

Utilizing a machine learning approach to identify risk factors associated with infantile epileptic spasms syndrome (IESS) treatment response

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BACKGROUND

- Infantile spasms is a rare epileptic disorder affecting young children that carries a severe prognosis
- Early identification and treatment of spasms is critical to improving prognosis
- Clinical models utilizing regression methods have done poorly in identifying children at risk of treatment failure
- Machine learning methods provide a novel approach to identifying risk factors

METHODS

- Retrospective cohort study of children with new onset IESS between the ages of 2 months and 2 years, obtained from the NISC database (2012-2018)
- Imputed missing data using MICE
- Compared supervised machine learning models to stepwise logistic regression

RESULTS

- 272 of 455 (60%) 2-week cessation
- Stepwise logistic regression AUROC 0.601 (0.584-0.618)
- SVM AUROC 0.557 (0.540-0.574)
- Random forest AUROC 0.615 (0.598-0.632)

DISCUSSION

- All models had incomplete classification of two-week outcomes, other variables need to be considered (qEEG, inflammatory biomarkers)
- All models good sensitivity, poor specificities
- The random forest model performed the best in predicting two-week IESS outcomes
- Future directions include an online risk calculator to assist with classification

Random forest and gradient boosted models were best at classification of children with IESS responding to therapy at two weeks

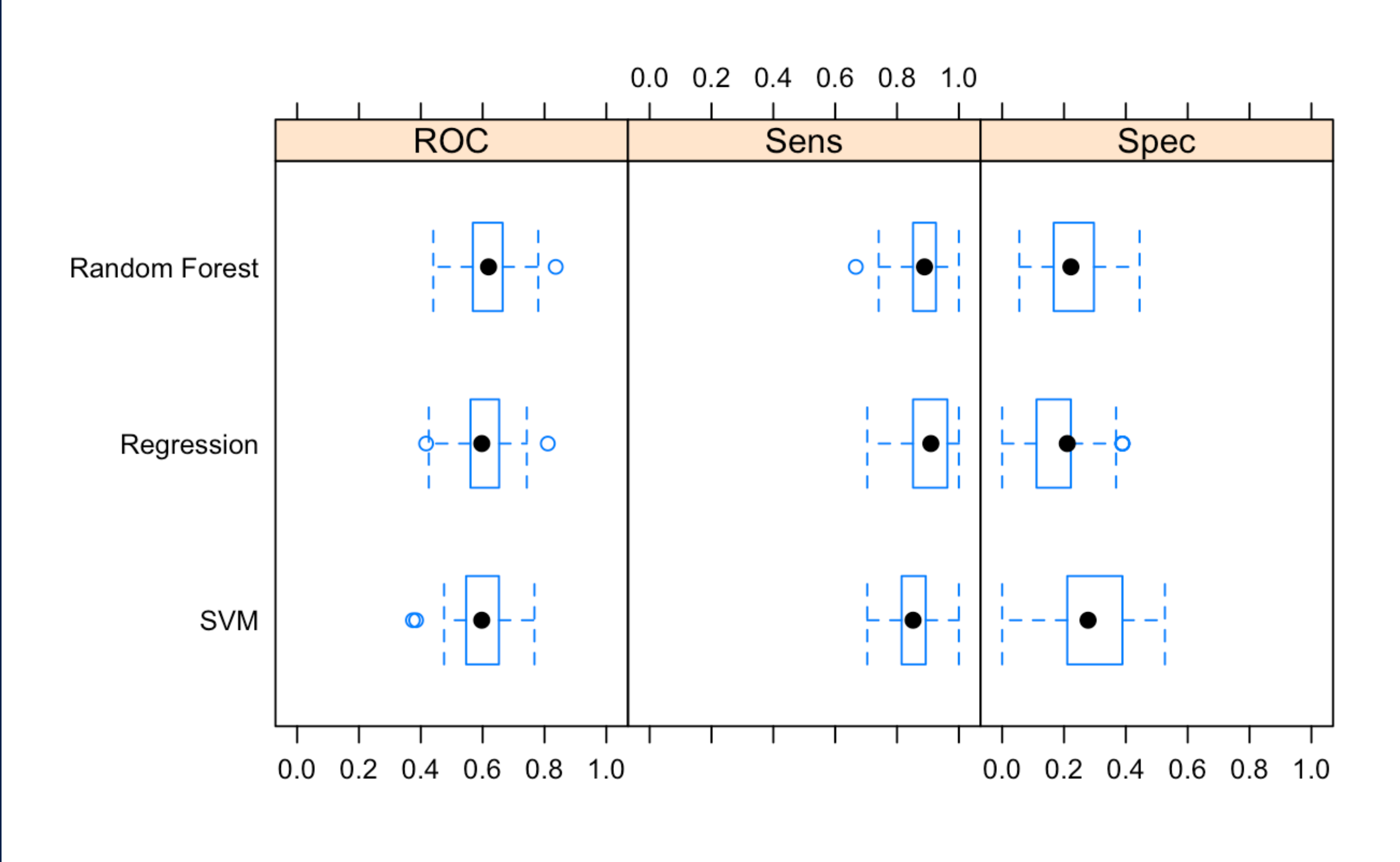
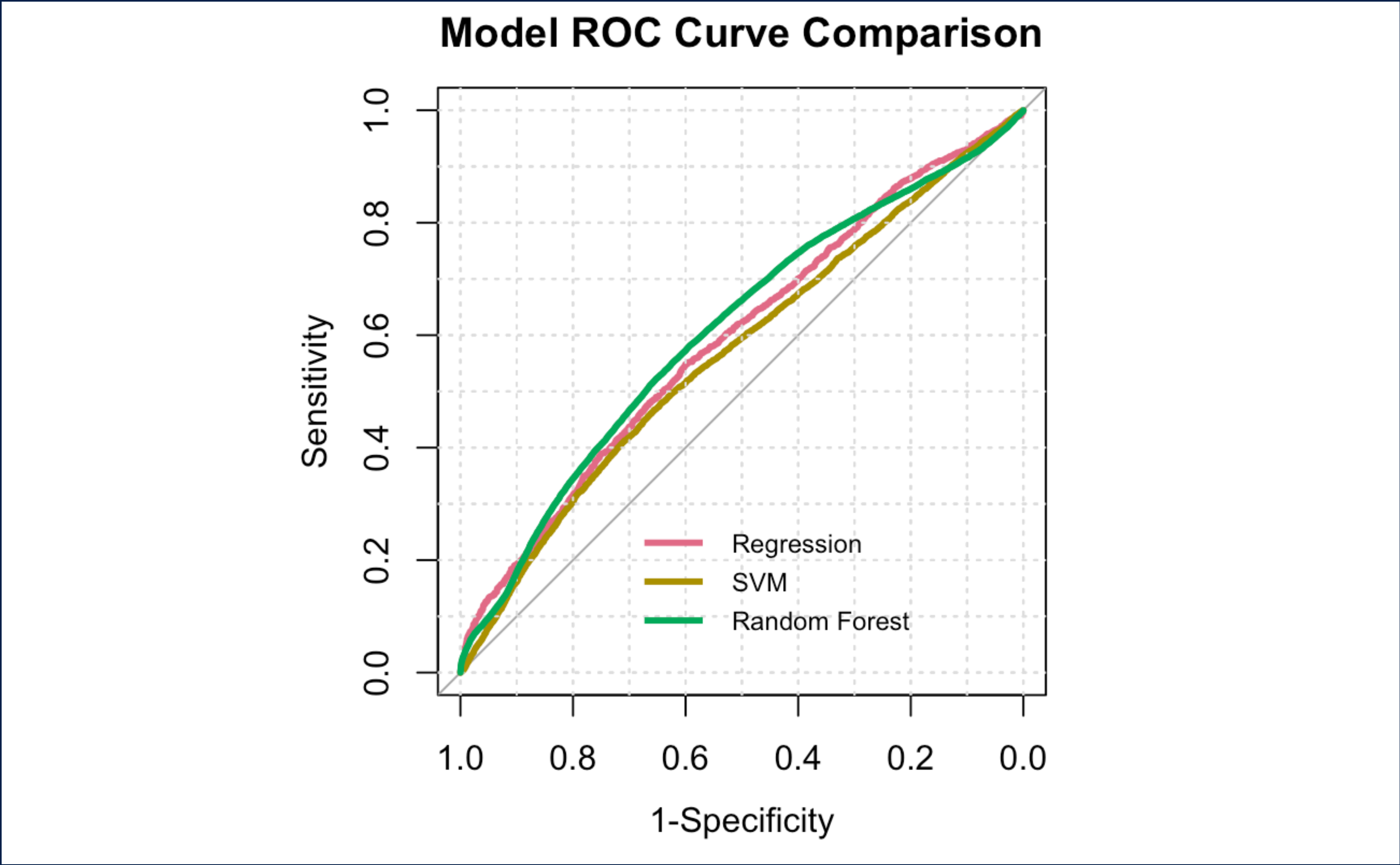


Table 1	Treatment failure (183)	Treatment response (272)
Male (%)	102 (55.74)	154 (56.62)
Hispanic or Latino (%)	27 (16.88)	45 (18.91)
Race (%)		
AI, NA, Alaskan Native	0 (0.00)	0 (0.00)
Asian	5 (2.86)	19 (7.57)
Black	26 (14.86)	20 (7.97)
Native Hawaiian/PI	1 (0.57)	1 (0.40)
White or Caucasian	123 (70.29)	182 (72.51)
Other	20 (11.43)	29 (11.55)
Insurance (%)		
Public	82 (47.95)	112 (45.90)
Private	85 (49.71)	124 (50.82)
Self-pay	0 (0.00)	3 (1.23)
Uninsured	0 (0.00)	1 (0.41)
Other	4 (2.34)	4 (1.64)
Distance to treatment center (%)		
Same city	41 (22.40)	72 (26.47)
Outside of city – within 100 miles	105 (57.38)	151 (55.51)
Outside of city – more than 100 miles away	33 (18.03)	41 (15.07)
More than 500 miles away	4 (2.19)	8 (2.94)
Gestational age (median [IQR])	39.00 [37.00, 40.00]	39.00 [37.00, 40.00]
Lag time to treatment start (median [IQR])	16.00 [6.00, 43.75]	15.00 [5.00, 32.00]
Weeks from treatment start to last spasm (median [IQR])	10.70 [6.25, 14.75]	1.00 [0.40, 4.80]
Age of spasm onset (mo) (mean (SD))	6.80 (3.86)	6.22 (4.02)
Pre- or perinatal complications (%)	85 (46.45)	104 (38.95)
Prior provoked seizures (%)	40 (21.86)	41 (15.07)
Abnormal overall baseline imaging (%)	69 (56.56)	112 (58.64)
Prior genetic testing (%)	87 (62.59)	87 (50.58)
Developmental delay (%)	153 (83.61)	208 (76.75)
History of AED use (%)	61 (33.33)	63 (23.16)
Etiology of spasms (%)		
MCD/Structural	30 (16.48)	37 (13.65)
Genetic	35 (19.23)	57 (21.03)
Prior injury	48 (26.37)	68 (25.09)
Impaired	45 (24.73)	66 (24.35)
Idiopathic	24 (13.19)	43 (15.87)
First therapeutic tried for spasms (%)		
ACTH	68 (37.16)	144 (52.94)
Steroids	34 (18.58)	61 (22.43)
VGB	28 (15.30)	30 (11.03)
Other	53 (28.96)	37 (13.60)
Second therapeutic tried for spasms (%)		
ACTH	32 (19.39)	34 (20.99)
Steroids	27 (16.36)	27 (16.67)
VGB	46 (27.88)	35 (21.60)
Other	60 (36.36)	66 (40.74)
Drug 1 Adequate Dose (%)	105 (84.00)	187 (80.95)
Drug 2 Adequate Dose (%)	87 (83.65)	69 (74.19)
Baseline hypsarrhythmia (%)		
Normal/not hypsarrhythmia	25 (14.97)	37 (14.45)
Modified/Hypsarrhythmia	142 (85.03)	219 (85.55)
Baseline EEG voltage >=200uV (%)	124 (83.78)	190 (84.07)

