Early use of gene panel testing may reduce overall diagnostic healthcare utilization for patients with seizure onset between 2 and <5 years of age

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Background

- Epilepsy is a highly prevalent neurologic disorder, affecting 5–8 individuals per 1000 with a lifetime risk of up to 3%[1]
- Developments in genetic technology have accelerated discovery of new genes associated with epilepsy, and over 30% of epilepsy cases are now known to be attributable to genetic variants[1,2]
- Gene panels can rapidly determine the genetic etiology of both benign and progressive forms of epilepsy in parallel, aiding in the timely implementation of appropriate and personalized management strategies[1–5]
- At present, however, gene panels are not used consistently early in the diagnostic process. This is in part due to inconsistent medical guidelines and insurance policies, and concerns around variant interpretation[6,7]
- The aim of this analysis was to assess the cost-effectiveness of early genetic testing for epilepsy (within 1 year of first unprovoked seizure) compared with later testing

Methods

- The analysis used deidentified electronic health record (EHR) data (Komodo Health) linked with epilepsy gene panel results (Invitae/LabCorp), including data from a sponsored epilepsy genetic testing program (Behind the Seizure™)
- Individuals with a first documented seizure between the ages of 24 and <60 months who were tested (at no cost to the patient) with the Invitae Epilepsy Gene Panel and who had ≥3 years of available EHR data after the date of first documented seizure were eligible for inclusion
- All eligible tests through the program from April 1, 2016 to September 4, 2023 were included
- Healthcare utilization related to diagnostic investigations was assessed over the 3 years following first documented seizure and were compared for those who received genetic testing within 12 months of the first documented seizure (early tested) with those tested >12 months after first documented seizure (late tested)
- Current Procedural Terminology codes were used to assess healthcare utilization in the following categories: outpatient visits, emergency room (ER) visits, magnetic resonance imaging (MRI), electroencephalogram (EEG), and number of molecular tests prior to gene panel testing
- Results were compared between groups using the Mann–Whitney U test

Results

Patients

- Overall, 626 early-tested and 897 late-tested individuals were included in the analysis (**Table 1**)
- Just under half of patients were female, and mean age at the time of first documented seizure was approximately 47 months
- Mean time from first diagnosed seizure to epilepsy panel testing was 4.3 months in the early-tested group and 39.3 months in the late-tested group

Healthcare utilization

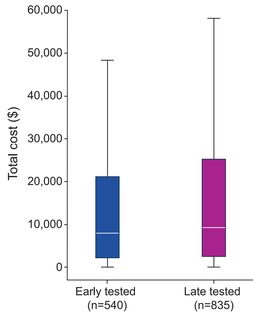
- Over the 3-year follow-up period, mean (SD) overall healthcare utilization costs were significantly lower for the early-tested group compared with the late-tested group ($31,578 [$217,143] vs $88,811 [$507,472])
  - Median healthcare utilization-associated costs were $8011 in the early tested group and $9407 in the late-tested group (*P*=0.03; **Figure 1**)
- **Figure 2** shows diagnostic healthcare utilization over the 3-year follow-up period
  - Use of MRI was higher in the early-tested vs late-tested group (1.98 vs 1.77 events; *P*=0.04)
  - The mean number of ER and outpatient visits was significantly higher for late-tested patients compared with early-tested patients (6.84 vs 4.87 [*P*<0.001] and 17.79 vs 14.47 [*P*<0.001], respectively)
  - The late-tested group underwent a significantly higher number of molecular tests prior to gene panel testing, with a mean (SD) count of 2.14 (3.67) compared with 1.19 (2.79) in the early-tested group (*P*<0.001)

Table 1. Baseline demographics and characteristics

	Early tested N=626	Late tested N=897
Sex, n (%)		
Female	235 (38)	416 (46)
Male	391 (62)	481 (54)
Age at first documented seizure, months		
Mean (SD)	47.8 (12.3)	46.7 (11.7)
Median (range)	47.1 (24.4–73.9)	46.7 (24.4–73.7)
Time from first documented seizure to gene panel test, months		
Mean (SD)	4.3 (3.5)	39.3 (19.2)
Median (range)	3.3 (0.1–12.1)	35.7 (12.4–99.3)
Result of gene panel test, n (%)		
Positive	42 (7)	131 (13)
Negative	154 (25)	189 (21)
Other	430 (69)	577 (64)

SD, standard deviation

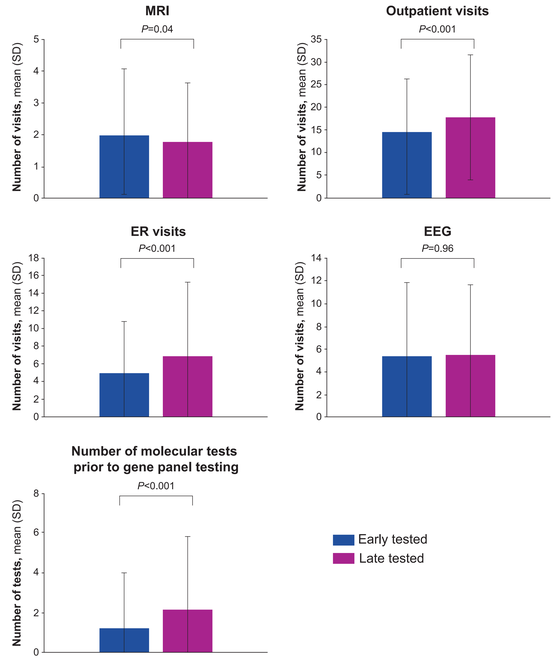
Figure 1. Overall healthcare utilization-associated costs in early- and late-tested patients through 3 years



Cost	Early tested (n=540)	Late tested (n=835)
Mean (SD)	$31,578 ($217,143)	$88,811 ($507,472)
Median	$8011	$9407
Min	$22	$29
IQR	$2373–$21,054	$2826–$25,034
Max	$4,886,117	$8,589,111
P-value[a]	0.03	

[a]Mann–Whitney U test. Graph shows median, IQR, and range (outliers removed).
IQR, interquartile range; SD, standard deviation

Figure 2. Healthcare utilization within the first 3 years after first documented seizure



EEG, electroencephalogram; ER, emergency room; MRI, magnetic resonance imaging; SD, standard deviation

Conclusions

- Early, broad gene panel testing for epilepsy may reduce healthcare utilization and costs associated with diagnostic investigations, while providing crucial information to guide management
- Delayed genetic testing was associated with additional molecular tests prior to gene panel testing, suggesting that early gene panel testing may streamline the diagnostic process in pediatric epilepsy
- These findings highlight the potential benefits of incorporating gene panel testing earlier in diagnostic protocols for pediatric epilepsy (eg, in medical guidelines or insurance policies)

References

1. Rastin C, et al. *Int J Mol Sci* 2023;24:14606.
2. Wang J, et al. *Seizure* 2017;44:11–20.
3. Karlin A, et al. *Curr Probl Pediatr Adolesc Health Care* 2024;54:101579.
4. Habela CW, et al. *Epilepsy Currents* 2025;25:153–7.
5. Oates S, et al. *NPJ Genom Med* 2018;3:13.
6. Fazenbaker AC, et al. *J Genet Couns* 2024;33:352–60.
7. Smith L, et al. *J Genetic Couns* 2023;32:266–80.

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Disclosures

MB, AV, and AH are employees of, and may own stocks/shares in, BioMarin Pharmaceutical Inc; JG is an employee of Labcorp (formerly Invitae Corporation).

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