.8%	291	62%
Hemorrhagic: Surgical site bleeding	254	6.4%	91	36%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	605	15.3%	295	49%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	181	4.6%	74	41%
Hemorrhagic: Peripheral cannulation site bleeding	17	0.4%	10	59%
Hemorrhagic: Mediastinal cannulation site bleeding	6	0.2%	4	67%
Neurologic: Brain death	10	0.3%	0	0%
Neurologic: Seizures: clinically determined	133	3.4%	66	50%
Neurologic: Seizures Confirmed by EEG	147	3.7%	64	44%
Neurologic: CNS Infarction (US or CT or MRI)	125	3.2%	42	34%
Neurologic: CNS hemorrhage by US/CT	401	10.1%	154	38%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	27	0.7%	10	37%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	44	1.1%	21	48%
Neurologic: CNS diffuse ischemia (CT/MRI)	3	0.1%	0	0%
Renal: Creatinine 1.5 - 3.0	151	3.8%	52	34%
Renal: Creatinine > 3.0	18	0.5%	6	33%
Renal: Renal Replacement Therapy Required	1,231	31.1%	572	46%
Cardiovascular: Inotropes on ECLS	1,301	32.9%	773	59%
Cardiovascular: CPR required	106	2.7%	31	29%
Cardiovascular: Myocardial stun by echo	50	1.3%	18	36%
Cardiovascular: Cardiac arrhythmia	177	4.5%	85	48%
Cardiovascular: Hypertension requiring vasodilators	333	8.4%	190	57%
Cardiovascular: PDA: R->L	115	2.9%	51	44%

	No Reported	% Reported	Survived	% Survived
Cardiovascular: PDA: L->R	72	1.8%	41	57%
Cardiovascular: PDA: bidirectional	148	3.7%	84	57%
Cardiovascular: PDA: unknown	6	0.2%	4	67%
Cardiovascular: Tamponade (blood)	77	1.9%	32	42%
Cardiovascular: Tamponade (not blood)	19	0.5%	7	37%
Pulmonary: Pneumothorax requiring treatment	205	5.2%	101	49%
Pulmonary: Pulmonary hemorrhage	188	4.8%	74	39%
Infectious: Culture proven infection (see Infections)	161	4.1%	62	39%
Infectious: WBC < 1,500	25	0.6%	13	52%
Metabolic: Glucose < 40	100	2.5%	64	64%
Metabolic: Glucose > 240	278	7%	179	64%
Metabolic: pH < 7.20	291	7.4%	149	51%
Metabolic: pH > 7.60	125	3.2%	90	72%
Metabolic: Hyperbilirubinemia	343	8.7%	164	48%
Metabolic: Moderate hemolysis	41	1%	25	61%
Metabolic: Severe hemolysis	58	1.5%	33	57%
Limb: Ischemia	15	0.4%	2	13%
Limb: Compartment Syndrome	2	0.1%	1	50%

Pediatric Respiratory (>28 days and <18 years)

Annual Respiratory Pediatric Runs



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	108	230	268	853	49	45%
1991	140	370	293	1,256	73	52%
1992	143	513	298	933	70	48%
1993	193	706	286	1,144	102	52%
1994	210	916	286	1,156	122	58%
1995	213	1,129	281	1,372	111	52%
1996	212	1,341	292	1,483	126	59%
1997	230	1,571	279	1,258	139	60%
1998	216	1,787	252	1,015	128	59%
1999	198	1,985	247	1,332	120	60%
2000	204	2,189	263	2,437	110	53%
2001	202	2,391	240	2,239	96	47%
2002	212	2,603	230	1,108	130	61%
2003	243	2,846	226	881	145	59%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2004	240	3,086	235	1,222	141	58%
2005	291	3,377	242	1,280	156	53%
2006	252	3,629	271	1,326	132	52%
2007	289	3,918	255	1,309	163	56%
2008	338	4,256	256	1,987	178	52%
2009	459	4,715	288	2,968	258	56%
2010	388	5,103	269	2,140	230	59%
2011	422	5,525	276	2,465	250	59%
2012	491	6,016	251	2,781	306	62%
2013	508	6,524	287	3,086	315	62%
2014	519	7,043	254	1,932	319	61%
2015	593	7,636	304	7,503	356	60%
2016	633	8,269	302	4,286	378	59%
2017	645	8,914	307	4,013	432	66%
2018	570	9,484	285	6,011	383	67%

Pediatric Respiratory Runs by Diagnosis from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Viral pneumonia	330	308	1,680	237	71%
Bacterial pneumonia	198	327	4,286	140	70%
Pneumocystis pneumonia	3	484	671	2	66%
Aspiration pneumonia	51	239	1,932	35	68%
ARDS, postop/trauma	21	212	711	14	66%
ARDS, not postop/trauma	238	377	4,013	156	65%
Acute resp failure, non-ARDS	357	304	7,503	226	63%
Other	1,686	274	6,011	1,015	60%

Note some runs are missing primary diagnoses

Pediatric Respiratory Support Mode Details from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	1,863	321	7,503	1,291	69%
VA	1,196	276	7,503	645	53%
VVA	60	636	6,011	26	43%
Other	25	725	2,846	7	28%
Unknown	18	489	1,932	9	50%

Includes conversions (VV-VA, VA-VV, etc) so counts are higher than number of runs

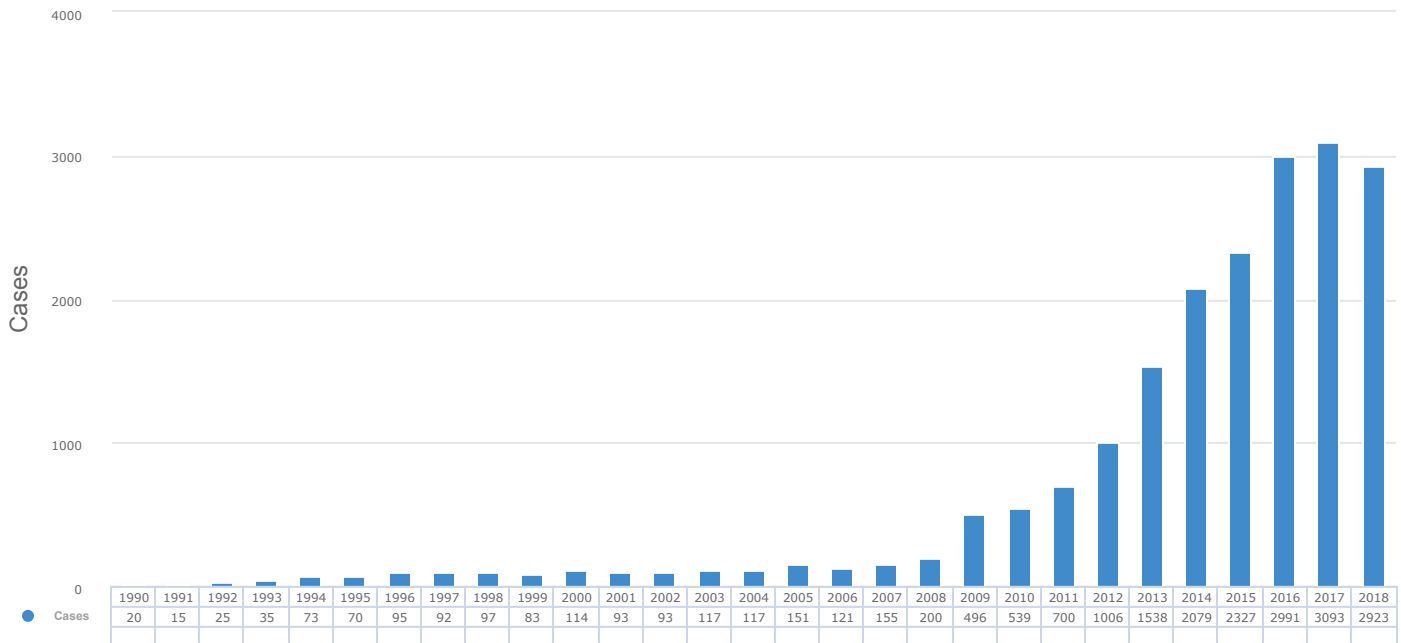
Pediatric Respiratory Complications from 2014 to Present

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	157	5.3%	75	48%
Mechanical: Raceway rupture	1	0%	1	100%
Mechanical: Other tubing rupture	3	0.1%	1	33%
Mechanical: Pump Failure	33	1.1%	15	45%
Mechanical: Heat exchanger malfunction	9	0.3%	7	78%
Mechanical: Clots: hemofilter	129	4.4%	69	53%
Mechanical: Clots: Circuit Component Clots	846	28.6%	490	58%
Mechanical: Air in circuit	151	5.1%	69	46%
Mechanical: Cracks in pigtail connectors	26	0.9%	11	42%
Mechanical: Cannula problems	385	13%	224	58%
Mechanical: Circuit change	146	4.9%	93	64%
Mechanical: Clots and Air Emboli	15	0.5%	2	13%
Mechanical: Thrombosis/Clots: circuit component	39	1.3%	22	56%
Hemorrhagic: GI hemorrhage	134	4.5%	49	37%
Hemorrhagic: Cannulation site bleeding	484	16.4%	287	59%
Hemorrhagic: Surgical site bleeding	232	7.8%	121	52%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	373	12.6%	188	50%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	102	3.4%	27	26%
Hemorrhagic: Peripheral cannulation site bleeding	24	0.8%	15	63%
Hemorrhagic: Mediastinal cannulation site bleeding	16	0.5%	12	75%
Neurologic: Brain death	68	2.3%	0	0%
Neurologic: Seizures: clinically determined	54	1.8%	27	50%
Neurologic: Seizures Confirmed by EEG	59	2%	26	44%
Neurologic: CNS Infarction (US or CT or MRI)	141	4.8%	44	31%
Neurologic: CNS hemorrhage by US/CT	151	5.1%	37	25%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	23	0.8%	6	26%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	30	1%	10	33%
Neurologic: CNS diffuse ischemia (CT/MRI)	13	0.4%	5	38%
Neurologic: Neurosurgical intervention performed	3	0.1%	1	33%
Renal: Creatinine 1.5 - 3.0	174	5.9%	82	47%
Renal: Creatinine > 3.0	74	2.5%	32	43%
Renal: Renal Replacement Therapy Required	1,091	36.9%	533	49%
Cardiovascular: Inotropes on ECLS	816	27.6%	422	52%
Cardiovascular: CPR required	185	6.3%	60	32%
Cardiovascular: Myocardial stun by echo	20	0.7%	10	50%
Cardiovascular: Cardiac arrhythmia	136	4.6%	69	51%
Cardiovascular: Hypertension requiring vasodilators	403	13.6%	255	63%

	No Reported	% Reported	Survived	% Survived
Cardiovascular: PDA: R->L	2	0.1%	0	0%
Cardiovascular: PDA: L->R	3	0.1%	2	67%
Cardiovascular: Tamponade (blood)	64	2.2%	30	47%
Cardiovascular: Tamponade (not blood)	13	0.4%	6	46%
Pulmonary: Pneumothorax requiring treatment	228	7.7%	115	50%
Pulmonary: Pulmonary hemorrhage	195	6.6%	59	30%
Infectious: Culture proven infection (see Infections)	305	10.3%	158	52%
Infectious: WBC < 1,500	92	3.1%	35	38%
Metabolic: Glucose < 40	26	0.9%	9	35%
Metabolic: Glucose > 240	219	7.4%	114	52%
Metabolic: pH < 7.20	232	7.8%	98	42%
Metabolic: pH > 7.60	59	2%	36	61%
Metabolic: Hyperbilirubinemia	169	5.7%	50	30%
Metabolic: Moderate hemolysis	57	1.9%	32	56%
Metabolic: Severe hemolysis	44	1.5%	23	52%
Limb: Ischemia	34	1.1%	11	32%
Limb: Compartment Syndrome	14	0.5%	4	29%
Limb: Fasciotomy	18	0.6%	10	56%
Limb: Amputation	9	0.3%	4	44%

Adult Respiratory (18 years and over)

Annual Respiratory Adult Runs



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%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2004	117	1,148	208	1,142	61	52%
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	195	1,596	104	52%
2009	496	2,271	259	3,018	289	58%
2010	539	2,810	246	1,663	316	58%
2011	700	3,510	254	2,554	406	58%
2012	1,006	4,516	268	6,248	563	55%
2013	1,538	6,054	284	6,745	923	60%
2014	2,079	8,133	290	3,288	1,255	60%
2015	2,327	10,460	275	7,576	1,313	56%
2016	2,991	13,451	307	5,355	1,876	62%
2017	3,093	16,544	276	5,199	1,891	61%
2018	2,923	19,467	262	5,076	1,821	62%

Adult Respiratory Runs by Diagnosis from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Viral pneumonia	634	344	3,691	407	64%
Bacterial pneumonia	960	304	3,911	607	63%
Aspiration pneumonia	180	253	1,361	134	74%
ARDS, postop/trauma	103	282	2,205	64	62%
ARDS, not postop/trauma	1,824	314	5,076	1,147	62%
Acute resp failure, non-ARDS	1,504	290	2,852	900	59%
Other	7,203	264	7,576	4,327	60%

Note some runs are missing primary diagnoses

Adult Respiratory Support Mode Details from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VV	12,395	292	7,576	7,622	61%
VA	1,177	255	5,009	592	50%
VVA	263	352	3,145	92	34%
Other	92	441	4,027	50	54%
Unknown	63	240	1,015	31	49%

Includes conversions (VV-VA, VA-VV, etc) so counts are higher than number of runs

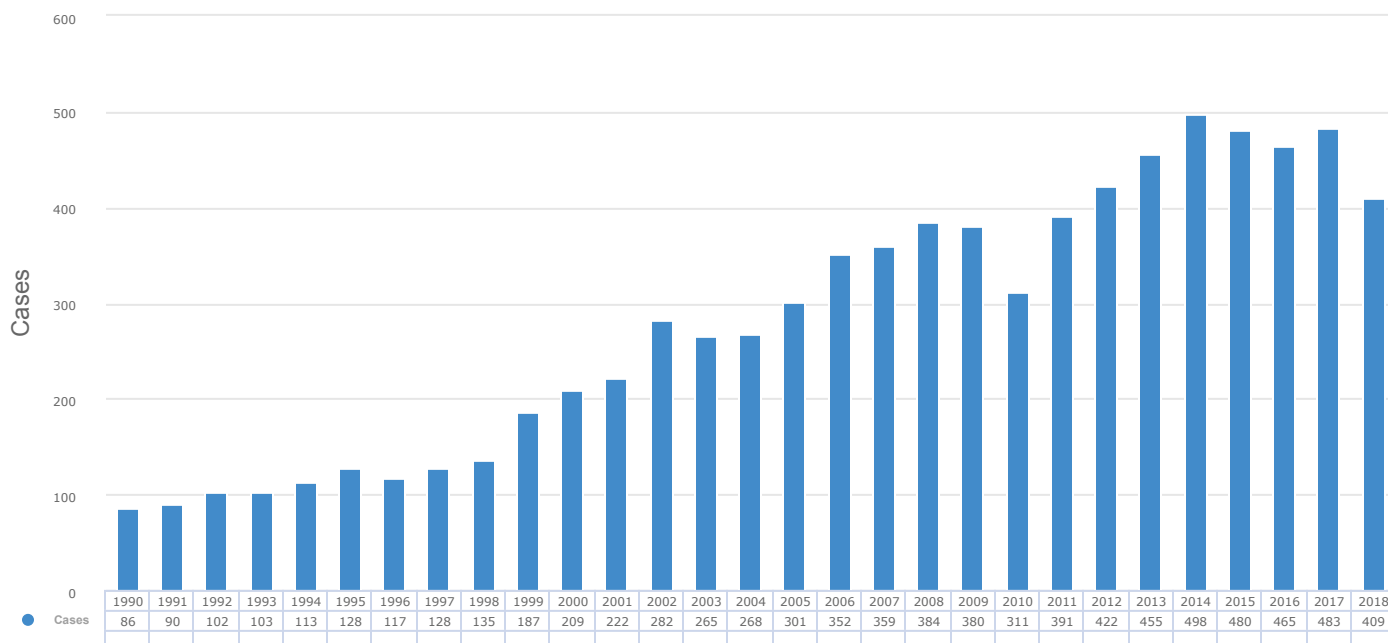
Adult Respiratory Complications from 2014 to Present

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	798	5.9%	398	50%
Mechanical: Raceway rupture	1	0%	0	0%
Mechanical: Other tubing rupture	16	0.1%	8	50%
Mechanical: Pump Failure	132	1%	57	43%
Mechanical: Heat exchanger malfunction	15	0.1%	10	67%
Mechanical: Clots: hemofilter	174	1.3%	87	50%
Mechanical: Clots: Circuit Component Clots	1,761	13.1%	1,039	59%
Mechanical: Air in circuit	155	1.2%	69	45%
Mechanical: Cracks in pigtail connectors	23	0.2%	9	39%
Mechanical: Cannula problems	644	4.8%	316	49%
Mechanical: Circuit change	316	2.4%	174	55%
Mechanical: Clots and Air Emboli	6	0%	1	17%
Mechanical: Thrombosis/Clots: circuit component	70	0.5%	35	50%
Hemorrhagic: GI hemorrhage	732	5.5%	311	42%
Hemorrhagic: Cannulation site bleeding	1,048	7.8%	550	52%
Hemorrhagic: Surgical site bleeding	910	6.8%	469	52%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	555	4.1%	306	55%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	270	2%	85	31%
Hemorrhagic: Peripheral cannulation site bleeding	69	0.5%	41	59%
Hemorrhagic: Mediastinal cannulation site bleeding	15	0.1%	5	33%
Neurologic: Brain death	179	1.3%	0	0%
Neurologic: Seizures: clinically determined	118	0.9%	52	44%
Neurologic: Seizures Confirmed by EEG	43	0.3%	14	33%
Neurologic: CNS Infarction (US or CT or MRI)	241	1.8%	71	29%
Neurologic: CNS hemorrhage by US/CT	331	2.5%	80	24%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	41	0.3%	7	17%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	77	0.6%	31	40%
Neurologic: CNS diffuse ischemia (CT/MRI)	29	0.2%	2	7%
Neurologic: Neurosurgical intervention performed	3	0%	2	67%
Renal: Creatinine 1.5 - 3.0	1,858	13.9%	1,015	55%
Renal: Creatinine > 3.0	913	6.8%	458	50%
Renal: Renal Replacement Therapy Required	4,033	30.1%	1,984	49%
Cardiovascular: Inotropes on ECLS	3,038	22.6%	1,601	53%
Cardiovascular: CPR required	555	4.1%	134	24%
Cardiovascular: Myocardial stun by echo	84	0.6%	39	46%
Cardiovascular: Cardiac arrhythmia	1,063	7.9%	462	43%
Cardiovascular: Hypertension requiring vasodilators	412	3.1%	243	59%

	No Reported	% Reported	Survived	% Survived
Cardiovascular: PDA: R->L	3	0%	2	67%
Cardiovascular: PDA: L->R	2	0%	1	50%
Cardiovascular: PDA: unknown	1	0%	0	0%
Cardiovascular: Tamponade (blood)	115	0.9%	56	49%
Cardiovascular: Tamponade (not blood)	17	0.1%	10	59%
Pulmonary: Pneumothorax requiring treatment	772	5.8%	370	48%
Pulmonary: Pulmonary hemorrhage	529	3.9%	207	39%
Infectious: Culture proven infection (see Infections)	1,483	11.1%	786	53%
Infectious: WBC < 1,500	285	2.1%	90	32%
Metabolic: Glucose < 40	173	1.3%	45	26%
Metabolic: Glucose > 240	838	6.2%	462	55%
Metabolic: pH < 7.20	740	5.5%	256	35%
Metabolic: pH > 7.60	203	1.5%	122	60%
Metabolic: Hyperbilirubinemia	986	7.4%	407	41%
Metabolic: Moderate hemolysis	64	0.5%	41	64%
Metabolic: Severe hemolysis	33	0.2%	20	61%
Limb: Ischemia	227	1.7%	84	37%
Limb: Compartment Syndrome	65	0.5%	29	45%
Limb: Fasciotomy	83	0.6%	31	37%
Limb: Amputation	36	0.3%	19	53%

Neonatal Cardiac (0-28 days)

Annual Cardiac Neonatal Runs



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	161	502	42	41%
1993	103	507	169	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	146	867	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%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2004	268	2,561	146	989	111	41%
2005	301	2,862	156	1,871	104	34%
2006	352	3,214	141	726	126	35%
2007	359	3,573	153	952	146	40%
2008	384	3,957	149	721	156	40%
2009	380	4,337	155	1,524	161	42%
2010	311	4,648	149	1,099	145	46%
2011	391	5,039	149	1,034	171	43%
2012	422	5,461	143	1,196	197	46%
2013	455	5,916	151	1,400	205	45%
2014	498	6,414	155	3,737	225	45%
2015	480	6,894	151	1,251	215	44%
2016	465	7,359	162	1,676	220	47%
2017	483	7,842	147	1,082	269	55%
2018	409	8,251	151	2,034	221	54%

Neonatal Cardiac Runs by Diagnosis from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Congenital Defect	1,487	144	1,481	698	46%
Cardiac Arrest	15	157	600	6	40%
Cardiogenic Shock	77	153	1,746	43	55%
Cardiomyopathy	27	231	848	15	55%
Myocarditis	25	250	628	13	52%
Other	621	168	3,737	342	55%

Note some runs are missing primary diagnoses

Neonatal Cardiac Runs by Congenital Diagnosis from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Left to right shunt (ASD/VSD/PDA/AV canal/AVSD/ECD)	92	154	1,066	42	45%
Left-sided obstructive (aortic stenosis/mitral stenosis/coarctation)	87	134	430	41	47%
Hypoplastic left heart	439	136	995	189	43%
Right-sided obstructive (pulmonary stenosis/pulmonary or tricuspid atresia)	52	132	862	21	40%
Cyanotic incr. pulmonary flow (truncus arteriosus/TGA/TGV)	73	166	716	32	43%
Cyanotic incr. pulm. congestion (TAP VR/P APVR)	167	139	1,481	79	47%
Cyanotic decr. pulmonary flow (TOF/DORV/Ebsteins)	295	163	1,251	149	50%
Other	282	135	1,080	145	51%

Note some runs are missing primary diagnoses

Neonatal Cardiac Support Mode Details from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VA	2,917	233	2,286	1,852	63%
VV	1,124	179	1,733	866	77%
VVA	22	234	982	13	59%
Unknown	14	169	276	7	50%
Other	3	174	254	2	66%

Includes conversions (VV-VA, VA-VV, etc) so counts are higher than number of runs

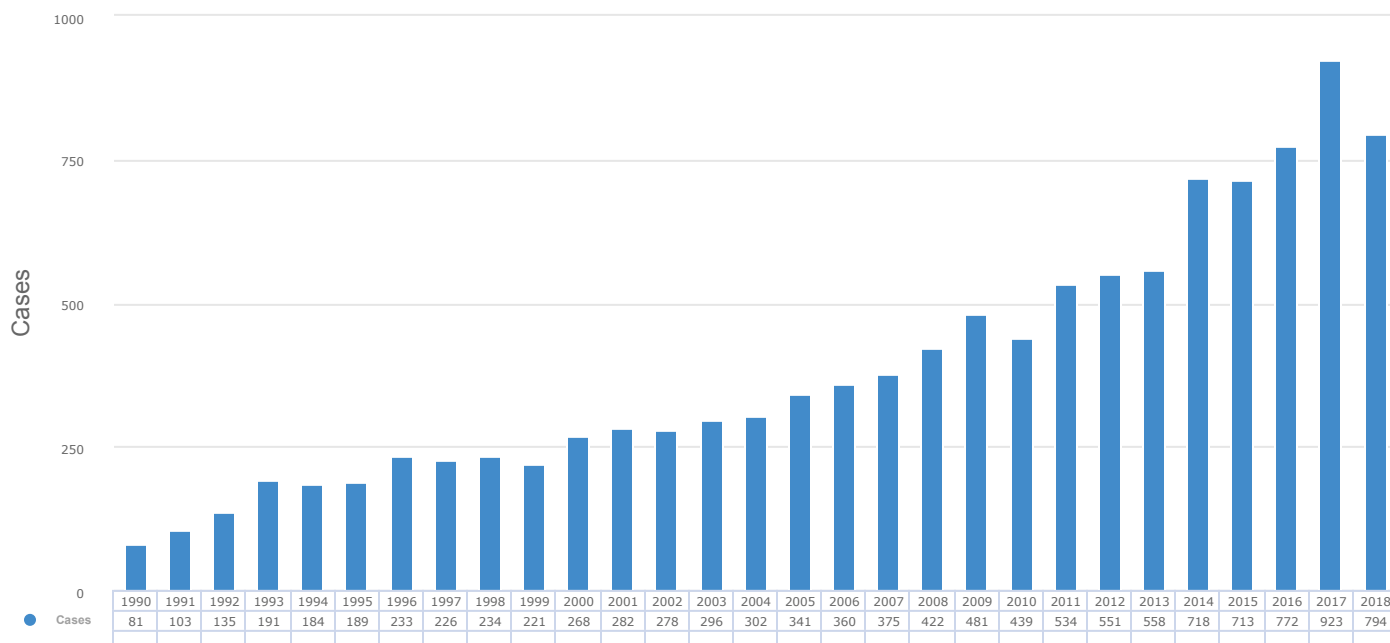
Neonatal Cardiac Complications from 2014 to Present

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	59	2.5%	10	17%
Mechanical: Raceway rupture	1	0%	0	0%
Mechanical: Other tubing rupture	5	0.2%	2	40%
Mechanical: Pump Failure	22	0.9%	11	50%
Mechanical: Heat exchanger malfunction	2	0.1%	2	100%
Mechanical: Clots: hemofilter	105	4.5%	35	33%
Mechanical: Clots: Circuit Component Clots	614	26.3%	254	41%
Mechanical: Air in circuit	74	3.2%	27	36%
Mechanical: Cracks in pigtail connectors	13	0.6%	5	38%
Mechanical: Cannula problems	166	7.1%	65	39%
Mechanical: Circuit change	52	2.2%	10	19%
Mechanical: Clots and Air Emboli	2	0.1%	1	50%
Mechanical: Thrombosis/Clots: circuit component	27	1.2%	12	44%
Hemorrhagic: GI hemorrhage	30	1.3%	5	17%
Hemorrhagic: Cannulation site bleeding	232	9.9%	81	35%
Hemorrhagic: Surgical site bleeding	476	20.4%	173	36%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	284	12.2%	55	19%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	86	3.7%	13	15%
Hemorrhagic: Peripheral cannulation site bleeding	4	0.2%	0	0%
Hemorrhagic: Mediastinal cannulation site bleeding	67	2.9%	20	30%
Neurologic: Brain death	15	0.6%	0	0%
Neurologic: Seizures: clinically determined	73	3.1%	23	32%
Neurologic: Seizures Confirmed by EEG	108	4.6%	34	31%
Neurologic: CNS Infarction (US or CT or MRI)	67	2.9%	20	30%
Neurologic: CNS hemorrhage by US/CT	223	9.6%	55	25%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	33	1.4%	10	30%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	24	1%	5	21%

	No Reported	% Reported	Survived	% Survived
Neurologic: CNS diffuse ischemia (CT/MRI)	2	0.1%	1	50%
Neurologic: Neurosurgical intervention performed	3	0.1%	2	67%
Renal: Creatinine 1.5 - 3.0	100	4.3%	24	24%
Renal: Creatinine > 3.0	20	0.9%	8	40%
Renal: Renal Replacement Therapy Required	807	34.6%	260	32%
Cardiovascular: Inotropes on ECLS	823	35.2%	295	36%
Cardiovascular: CPR required	50	2.1%	11	22%
Cardiovascular: Myocardial stun by echo	73	3.1%	13	18%
Cardiovascular: Cardiac arrhythmia	268	11.5%	89	33%
Cardiovascular: Hypertension requiring vasodilators	223	9.6%	109	49%
Cardiovascular: PDA: R->L	6	0.3%	1	17%
Cardiovascular: PDA: L->R	15	0.6%	5	33%
Cardiovascular: PDA: bidirectional	11	0.5%	3	27%
Cardiovascular: PDA: unknown	4	0.2%	0	0%
Cardiovascular: Tamponade (blood)	92	3.9%	41	45%
Cardiovascular: Tamponade (not blood)	6	0.3%	3	50%
Pulmonary: Pneumothorax requiring treatment	42	1.8%	14	33%
Pulmonary: Pulmonary hemorrhage	66	2.8%	9	14%
Infectious: Culture proven infection (see Infections)	97	4.2%	27	28%
Infectious: WBC < 1,500	17	0.7%	5	29%
Metabolic: Glucose < 40	36	1.5%	13	36%
Metabolic: Glucose > 240	194	8.3%	70	36%
Metabolic: pH < 7.20	158	6.8%	40	25%
Metabolic: pH > 7.60	82	3.5%	35	43%
Metabolic: Hyperbilirubinemia	143	6.1%	45	31%
Metabolic: Moderate hemolysis	32	1.4%	8	25%
Metabolic: Severe hemolysis	25	1.1%	9	36%
Limb: Ischemia	32	1.4%	5	16%
Limb: Compartment Syndrome	1	0%	0	0%

Pediatric Cardiac (>28 days and <18 years)

Annual Cardiac Pediatric Runs



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	135	489	137	547	45	33%
1993	191	680	143	1,080	81	42%
1994	184	864	136	720	64	34%
1995	189	1,053	151	984	67	35%
1996	233	1,286	135	721	91	39%
1997	226	1,512	159	864	92	40%
1998	234	1,746	163	1,183	97	41%
1999	221	1,967	150	1,029	93	42%
2000	268	2,235	140	871	128	47%
2001	282	2,517	156	1,490	121	42%
2002	278	2,795	162	1,246	131	47%
2003	296	3,091	164	987	152	51%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2004	302	3,393	164	1,157	138	45%
2005	341	3,734	166	1,207	187	54%
2006	360	4,094	147	1,260	191	53%
2007	375	4,469	170	963	192	51%
2008	422	4,891	150	910	217	51%
2009	481	5,372	149	1,282	313	65%
2010	439	5,811	144	1,059	227	51%
2011	534	6,345	159	3,605	304	56%
2012	551	6,896	153	2,270	311	56%
2013	558	7,454	177	3,605	308	55%
2014	718	8,172	161	3,506	389	54%
2015	713	8,885	175	2,564	413	57%
2016	772	9,657	176	2,977	441	57%
2017	923	10,580	172	3,408	572	61%
2018	794	11,374	176	2,879	462	58%

Pediatric Cardiac Runs by Diagnosis from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Congenital Defect	1,558	152	2,736	868	55%
Cardiac Arrest	88	174	2,352	40	45%
Cardiogenic Shock	266	176	2,977	155	58%
Cardiomyopathy	125	255	2,506	77	61%
Myocarditis	134	185	866	102	76%
Other	1,555	184	3,506	925	59%

Note some runs are missing primary diagnoses

Pediatric Cardiac Runs by Congenital Diagnosis from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Left to right shunt (ASD/VSD/PDA/AV canal/AVSD/ECD)	265	172	1,988	129	48%
Left-sided obstructive (aortic stenosis/mitral stenosis/coarctation)	155	134	809	97	62%
Hypoplastic left heart	247	174	2,736	114	46%
Right-sided obstructive (pulmonary stenosis/pulmonary or tricuspid atresia)	66	151	1,055	40	60%
Cyanotic incr. pulmonary flow (truncus arteriosus/TGA/TGV)	38	166	551	19	50%
Cyanotic incr. pulm. congestion (TAP VR/P APVR)	48	168	1,350	21	43%
Cyanotic decr. pulmonary flow (TOF/DORV/Ebsteins)	258	135	1,810	156	60%
Other	481	141	1,238	292	60%

Pediatric Cardiac Support Mode Details from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VA	3,824	174	3,506	2,225	58%
VVA	72	217	1,336	43	59%
VV	67	370	2,720	38	56%
Other	32	287	1,315	12	37%
Unknown	18	140	384	6	33%

Includes conversions (VV-VA, VA-VV, etc) so counts are higher than number of runs

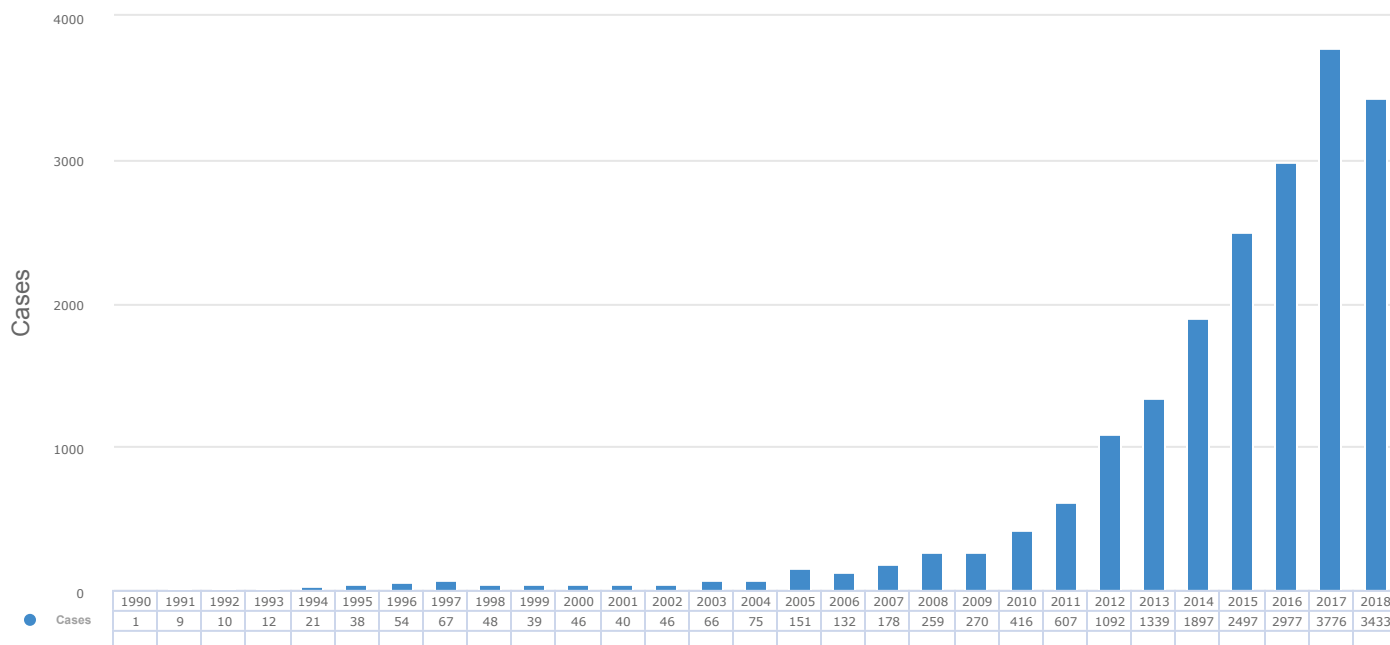
Pediatric Cardiac Complications from 2014 to Present

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	128	3.3%	58	45%
Mechanical: Raceway rupture	6	0.2%	1	17%
Mechanical: Other tubing rupture	9	0.2%	2	22%
Mechanical: Pump Failure	39	1%	22	56%
Mechanical: Heat exchanger malfunction	4	0.1%	2	50%
Mechanical: Clots: hemofilter	104	2.7%	50	48%
Mechanical: Clots: Circuit Component Clots	897	22.9%	448	50%
Mechanical: Air in circuit	90	2.3%	46	51%
Mechanical: Cracks in pigtail connectors	22	0.6%	11	50%
Mechanical: Cannula problems	237	6%	120	51%
Mechanical: Circuit change	104	2.7%	49	47%
Mechanical: Clots and Air Emboli	6	0.2%	3	50%
Mechanical: Thrombosis/Clots: circuit component	64	1.6%	31	48%
Hemorrhagic: GI hemorrhage	98	2.5%	28	29%
Hemorrhagic: Cannulation site bleeding	524	13.4%	288	55%
Hemorrhagic: Surgical site bleeding	773	19.7%	384	50%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	350	8.9%	131	37%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	115	2.9%	29	25%
Hemorrhagic: Peripheral cannulation site bleeding	27	0.7%	17	63%
Hemorrhagic: Mediastinal cannulation site bleeding	118	3%	72	61%
Neurologic: Brain death	78	2%	0	0%
Neurologic: Seizures: clinically determined	129	3.3%	48	37%
Neurologic: Seizures Confirmed by EEG	127	3.2%	53	42%
Neurologic: CNS Infarction (US or CT or MRI)	231	5.9%	77	33%
Neurologic: CNS hemorrhage by US/CT	161	4.1%	45	28%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	26	0.7%	4	15%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	30	0.8%	7	23%

	No Reported	% Reported	Survived	% Survived
Neurologic: CNS diffuse ischemia (CT/MRI)	15	0.4%	3	20%
Neurologic: Neurosurgical intervention performed	3	0.1%	1	33%
Renal: Creatinine 1.5 - 3.0	266	6.8%	120	45%
Renal: Creatinine > 3.0	77	2%	32	42%
Renal: Renal Replacement Therapy Required	1,355	34.6%	572	42%
Cardiovascular: Inotropes on ECLS	1,254	32%	629	50%
Cardiovascular: CPR required	99	2.5%	32	32%
Cardiovascular: Myocardial stun by echo	105	2.7%	43	41%
Cardiovascular: Cardiac arrhythmia	403	10.3%	205	51%
Cardiovascular: Hypertension requiring vasodilators	430	11%	254	59%
Cardiovascular: PDA: R->L	4	0.1%	1	25%
Cardiovascular: PDA: L->R	2	0.1%	1	50%
Cardiovascular: Tamponade (blood)	129	3.3%	59	46%
Cardiovascular: Tamponade (not blood)	10	0.3%	6	60%
Pulmonary: Pneumothorax requiring treatment	69	1.8%	25	36%
Pulmonary: Pulmonary hemorrhage	169	4.3%	62	37%
Infectious: Culture proven infection (see Infections)	280	7.1%	111	40%
Infectious: WBC < 1,500	58	1.5%	15	26%
Metabolic: Glucose < 40	40	1%	13	33%
Metabolic: Glucose > 240	331	8.4%	184	56%
Metabolic: pH < 7.20	205	5.2%	66	32%
Metabolic: pH > 7.60	93	2.4%	53	57%
Metabolic: Hyperbilirubinemia	182	4.6%	56	31%
Metabolic: Moderate hemolysis	39	1%	11	28%
Metabolic: Severe hemolysis	42	1.1%	6	14%
Limb: Ischemia	88	2.2%	28	32%
Limb: Compartment Syndrome	31	0.8%	13	42%
Limb: Fasciotomy	29	0.7%	12	41%
Limb: Amputation	8	0.2%	4	50%

Adult Cardiac (18 years and over)

Annual Cardiac Adult Runs



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	84	900	28	41%
1998	48	266	114	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%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2005	151	729	116	663	48	31%
2006	132	861	135	965	63	47%
2007	178	1,039	116	761	70	39%
2008	259	1,298	119	937	123	47%
2009	270	1,568	127	871	111	41%
2010	416	1,984	135	2,105	182	43%
2011	607	2,591	129	813	224	36%
2012	1,092	3,683	140	2,040	447	40%
2013	1,339	5,022	153	3,066	546	40%
2014	1,897	6,919	147	3,306	802	42%
2015	2,497	9,416	150	2,849	1,066	42%
2016	2,977	12,393	154	2,941	1,296	43%
2017	3,776	16,169	163	6,359	1,656	43%
2018	3,433	19,602	158	4,049	1,546	45%

Adult Cardiac Runs by Diagnosis from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Congenital Defect	209	151	928	79	37%
Cardiac Arrest	354	112	769	123	34%
Cardiogenic Shock	3,753	162	3,306	1,641	43%
Cardiomyopathy	330	162	865	172	52%
Myocarditis	128	218	1,370	80	62%
Other	8,387	155	6,359	3,754	44%

Note some runs are missing primary diagnoses

Adult Cardiac Runs by Congenital Diagnosis from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
Left to right shunt (ASD/VSD/PDA/AV canal/AVSD/ECD)	69	172	928	21	30%
Left-sided obstructive (aortic stenosis/mitral stenosis/coarctation)	86	133	555	30	34%
Hypoplastic left heart	3	134	312	2	66%
Right-sided obstructive (pulmonary stenosis/pulmonary or tricuspid atresia)	6	260	801	2	33%
Cyanotic incr. pulmonary flow (truncus arteriosus/TGA/TGV)	7	136	556	5	71%
Cyanotic decr. pulmonary flow (TOF/DORV/Ebsteins)	7	117	281	4	57%
Other	31	148	443	15	48%

Note some runs are missing primary diagnoses

Adult Cardiac Support Mode Details from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VA	14,054	157	6,359	6,163	43%
VV	509	283	1,817	219	43%
VVA	394	233	1,892	137	34%
Other	199	242	1,892	85	42%
Unknown	83	147	600	27	32%

Includes conversions (VV-VA, VA-VV, etc) so counts are higher than number of runs

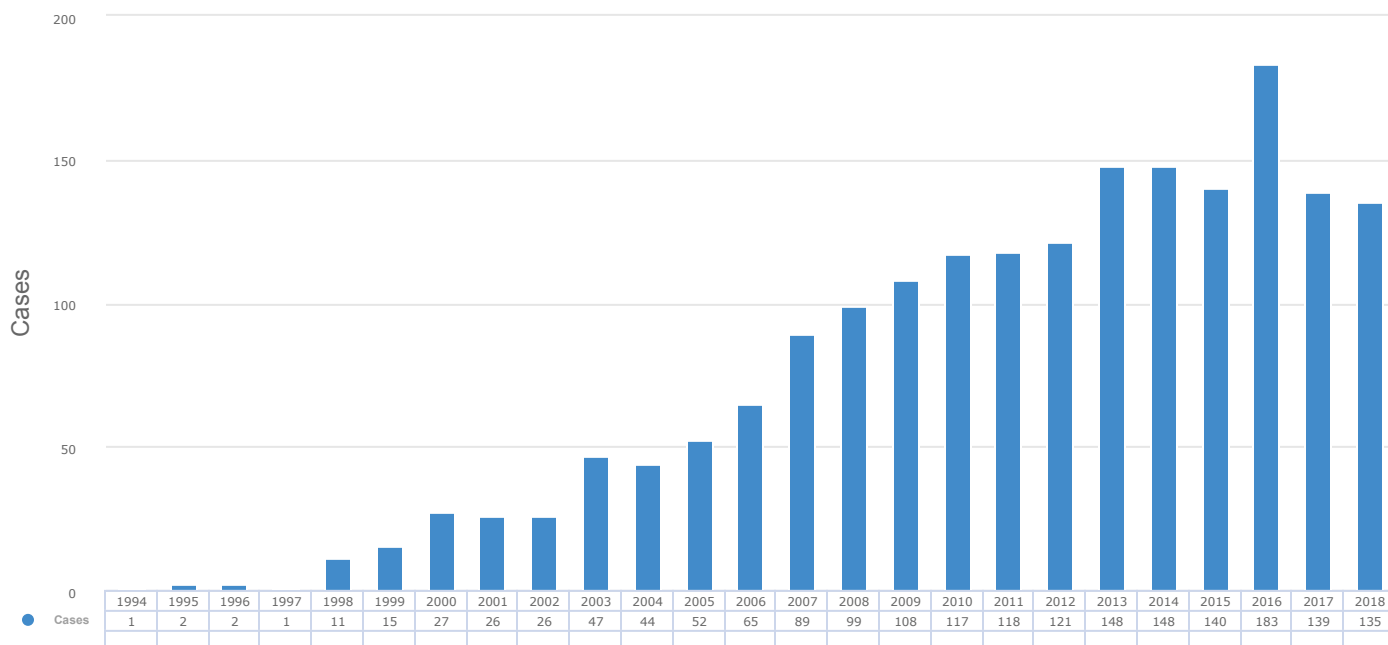
Adult Cardiac Complications from 2014 to Present

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	400	2.7%	151	38%
Mechanical: Raceway rupture	2	0%	2	100%
Mechanical: Other tubing rupture	8	0.1%	1	13%
Mechanical: Pump Failure	92	0.6%	25	27%
Mechanical: Heat exchanger malfunction	5	0%	4	80%
Mechanical: Clots: hemofilter	66	0.5%	17	26%
Mechanical: Clots: Circuit Component Clots	1,338	9.2%	553	41%
Mechanical: Air in circuit	142	1%	34	24%
Mechanical: Cracks in pigtail connectors	34	0.2%	14	41%
Mechanical: Cannula problems	466	3.2%	161	35%
Mechanical: Circuit change	149	1%	57	38%
Mechanical: Clots and Air Emboli	9	0.1%	2	22%
Mechanical: Thrombosis/Clots: circuit component	93	0.6%	41	44%
Hemorrhagic: GI hemorrhage	621	4.3%	148	24%
Hemorrhagic: Cannulation site bleeding	1,817	12.5%	689	38%
Hemorrhagic: Surgical site bleeding	2,109	14.5%	693	33%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	489	3.4%	158	32%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	267	1.8%	42	16%
Hemorrhagic: Peripheral cannulation site bleeding	191	1.3%	82	43%
Hemorrhagic: Mediastinal cannulation site bleeding	150	1%	55	37%
Neurologic: Brain death	304	2.1%	0	0%
Neurologic: Seizures: clinically determined	136	0.9%	40	29%
Neurologic: Seizures Confirmed by EEG	84	0.6%	23	27%
Neurologic: CNS Infarction (US or CT or MRI)	508	3.5%	113	22%
Neurologic: CNS hemorrhage by US/CT	207	1.4%	22	11%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	29	0.2%	4	14%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	43	0.3%	2	5%
Neurologic: CNS diffuse ischemia (CT/MRI)	33	0.2%	6	18%
Neurologic: Neurosurgical intervention performed	2	0%	0	0%

	No Reported	% Reported	Survived	% Survived
Renal: Creatinine 1.5 - 3.0	2,489	17.1%	912	37%
Renal: Creatinine > 3.0	1,264	8.7%	408	32%
Renal: Renal Replacement Therapy Required	4,312	29.6%	1,326	31%
Cardiovascular: Inotropes on ECLS	4,529	31.1%	1,754	39%
Cardiovascular: CPR required	379	2.6%	61	16%
Cardiovascular: Myocardial stun by echo	479	3.3%	159	33%
Cardiovascular: Cardiac arrhythmia	1,934	13.3%	707	37%
Cardiovascular: Hypertension requiring vasodilators	372	2.6%	212	57%
Cardiovascular: PDA: L->R	3	0%	1	33%
Cardiovascular: PDA: bidirectional	1	0%	0	0%
Cardiovascular: PDA: unknown	2	0%	0	0%
Cardiovascular: Tamponade (blood)	639	4.4%	238	37%
Cardiovascular: Tamponade (not blood)	39	0.3%	10	26%
Pulmonary: Pneumothorax requiring treatment	195	1.3%	63	32%
Pulmonary: Pulmonary hemorrhage	336	2.3%	76	23%
Infectious: Culture proven infection (see Infections)	1,106	7.6%	445	40%
Infectious: WBC < 1,500	232	1.6%	81	35%
Metabolic: Glucose < 40	171	1.2%	13	8%
Metabolic: Glucose > 240	1,057	7.2%	453	43%
Metabolic: pH < 7.20	946	6.5%	177	19%
Metabolic: pH > 7.60	305	2.1%	157	51%
Metabolic: Hyperbilirubinemia	1,415	9.7%	403	28%
Metabolic: Moderate hemolysis	69	0.5%	14	20%
Metabolic: Severe hemolysis	48	0.3%	13	27%
Limb: Ischemia	767	5.3%	227	30%
Limb: Compartment Syndrome	225	1.5%	52	23%
Limb: Fasciotomy	371	2.5%	120	32%
Limb: Amputation	102	0.7%	53	52%

Neonatal ECPR (0-28 days)

Annual ECPR Neonatal Runs



Neonatal ECPR Runs by Year

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	44	202	124	653	19	43%
2005	52	254	152	1,079	16	30%
2006	65	319	124	474	27	41%
2007	89	408	113	700	34	38%
2008	99	507	161	1,082	35	35%
2009	108	615	120	701	46	42%
2010	117	732	127	856	54	46%
2011	118	850	132	924	43	36%
2012	121	971	107	516	51	42%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2013	148	1,119	135	871	72	48%
2014	148	1,267	119	723	64	43%
2015	140	1,407	129	1,010	63	45%
2016	183	1,590	150	747	74	40%
2017	139	1,729	173	1,488	49	35%
2018	135	1,864	125	2,380	65	48%

Neonatal ECPR Support Mode Details from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VA	756	144	2,380	317	41%
VV	3	230	495	1	33%
Other	3	111	220	1	33%
VVA	1	143	143	1	100%

Includes conversions (VV-VA, VA-VV, etc) so counts are higher than number of runs

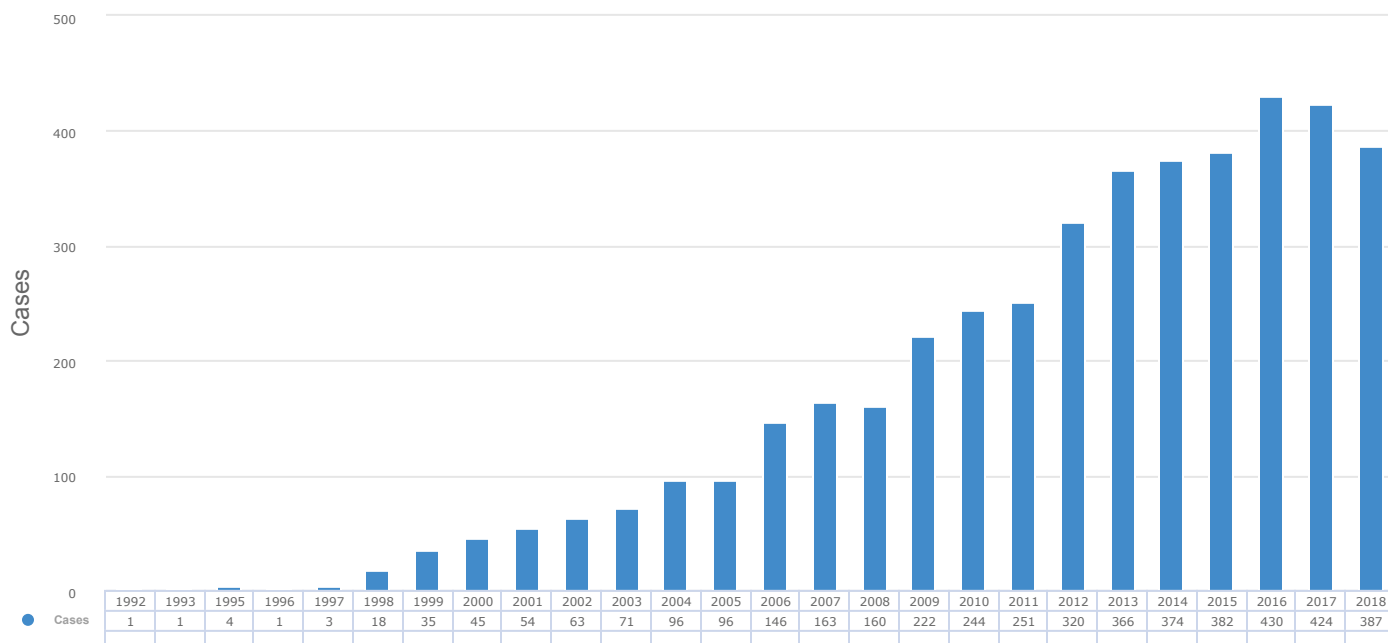
Neonatal ECPR Complications from 2014 to Present

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	18	2.4%	2	11%
Mechanical: Other tubing rupture	3	0.4%	0	0%
Mechanical: Pump Failure	8	1.1%	0	0%
Mechanical: Clots: hemofilter	26	3.5%	7	27%
Mechanical: Clots: Circuit Component Clots	191	25.6%	63	33%
Mechanical: Air in circuit	37	5%	14	38%
Mechanical: Cracks in pigtail connectors	3	0.4%	2	67%
Mechanical: Cannula problems	58	7.8%	11	19%
Mechanical: Circuit change	13	1.7%	0	0%
Mechanical: Thrombosis/Clots: circuit component	7	0.9%	4	57%
Hemorrhagic: GI hemorrhage	12	1.6%	1	8%
Hemorrhagic: Cannulation site bleeding	76	10.2%	21	28%
Hemorrhagic: Surgical site bleeding	124	16.6%	32	26%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	99	13.3%	16	16%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	40	5.4%	7	18%
Hemorrhagic: Mediastinal cannulation site bleeding	11	1.5%	7	64%
Neurologic: Brain death	10	1.3%	0	0%
Neurologic: Seizures: clinically determined	39	5.2%	14	36%
Neurologic: Seizures Confirmed by EEG	73	9.8%	9	12%
Neurologic: CNS Infarction (US or CT or MRI)	27	3.6%	1	4%
Neurologic: CNS hemorrhage by US/CT	85	11.4%	20	24%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	11	1.5%	4	36%

	No Reported	% Reported	Survived	% Survived
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	14	1.9%	1	7%
Neurologic: CNS diffuse ischemia (CT/MRI)	10	1.3%	1	10%
Renal: Creatinine 1.5 - 3.0	34	4.6%	6	18%
Renal: Creatinine > 3.0	4	0.5%	1	25%
Renal: Renal Replacement Therapy Required	291	39.1%	88	30%
Cardiovascular: Inotropes on ECLS	280	37.6%	94	34%
Cardiovascular: CPR required	21	2.8%	2	10%
Cardiovascular: Myocardial stun by echo	26	3.5%	5	19%
Cardiovascular: Cardiac arrhythmia	73	9.8%	17	23%
Cardiovascular: Hypertension requiring vasodilators	95	12.8%	39	41%
Cardiovascular: PDA: R->L	3	0.4%	1	33%
Cardiovascular: PDA: L->R	6	0.8%	2	33%
Cardiovascular: PDA: bidirectional	3	0.4%	0	0%
Cardiovascular: Tamponade (blood)	16	2.1%	6	38%
Cardiovascular: Tamponade (not blood)	3	0.4%	1	33%
Pulmonary: Pneumothorax requiring treatment	28	3.8%	9	32%
Pulmonary: Pulmonary hemorrhage	23	3.1%	5	22%
Infectious: Culture proven infection (see Infections)	31	4.2%	6	19%
Infectious: WBC < 1,500	7	0.9%	0	0%
Metabolic: Glucose < 40	18	2.4%	7	39%
Metabolic: Glucose > 240	104	14%	35	34%
Metabolic: pH < 7.20	88	11.8%	22	25%
Metabolic: pH > 7.60	22	3%	4	18%
Metabolic: Hyperbilirubinemia	56	7.5%	17	30%
Metabolic: Moderate hemolysis	8	1.1%	3	38%
Metabolic: Severe hemolysis	13	1.7%	1	8%
Limb: Ischemia	10	1.3%	1	10%

Pediatric ECPR (>28 days and <18 years)

Annual ECPR Pediatric Runs



Pediatric ECPR Runs by Year

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	244	1,423	118	645	105	43%
2011	251	1,674	113	944	119	47%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2012	320	1,994	140	4,755	141	44%
2013	366	2,360	133	2,320	155	42%
2014	374	2,734	125	1,427	171	45%
2015	382	3,116	119	1,203	151	39%
2016	430	3,546	123	1,511	179	41%
2017	424	3,970	132	4,281	212	50%
2018	387	4,357	127	3,010	164	42%

Pediatric ECPR Support Mode Details from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VA	1,945	126	4,281	851	43%
VV	36	224	1,111	19	52%
VVA	33	127	376	13	39%
Other	12	217	518	6	50%
Unknown	7	143	216	3	42%

Includes conversions (VV-VA, VA-VV, etc) so counts are higher than number of runs

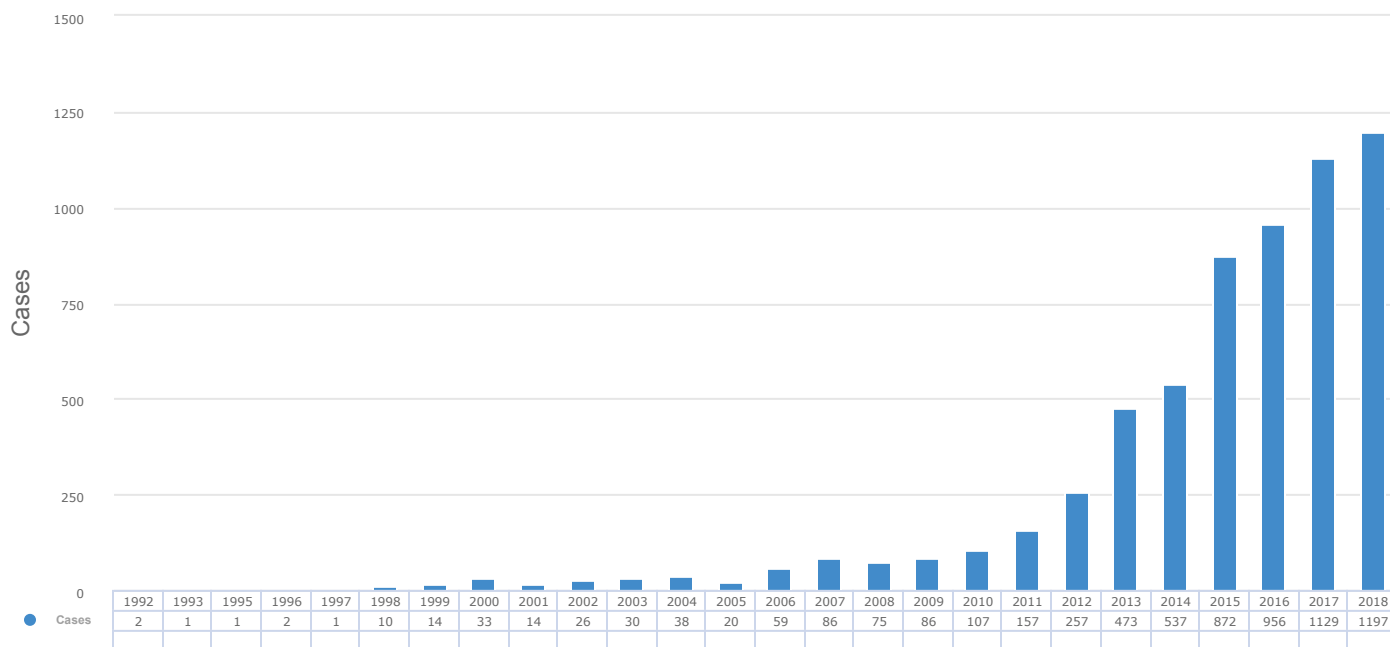
Pediatric ECPR Complications from 2014 to Present

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	41	2.1%	13	32%
Mechanical: Raceway rupture	1	0.1%	1	100%
Mechanical: Other tubing rupture	3	0.2%	2	67%
Mechanical: Pump Failure	8	0.4%	4	50%
Mechanical: Heat exchanger malfunction	5	0.3%	1	20%
Mechanical: Clots: hemofilter	30	1.5%	14	47%
Mechanical: Clots: Circuit Component Clots	260	13%	118	45%
Mechanical: Air in circuit	52	2.6%	16	31%
Mechanical: Cracks in pigtail connectors	6	0.3%	3	50%
Mechanical: Cannula problems	145	7.3%	56	39%
Mechanical: Circuit change	25	1.3%	10	40%
Mechanical: Thrombosis/Clots: circuit component	17	0.9%	6	35%
Hemorrhagic: GI hemorrhage	59	3%	8	14%
Hemorrhagic: Cannulation site bleeding	281	14.1%	111	40%
Hemorrhagic: Surgical site bleeding	212	10.6%	81	38%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	113	5.7%	38	34%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	78	3.9%	6	8%
Hemorrhagic: Peripheral cannulation site bleeding	13	0.7%	4	31%
Hemorrhagic: Mediastinal cannulation site bleeding	25	1.3%	12	48%
Neurologic: Brain death	157	7.9%	0	0%

	No Reported	% Reported	Survived	% Survived
Neurologic: Seizures: clinically determined	144	7.2%	47	33%
Neurologic: Seizures Confirmed by EEG	170	8.5%	58	34%
Neurologic: CNS Infarction (US or CT or MRI)	212	10.6%	54	25%
Neurologic: CNS hemorrhage by US/CT	122	6.1%	28	23%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	11	0.6%	4	36%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	26	1.3%	12	46%
Neurologic: CNS diffuse ischemia (CT/MRI)	27	1.4%	6	22%
Neurologic: Neurosurgical intervention performed	1	0.1%	0	0%
Renal: Creatinine 1.5 - 3.0	170	8.5%	60	35%
Renal: Creatinine > 3.0	46	2.3%	14	30%
Renal: Renal Replacement Therapy Required	611	30.6%	224	37%
Cardiovascular: Inotropes on ECLS	647	32.4%	246	38%
Cardiovascular: CPR required	74	3.7%	11	15%
Cardiovascular: Myocardial stun by echo	61	3.1%	20	33%
Cardiovascular: Cardiac arrhythmia	231	11.6%	100	43%
Cardiovascular: Hypertension requiring vasodilators	240	12%	127	53%
Cardiovascular: PDA: L->R	4	0.2%	2	50%
Cardiovascular: PDA: bidirectional	1	0.1%	1	100%
Cardiovascular: Tamponade (blood)	33	1.7%	12	36%
Cardiovascular: Tamponade (not blood)	7	0.4%	2	29%
Pulmonary: Pneumothorax requiring treatment	42	2.1%	12	29%
Pulmonary: Pulmonary hemorrhage	121	6.1%	29	24%
Infectious: Culture proven infection (see Infections)	105	5.3%	47	45%
Infectious: WBC < 1,500	24	1.2%	7	29%
Metabolic: Glucose < 40	39	2%	11	28%
Metabolic: Glucose > 240	214	10.7%	70	33%
Metabolic: pH < 7.20	219	11%	46	21%
Metabolic: pH > 7.60	50	2.5%	20	40%
Metabolic: Hyperbilirubinemia	86	4.3%	28	33%
Metabolic: Moderate hemolysis	27	1.4%	10	37%
Metabolic: Severe hemolysis	33	1.7%	8	24%
Limb: Ischemia	35	1.8%	8	23%
Limb: Compartment Syndrome	17	0.9%	8	47%
Limb: Fasciotomy	19	1%	13	68%
Limb: Amputation	7	0.4%	2	29%

Adult ECPR (18 years and over)

Annual ECPR Adult Runs



Adult ECPR Runs by Year

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	157	762	107	2,209	41	26%
2012	257	1,019	105	718	64	24%

	Annual Runs	Cumulative Runs	Average Run Time	Longest Run Time	No. Survived	% Survived
2013	473	1,492	102	995	146	30%
2014	537	2,029	103	1,481	173	32%
2015	872	2,901	105	1,513	259	29%
2016	956	3,857	110	1,865	250	26%
2017	1,129	4,986	99	2,874	341	30%
2018	1,197	6,183	101	2,892	376	31%

Adult ECPR Support Mode Details from 2014 to Present

	Total Runs	Avg Run Time	Longest Run Time	Survived	% Survived
VA	4,573	103	2,892	1,366	29%
VV	121	203	2,892	50	41%
VVA	83	195	2,892	25	30%
Unknown	29	128	899	4	13%
Other	15	228	551	6	40%

Includes conversions (VV-VA, VA-VV, etc) so counts are higher than number of runs

Adult ECPR Complications from 2014 to Present

	No Reported	% Reported	Survived	% Survived
Mechanical: Oxygenator failure	105	2.2%	22	21%
Mechanical: Other tubing rupture	8	0.2%	3	38%
Mechanical: Pump Failure	25	0.5%	5	20%
Mechanical: Heat exchanger malfunction	1	0%	0	0%
Mechanical: Clots: hemofilter	26	0.6%	7	27%
Mechanical: Clots: Circuit Component Clots	307	6.5%	98	32%
Mechanical: Air in circuit	58	1.2%	7	12%
Mechanical: Cracks in pigtail connectors	9	0.2%	0	0%
Mechanical: Cannula problems	184	3.9%	33	18%
Mechanical: Circuit change	31	0.7%	6	19%
Mechanical: Clots and Air Emboli	4	0.1%	0	0%
Mechanical: Thrombosis/Clots: circuit component	23	0.5%	11	48%
Hemorrhagic: GI hemorrhage	229	4.9%	35	15%
Hemorrhagic: Cannulation site bleeding	581	12.4%	190	33%
Hemorrhagic: Surgical site bleeding	344	7.3%	105	31%
Hemorrhagic: Hemolysis (hgb > 50 mg/dl)	121	2.6%	29	24%
Hemorrhagic: Disseminated intravascular coagulation (DIC)	105	2.2%	13	12%
Hemorrhagic: Peripheral cannulation site bleeding	77	1.6%	26	34%
Hemorrhagic: Mediastinal cannulation site bleeding	15	0.3%	4	27%
Neurologic: Brain death	317	6.8%	0	0%
Neurologic: Seizures: clinically determined	75	1.6%	22	29%

	No Reported	% Reported	Survived	% Survived
Neurologic: Seizures Confirmed by EEG	59	1.3%	11	19%
Neurologic: CNS Infarction (US or CT or MRI)	213	4.5%	38	18%
Neurologic: CNS hemorrhage by US/CT	90	1.9%	10	11%
Neurologic: Intraventricular CNS hemorrhage (US or CT or MRI)	21	0.4%	3	14%
Neurologic: Intra/extra parenchymal CNS Hemorrhage (US or CT or MRI)	18	0.4%	5	28%
Neurologic: CNS diffuse ischemia (CT/MRI)	53	1.1%	5	9%
Neurologic: Neurosurgical intervention performed	3	0.1%	0	0%
Renal: Creatinine 1.5 - 3.0	721	15.4%	204	28%
Renal: Creatinine > 3.0	378	8.1%	107	28%
Renal: Renal Replacement Therapy Required	1,219	26%	320	26%
Cardiovascular: Inotropes on ECLS	1,325	28.2%	356	27%
Cardiovascular: CPR required	270	5.8%	35	13%
Cardiovascular: Myocardial stun by echo	192	4.1%	46	24%
Cardiovascular: Cardiac arrhythmia	640	13.6%	166	26%
Cardiovascular: Hypertension requiring vasodilators	90	1.9%	51	57%
Cardiovascular: PDA: L->R	2	0%	0	0%
Cardiovascular: Tamponade (blood)	95	2%	17	18%
Cardiovascular: Tamponade (not blood)	10	0.2%	2	20%
Pulmonary: Pneumothorax requiring treatment	78	1.7%	12	15%
Pulmonary: Pulmonary hemorrhage	117	2.5%	24	21%
Infectious: Culture proven infection (see Infections)	288	6.1%	106	37%
Infectious: WBC < 1,500	53	1.1%	5	9%
Metabolic: Glucose < 40	42	0.9%	1	2%
Metabolic: Glucose > 240	507	10.8%	147	29%
Metabolic: pH < 7.20	496	10.6%	98	20%
Metabolic: pH > 7.60	67	1.4%	24	36%
Metabolic: Hyperbilirubinemia	221	4.7%	49	22%
Metabolic: Moderate hemolysis	15	0.3%	3	20%
Metabolic: Severe hemolysis	9	0.2%	2	22%
Limb: Ischemia	268	5.7%	69	26%
Limb: Compartment Syndrome	64	1.4%	20	31%
Limb: Fasciotomy	102	2.2%	34	33%
Limb: Amputation	23	0.5%	13	57%