



ECMO utilization in infants with congenital diaphragmatic hernia in the United States

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Background

- Congenital diaphragmatic hernia (CDH) is a cause of significant neonatal morbidity.
- CDH is the most common neonatal diagnosis requiring extracorporeal membrane oxygenation (ECMO).
- At the same time CDH has the lowest survival rate in comparison with other conditions requiring neonatal ECMO.

Hypothesis

We hypothesized that the demographic and clinical characteristics of neonates with CDH differ between those needing ECMO and those not needing it.

Aims

- Determine the characteristics of ECMO use in neonates with CDH among different Census regions of the United States and over time
- Determine the risk factors for patients with CDH needing ECMO

Methods

- Healthcare Cost and Utilization Project (HCUP) Kids' Inpatient Database (KID), 2006-2016.
- Demographic:** birth weight, gender, race/ethnicity, insurance type, and mortality
- Hospital characteristics:** hospital region, location/teaching status, and bed size.
- Statistical methods**
 - Chi-square tests to determine associations between the ECMO-treated and non-ECMO treated infants with CDH on demographic and clinical characteristics.
 - T-test for cost of hospitalization analysis
 - Multivariate logistic regression analyses to identify factors associated with ECMO.

Figure 1. Flowchart of the study population

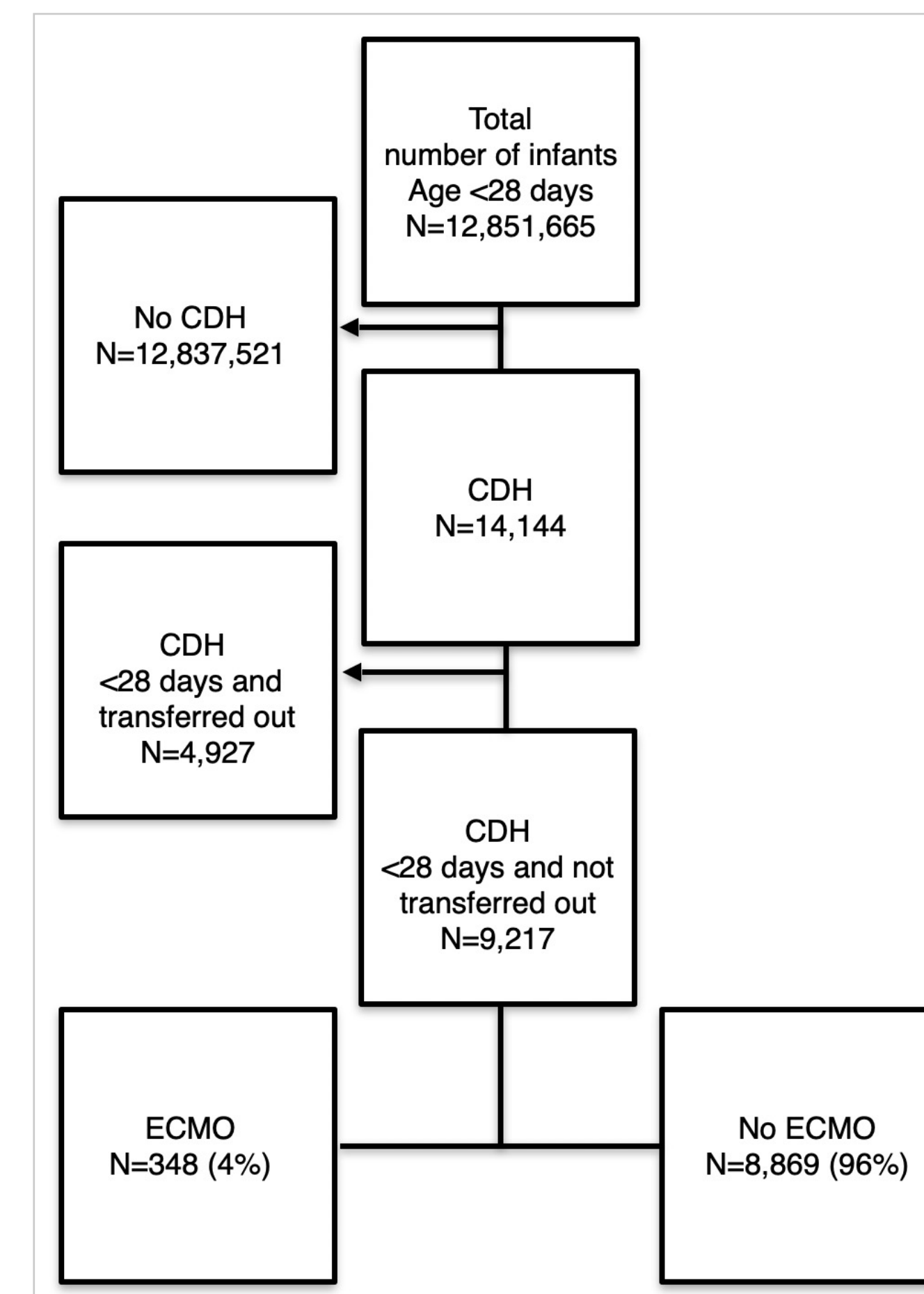


Table 1. Characteristics of study infants

	Total (n=9,217) n (%)	No ECMO (n=8,869) n (%)	ECMO (n=348) n (%)	p-Value
Infant demographics				
Gender				
Male	5,260 (57.1)	5,064 (57.2)	196 (56.3)	0.752
Female	3,945 (42.9)	3,793 (42.8)	152 (43.7)	
Race/ethnicity				
White	4,079 (51.1)	3,920 (51.0)	159 (54.5)	0.002
Black	894 (11.2)	853 (11.1)	41 (14.0)	
Hispanic	2,093 (26.2)	2,043 (26.6)	50 (17.1)	
Other	914 (11.5)	872 (11.3)	42 (14.4)	
In-hospital birth				
No	7,976 (86.5)	7,749 (87.4)	227 (65.2)	<0.001
Yes	1,241 (13.5)	1,120 (12.6)	121 (34.8)	
Hospital bed size				
Large	5,958 (65.9)	5,751 (66.0)	207 (62.7)	0.219
Small to medium	3,086 (34.1)	2,963 (34.0)	123 (37.3)	
Hospital location/teaching status				
Urban teaching	8,154 (90.2)	7,827 (89.8)	327 (99.1)	<0.001
Rural/urban non-teaching	890 (9.8)	887 (10.2)	3 (0.9)	
Region				
Northeast	1,275 (13.8)	1,220 (13.8)	55 (15.8)	<0.001
Midwest	2,405 (26.1)	2,322 (26.2)	83 (23.9)	
South	2,715 (29.5)	2,581 (29.1)	134 (38.5)	
West	2,822 (30.6)	2,746 (31.0)	76 (21.8)	
Insurance				
Government issued	4,816 (52.3)	4,654 (52.5)	162 (46.6)	0.011
Private insurance	3,571 (38.8)	3,419 (38.6)	152 (43.7)	
Self-pay	219 (2.4)	216 (2.4)	3 (0.9)	
Other	602 (6.5)	571 (6.4)	31 (8.9)	
Clinical characteristics				
Pneumothorax	87 (0.9)	76 (0.9)	11 (3.2)	<0.001
Survival				
Survived	8,743 (94.9)	8,548 (96.4)	195 (56.4)	<0.001
Died	470 (5.1)	319 (3.6)	151 (43.6)	

Figure 2. Percent of ECMO use for CDH decreased from 2006 to 2016

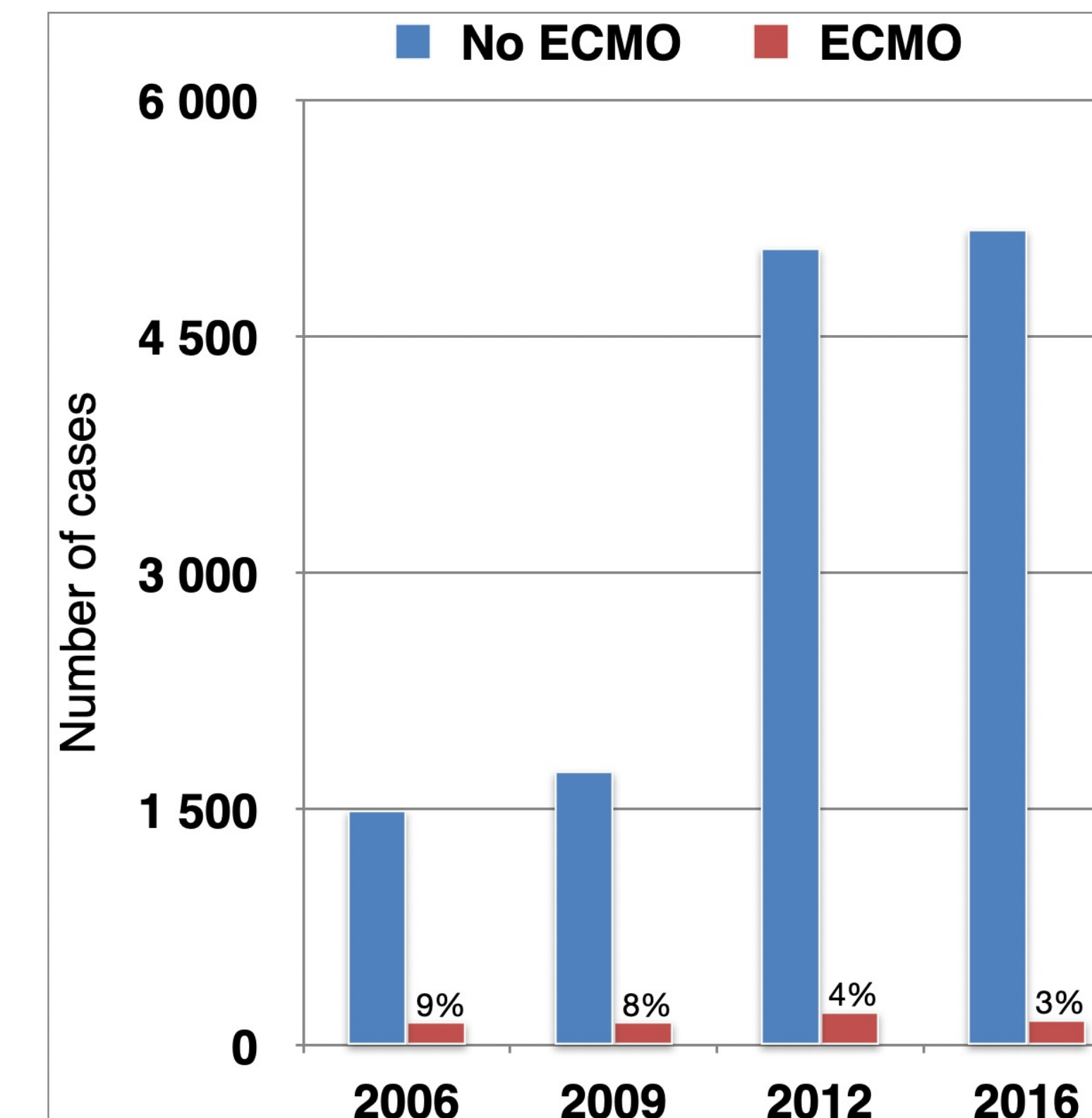


Figure 3. Proportion of ECMO use for CDH By US census region (2006-2016)

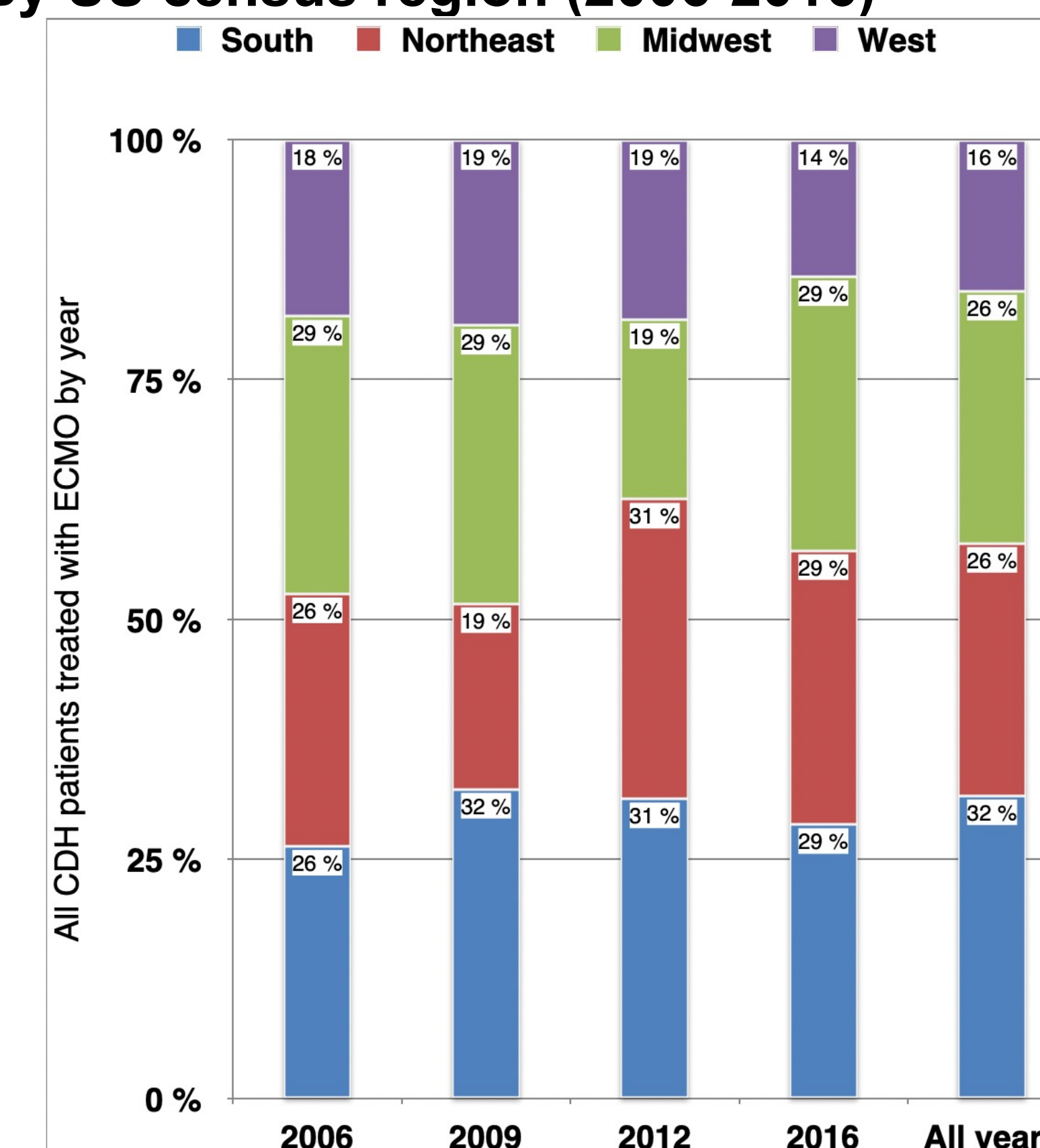
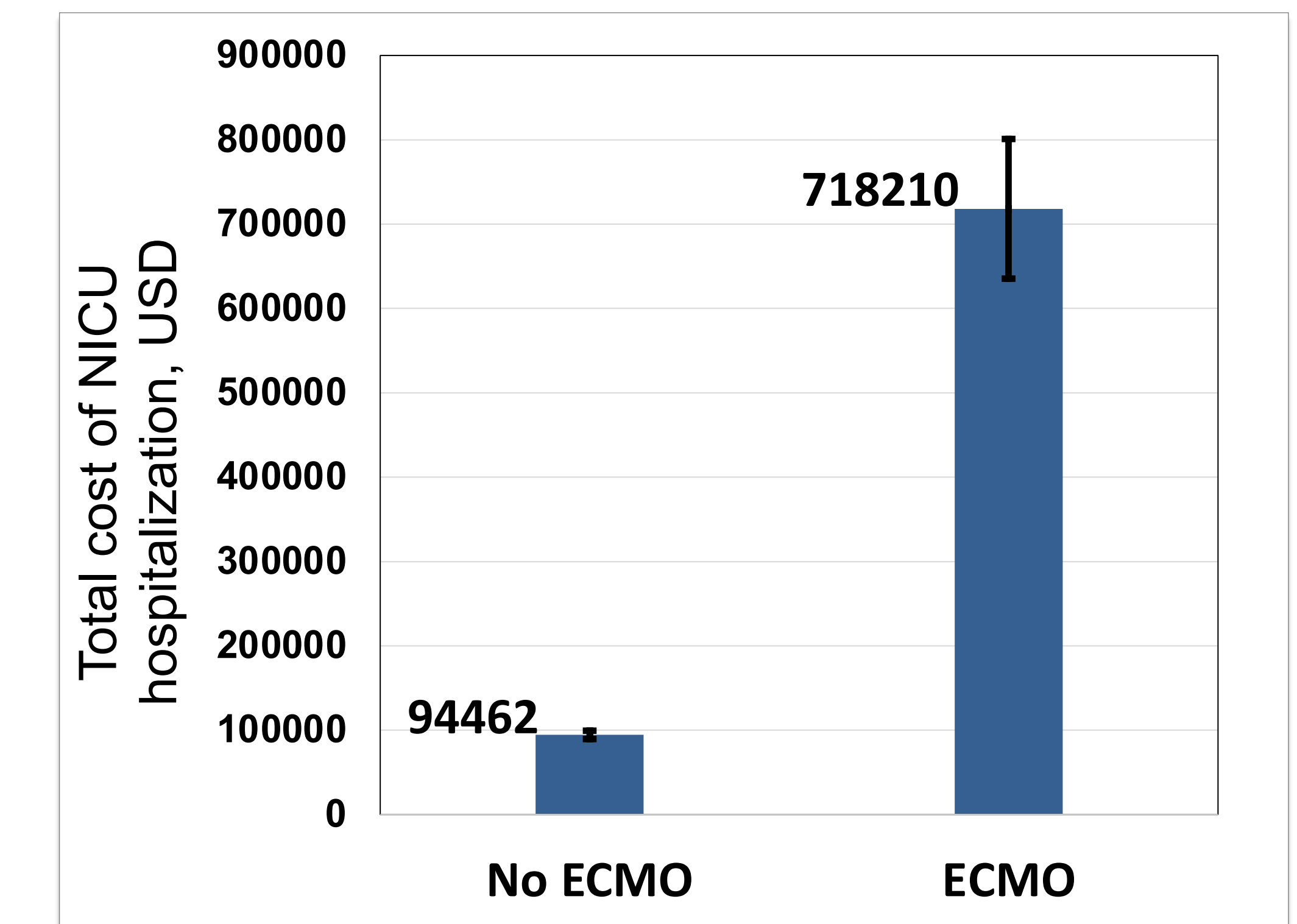


Table 2. Risk factors for ECMO use among CDH infants (multivariate analysis)

	ECMO use, OR (95% CI)	p-Value
Female vs male	0.8 (0.7–1.0)	0.081
Race/ethnicity		
Black vs white	1.1 (0.8–1.5)	0.408
Hispanic vs white	0.6 (0.5–0.8)	0.001
Born in-hospital vs not	1.6 (1.3–2.0)	<0.001
Insurance		
Private vs government-issued	1.2 (1.0–1.5)	0.038
Self-pay vs government-issued	0.3 (0.1–0.7)	0.007
Pneumothorax		
Pneumothorax	4.2 (2.3–7.5)	<0.001
Death vs survivor	13.9 (11.2–17.2)	<0.001

Figure 4. Hospitalization cost of CDH patients is higher with ECMO use



Results

- Most infants with CDH were cared for in the Western or Southern regions of the US in this cohort.
- The proportion of CDH infants treated with ECMO was higher in the South in this cohort.
- The proportion of CDH infants treated with ECMO was higher in White infants, and lower in Hispanics in this cohort.
- The average cost of hospitalization was higher with ECMO use (\$94,462 in non-ECMO versus \$718,210 in ECMO, $p < 0.0001$).
- ECMO patients were more likely to be treated in their birth hospital ($p < 0.001$), at an urban location ($p < 0.001$) and were more likely to have private insurance ($p = 0.011$).
- After adjusting for confounders, odds of ECMO treatment remained statistically lower in Hispanic infants or self-payers.
- Odds of ECMO were higher in infants with pneumothorax ($p = 0.001$).

Limitations

- The retrospective nature of the study
- The KID database is comprised of ICD data, which is subject to variability of coding practices and coding errors
- Potential disagreement between coding that is used primarily for billing, and pertinent clinical information.

References

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