

	<b>ICD-9 or CTC</b>
Cardiac catheterization	37.21-37.29
Electrophysiology study	37.2, 37.26, and 37.27
Genetic syndrome	758.1, 758.2, 758.0, 758.31, 758.32, 758.33, 758.9, 758.6, 758.83, and 758.89)
Non-cardiac congenital anomaly	740.0-740.2, 741.0, 741.9, 742.0-742.5, 742.9, 748.0-748.4, 749.0-749.2, 750.3, 751.1, 751.2, 751.4, 751.6, 753.0, 753.15, 753.2, 753.5, 756.6, and 756.7
Prematurity	765.2-765.28
Congenital heart disease	745, 746, 747
Pulmonary hypertension	416.0, 416.2, 416.8, 416.9
Myocarditis	422.0, 422.9, 422.91, 422.99, 429.0
Cardiomyopathy	425.1, 425.4, 425.7-9
Orthotopic heart transplant	v42.1
Cardiac operations	35.00- 35.99 and 37.5, 37.51, 37.52, and 39.0 and 39.21
Trans-catheter interventions	00.40-00.48, 0.66, 35.05, 35.07, 35.09, 35.52, 35.55, 35.96, 35.97, 36.06, 36.07, 37.34, 37.90
Mechanical ventilation	93.90, 96.70-96.72
Mechanical circulatory support	39.65,39.61, 39.66, 37.62, 37.61, 37.60
Hemodialysis	39.95
Inotropes	131321.20.20.70.1, 131321.20.20.01.2, 131321.20.20.70.1, 131321.20.20.04.2, 131321.20.20.29.2, 131351 (all suffixes), 131311.20.20.33.2, 131311.20.20.65.2, 131311.20.20.82.2, 131311.20.20.94.2, 131311.20.20.45.2, 131311.20.20.82.2, 131311.20.20.94.2, 131305.20.20.22.2, 131305.20.20.68.2, 131305.20.20.86.2, 131305.20.20.02.3, 131305.20.20.06.3,, 151471.20.20.26.6, 151471.20.20.20.6, 151471.20.20.33.6, 151471.20.20.65.6,, 131355.20.20.86.1, 131355.20.20.20.2, 131321.20.20.36.2, 131321.20.20.51.2
Systemic vasodilators	136110.10.11.20.2, 136105.20.20.82.1, 136105.20.20.11.2, 134101.20.20.36.2, 133181.20.20.03.2, 13111.20.20.01.2, 13111.20.20.11.2, 13111.20.20.20.2, 13111.20.20.26.2, 13111.20.20.36.2, 133245
Pulmonary vasodilators	191321.10.11.26.2, 191321.10.11.27.2, 191321.10.11.36.2, 191321.10.11.51.2, 191321.20.20.20.2, 191322.10.11.06.2, 191322.10.11.11.2, 191322.10.11.20.2, 191322.10.11.26.2, 191323.10.11.06.02, 191323.10.11.11.2, 191323.10.11.20.2, 191323.10.11.26.2, 133155.20.20.86.1, 133155.20.20.03.2, 161217.20.20.01.2, 161217.20.20.26.2, 161217.20.20.06.2, 161217.20.20.36.2, 161217.20.20.11.2, 161217.20.20.51.2, 161217.20.20.20.2, 161217.20.20.20.2, 161217.42.42.12.1, 161217.42.42.10.2, 133153.42.42.20.1, 133153.42.42.26.1, 133151.10.11.39.2, 133151.10.11.55.2, 133148.10.11.2, 133148.10.11.20.2, 115140.42.42.00.0
Calcium Channel Blockers	133201,133231, 133211

**Supplementary Table 1: International Classification of Disease ninth revision code (ICD-9) and Clinical Transaction Code (CTC)**

	No intervention performed	Intervention performed	<i>p</i>
Catheterization Procedures (n)	4898	1441	
Individual Patients (n)	3602	982	
Age (years)	2.7 (IQR: 0.6-10.7)	1.3 (IQR: 0.5-4.4)	<0.001
Age categories:			
<i>Neonate with prematurity</i>	0.3% (14)	0.5% (7)	<0.001
<i>Neonate without prematurity</i>	2.6% (126)	5.6% (81)	
<i>Infant (30 days to 1 year) with prematurity</i>	3.4% (168)	4.7% (68)	
<i>Infant (30 days to 1 year) without prematurity</i>	27.5% (1,345)	33.5% (482)	
1-8 years	35.3% (1,727)	38.3% (552)	
8-18 years	26.4% (1,295)	14.4% (208)	
>18 years	4.6% (223)	3.0% (43)	
Male sex % (n)	50.2% (2,460)	53.9% (776)	0.02
Race % (n)			
White	62.4% (3,054)	60.1% (866)	0.01
Black	14.9% (731)	12.9% (186)	
Asian	3.2% (156)	4.2% (60)	
Other	15.1% (740)	17.9% (258)	
Missing	4.4% (217)	4.9% (71)	
Payor % (n)			
Private	37.9% (1,854)	40.0% (576)	0.29
Medicaid	43.3% (2,122)	41.2% (594)	
Other	18.8% (922)	18.8% (271)	
Diagnosis % (n)			
IPAH	24.6% (1,205)	6.9% (99)	<0.001
APAH-CHD	62.8% (3,074)	89.0% (1,283)	
Cardiomyopathy with PH	7.0% (341)	1.3% (18)	
Chronic thromboembolic pulmonary hypertension	0.8% (37)	0.8% (12)	
PH with orthotopic heart transplant	4.9% (241)	2.0% (29)	
Genetic syndrome % (n)	18.6% (913)	14.8% (213)	0.001
Non-cardiac congenital anomaly	11.8% (580)	11.9% (172)	0.922
Mechanical ventilation prior to catheterization	16.0% (781)	17.8% (257)	0.09
Medications prior to catheterization			
Pulmonary vasodilator	19.0% (930)	14.9% (215)	<0.001
PDE-5 inhibitors	10.1% (494)	9.0% (130)	0.23
Calcium channel blockers	5.8% (286)	3.4% (49)	<0.001
Prostacyclin analogues	1.3% (64)	0.4% (6)	0.004
ETA antagonists	6.1% (298)	3.5% (51)	<0.001
Inhaled nitric oxide	0.1% (4)	0.1% (1)	0.88
Inotropic agents	11.8% (579)	16.5% (238)	<0.001
Systemic vasodilators	9.4% (458)	12.7% (183)	<0.001
Hemodialysis	0.2% (12)	0.2% (3)	0.80
Cardiothoracic operation prior to catheterization during the same hospitalization	4.1% (199)	8.7% (125)	<0.001
Outcomes % (n)			
Composite outcome within 1 day	3.6% (174)	3.3% (48)	0.69
Death within 1 day	0.3% (13)	0.3% (4)	0.94
ECMO within 1 day	3.3% (162)	3.1% (44)	0.63
Composite outcome on day of catheterization	0.9% (44)	1.2% (17)	0.34
Death on day of catheterization	0.1% (6)	0.2% (3)	0.45
ECMO on day of catheterization	0.8% (38)	1.0% (14)	0.47

**Supplementary Table 2: Study population and outcome stratified by performance of trans-catheter intervention**

	Odds Ratio	95% CI	p
Age			
<i>0 to 30 days with prematurity</i>	4.84	1.26-18.52	0.02
<i>0-30 days without prematurity</i>	1.67	0.86-3.24	0.13
<i>30 days to 1 year with prematurity</i>	1.01	0.45-2.23	0.99
<i>30 days to 1 year without prematurity</i>	1.62	1.14-2.30	0.006
<i>1-8 years</i>	1	n/a	n/a
<i>8-18 years</i>	0.46	0.27-0.76	0.003
<i>&gt;18 years</i>	0.50	0.18-1.42	0.19
Race			
<i>White</i>	1	n/a	n/a
<i>Black or African-American</i>	0.71	0.44-1.16	0.18
<i>Asian</i>	0.72	0.31-1.70	0.46
<i>Other</i>	0.87	0.57-1.33	0.52
<i>Missing</i>	1.67	0.97-2.85	0.06
Payor			
<i>Private insurance</i>	1	n/a	n/a
<i>Public insurance</i>	0.64	0.46-0.89	0.007
<i>Other</i>	0.82	0.54-1.26	0.36
Diagnosis			
<i>IPAH</i>	1	n/a	n/a
<i>PAH with congenital heart disease</i>	1.31	0.82-2.12	0.26
<i>PAH with cardiomyopathy</i>	1.59	0.78-3.26	0.20
<i>PAH with orthotopic heart transplant</i>	2.78	1.34-5.73	0.006
<i>PAH with chronic pulmonary embolism</i>	0.93	0.12-7.19	0.95
Genetic syndrome	0.94	0.65-1.35	0.74
Non-cardiac structural anomaly	1.06	0.71-1.58	0.78
Cardiac operation prior to catheterization	2.85	1.71-4.78	<0.001
Pre-procedural medical care			
<i>Mechanical ventilation</i>	0.81	0.55-1.20	0.29
<i>Hemodialysis</i>	20.83	5.93-73.15	<0.001
<i>Inotropic agents</i>	1.25	0.77-2.02	0.36
<i>Systemic vasodilators</i>	1.20	0.73-1.97	0.47
<i>PDE-5 inhibitors</i>	0.44	0.22-0.90	0.02
<i>ETA antagonists</i>	0.63	0.25-1.60	0.34
<i>Calcium channel blockers</i>	0.47	0.20-1.08	0.08
<i>*Prostacyclin analogues</i>	*	*	*
<i>*Inhaled nitric oxide</i>	*	*	*
Intervention during procedure	0.69	0.49-0.99	0.04

**Supplementary Table 3: Multivariate model of risk factors for combined outcome with pulmonary vasodilators separated by class.**

Adjusted risk is 3.2% (95% CI: 1.9-5.4%)

Akaike Information Criteria: 1799

\* No odds ratios were calculated for these covariates because no events occurred in these groups.

		Odds Ratio	95% CI	p
Diagnosis	<i>IPAH</i>	1	n/a	n/a
	<i>PAH with congenital heart disease</i>	1.32	0.82-2.12	0.26
	<i>PAH with cardiomyopathy</i>	1.53	0.74-3.12	0.25
	<i>PAH with orthotopic heart transplant</i>	2.62	1.28-5.36	0.008
	<i>PAH with chronic pulmonary embolism</i>	0.95	0.12-7.34	0.96
Age	<i>0 to 30 days with prematurity</i>	4.95	1.30-18.85	0.02
	<i>0-30 days without prematurity</i>	1.63	0.84-3.16	0.15
	<i>30 days to 1 year with prematurity</i>	0.99	0.45-2.20	0.99
	<i>30 days to 1 year without prematurity</i>	1.61	1.14-2.28	0.007
	<i>1-8 years</i>	1	n/a	n/a
	<i>8-18 years</i>	0.45	0.27-0.75	0.002
	<i>&gt;18 years</i>	0.49	0.17-1.38	0.18
Race	<i>White</i>	1	n/a	n/a
	<i>Black or African-American</i>	0.71	0.44-1.17	0.19
	<i>Asian</i>	0.75	0.32-1.76	0.51
	<i>Other</i>	0.86	0.56-1.31	0.48
	<i>Missing</i>	1.62	0.95-2.79	0.08
Payor	<i>Private insurance</i>	1	n/a	n/a
	<i>Public insurance</i>	0.63	0.45-0.88	0.006
	<i>Other</i>	0.81	0.53-1.24	0.32
Genetic syndrome		0.93	0.65-1.34	0.69
Non-cardiac structural anomaly		1.06	0.71-1.58	0.77
Cardiac operation prior to catheterization		2.57	1.54-4.29	<0.001
Pre-procedural medical care	<i>Mechanical ventilation</i>	0.79	0.54-1.17	0.24
	<i>Hemodialysis</i>	19.30	5.47-68.15	<0.001
	<i>Inotropic agents</i>	1.06	0.65-1.71	0.82
	<i>Systemic vasodilators</i>	1.85	1.18-2.91	0.007
	<i>Number of pulmonary hypertension medications</i>			
	<i>0</i>	1	n/a	n/a
	<i>1</i>	0.39	0.22-0.67	0.001
	<i>≥2</i>	0.35	0.10-1.15	0.08
Intervention during procedure		0.69	0.48-0.99	0.041

**Supplementary Table 4: Multivariate model of risk factors for combined outcome with pulmonary vasodilators counted as number of classes of medications**

(Adjusted risk is 3.2% (95% CI: 1.9%-5.4%))

Akaike information criteria: 1792

	Odds Ratio	95% CI	p	
Age				
	<i>0 to 30 days with prematurity</i>	5.36	1.12-25.66	0.04
	<i>0-30 days without prematurity</i>	2.03	0.93-4.43	0.08
	<i>30 days to 1 year with prematurity</i>	0.93	0.32-2.73	0.90
	<i>30 days to 1 year without prematurity</i>	2.25	1.46-3.46	<0.001
	<i>1-8 years</i>	1	n/a	n/a
	<i>8-18 years</i>	0.62	0.34-1.14	0.127
	<i>&gt;18 years</i>	0.78	0.26-2.34	0.66
Race				
	<i>White</i>	1	n/a	n/a
	<i>Black or African-American</i>	0.63	0.35-1.15	0.136
	<i>Asian</i>	0.76	0.27-2.13	0.61
	<i>Other</i>	0.96	0.59-1.56	0.87
	<i>Missing</i>	1.66	0.89-3.08	0.11
Payor				
	<i>Private insurance</i>	1	n/a	n/a
	<i>Public insurance</i>	0.51	0.35-0.75	<0.001
	<i>Other</i>	0.62	0.38-1.01	0.05
Diagnosis				
	<i>IPAH</i>	1	n/a	n/a
	<i>APAH-CHD</i>	1.18	0.70-2.00	0.54
	<i>PAH with cardiomyopathy</i>	1.18	0.52-2.66	0.69
	<i>PAH with orthotopic heart transplant</i>	1.41	0.44-4.54	0.57
	<i>Chronic thromboembolic pulmonary hypertension</i>	*	*	*
Genetic syndrome		0.73	0.47-1.14	0.16
Non-cardiac structural anomaly		0.83	0.49-1.38	0.46
Cardiac operation prior to catheterization		2.28	1.08-4.82	0.031
Pre-procedural medical care				
	<i>Mechanical ventilation</i>	0.80	0.51-1.28	0.36
	<i>Hemodialysis</i>	20.84	4.18-103.98	<0.001
	<i>Inotropic agents</i>	1.11	0.62-1.99	0.73
	<i>Systemic vasodilators</i>	1.93	1.10-3.42	0.02
	<i>Pulmonary vasodilators</i>	0.37	0.18-0.78	0.009
Intervention during procedure		0.59	0.37-0.94	0.03

**Supplementary Table 5: Multivariate model of risk factors for combined outcome restricted to first catheterization for each subject**

Adjusted risk of composite outcome is 4.0% (95% CI:2.3-7.1%).

Akaike information criteria: 1259

\* No odds ratio or confidence intervals are listed because no events occurred for subjects with chronic thromboembolic disease.

	Odds Ratio	95% CI	p	
Age				
	<i>0 to 30 days with prematurity</i>	7.08	1.86-27.00	0.004
	<i>0-30 days without prematurity</i>	1.95	0.87-4.38	0.11
	<i>30 days to 1 year with prematurity</i>	0.19	0.03-1.45	0.11
	<i>30 days to 1 year without prematurity</i>	0.98	0.58-1.66	0.95
	<i>1-8 years</i>	1	n/a	n/a
	<i>8-18 years</i>	0.47	0.26-0.88	0.02
	<i>&gt;18 years</i>	0.70	0.23-2.12	0.53
Race				
	<i>White</i>	1	n/a	n/a
	<i>Black or African-American</i>	0.92	0.51-1.66	0.78
	<i>Asian</i>	0.27	0.04-2.00	0.20
	<i>Other</i>	0.70	0.38-1.29	0.25
	<i>Missing</i>	1.39	0.64-3.03	0.41
Payor				
	<i>Private insurance</i>	1	n/a	n/a
	<i>Public insurance</i>	0.64	0.40-1.02	0.06
	<i>Other</i>	0.86	0.50-1.46	0.57
Diagnosis				
	<i>IPAH</i>	1	n/a	n/a
	<i>APAH-CHD</i>	0.59	0.33-1.02	0.06
	<i>PAH with cardiomyopathy</i>	1.56	0.74-3.31	0.24
	<i>PAH with orthotopic heart transplant</i>	2.43	1.12-5.29	0.03
	<i>Chronic thromboembolic pulmonary hypertension</i>	*	*	*
Genetic syndrome		0.77	0.44-1.38	0.39
Non-cardiac structural anomaly		1.09	0.61-1.95	0.76
Cardiac operation prior to catheterization		1.43	0.69-2.97	0.333
Pre-procedural medical care				
	<i>Mechanical ventilation</i>	1.67	1.01-2.76	0.05
	<i>Hemodialysis</i>	13.67	3.75-49.75	<0.001
	<i>Inotropic agents</i>	1.81	1.00-3.30	0.05
	<i>Systemic vasodilators</i>	1.58	0.87-2.88	0.14
	<i>Pulmonary vasodilators</i>	0.51	0.27-0.95	0.03
Intervention during procedure		0.96	0.58-1.58	0.88

**Supplementary Table 6: Multivariate model of risk factors for combined outcome excluding subjects with cardiac operation within 1 day of catheterization**

Adjusted risk: 2.6% (95% CI: 1.5-4.7%)

Akaike information criteria: 1009

\* No odds ratio or confidence intervals are listed because no events occurred for subjects with chronic thromboembolic disease

Center catheterization volume (by quintile)	Observed risk of death or ECMO within 1 day of procedure	<i>p</i>	Adjusted risk of death or ECMO within 1 day of procedure
1	6.2% (35/562)	<0.0001	6.2% (3.3-11.4%)
2	5.5% (40/688)		5.8% (3.3-10.5%)
3	3.5% (35/962)		3.7% (2.1-6.6%)
4	3.3% (48/1,410)		3.3% (1.8-5.8%)
5	2.5% (64/2,530)		2.7% (1.6-4.7%)

**Supplementary Table 7: Observed risk and adjusted risk for composite outcomes stratified by center catheterization lab volume**

		Odds Ratio	95% CI	p
Center catheterization volume (by quintile)				
	1	1.67	1.00-2.77	0.04
	2	1.56	0.98-2.59	0.06
	3	1	n/a	n/a
	4	0.88	0.55-1.41	0.59
	5	0.75	0.49-1.16	0.20
Age				
	<i>0 to 30 days with prematurity</i>	5.06	1.37-18.7	0.02
	<i>0-30 days without prematurity</i>	1.52	0.78-2.93	0.22
	<i>30 days to 1 year with prematurity</i>	0.98	0.45-2.14	0.96
	<i>30 days to 1 year without prematurity</i>	1.54	1.09-2.18	0.02
	<i>1-8 years</i>	1	n/a	n/a
	<i>8-18 years</i>	0.44	0.27-0.74	0.002
	<i>&gt;18 years</i>	0.47	0.17-1.35	0.16
Race				
	<i>White</i>	1	n/a	n/a
	<i>Black or African-American</i>	0.69	0.43-1.11	0.13
	<i>Asian</i>	0.79	0.34-1.83	0.58
	<i>Other</i>	0.87	0.57-1.31	0.50
	<i>Missing</i>	1.67	0.99-2.81	0.06
Payor				
	<i>Private insurance</i>	1	n/a	n/a
	<i>Public insurance</i>	0.56	0.41-0.78	<0.001
	<i>Other</i>	0.70	0.47-1.05	0.08
Diagnosis				
	<i>IPAH</i>	1	n/a	n/a
	<i>APAH-CHD</i>	1.32	0.82-2.12	0.25
	<i>PAH with cardiomyopathy</i>	1.48	0.72-3.02	0.28
	<i>PAH with orthotopic heart transplant</i>	2.77	1.36-5.62	0.005
	<i>Chronic thromboembolic pulmonary hypertension</i>	0.96	0.13-7.41	0.97
	<i>Genetic syndrome</i>	0.92	0.64-1.32	0.66
	<i>Non-cardiac structural anomaly</i>	1.12	0.76-1.67	0.55
	<i>Cardiac operation prior to catheterization</i>	2.52	1.52-4.19	<0.001
Pre-procedural medical care				
	<i>Mechanical ventilation</i>	0.78	0.54-1.15	0.21
	<i>Hemodialysis</i>	15.97	4.65-54.79	<0.001
	<i>Inotropic agents</i>	1.06	0.66-1.72	0.35
	<i>Systemic vasodilators</i>	2.11	1.36-3.27	0.001
	<i>Pulmonary vasodilators</i>	0.39	0.23-0.66	0.001
Intervention during procedure				
		0.73	0.51-1.03	0.07

**Supplementary Table 8: Multivariate model of risk factors for combined outcome including center catheterization volume**

Adjusted risk: 3.7% (95% CI: 2.1-6.6%)

Akaike Information Criteria: 1791