

Differential Contributions of Performance-Based & Parental Reports of Executive Functioning on Memory in Pediatric Focal & Generalized Epilepsies

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Introduction:

- Children with epilepsy often exhibit neuropsychological impairment across multiple domains including attention, memory, and/or executive functioning (EF).
- Focal and generalized epilepsies are best conceptualized as disorders of brain networks, which partially explain differences in neuropsychological strengths and weaknesses within and between syndromes.
- While the neural substrates responsible for EF largely differ from those responsible for memory, cognitive processes do not function in isolation.
- Consistent with this, research has shown that EF impacts memory in pediatric focal epilepsy.
- The purpose of this study was to broaden the study of EF-memory relationships in children with generalized epilepsies.
- We examined how much memory scores were accounted for by EF in children with either genetic generalized epilepsy (GGE) or localization-related epilepsy (LRE).
- Given the complexity of measuring EF, we investigated the independent contributions to memory of patients' performances on EF measures and parental reports of their child's EF.
- We hypothesized that parental report of EF would play a significant role toward explaining patients' memory scores in both epilepsy groups when compared to the performance-based EF measures, because parental EF reports are much broader than the specific performance-based EF measures examined in this study.

Methods:

Participants:

- 174 children diagnosed with epilepsy were retrospectively examined from a clinical database of patients referred for neuropsychological evaluations between 2012 and 2018.
- 88 children with LRE
- 86 children with GGE
- Patients with an IQ score < 70 were excluded.
- Patients who did not pass performance validity testing also were excluded.

Measures:

- All patients were administered a comprehensive neuropsychological test battery, but only select scores from EF and memory measures were analyzed. (Table 1)

Table 1- Scores Included In Analyses

Domain	Measure	Ability Assessed
Performance Based EF	Delis-Kaplan Executive Function System (D-KEFS) Trail Making Test (TMT) Letter-Number Switching (LNS)	Cognitive Flexibility & Working Memory
	D-KEFS Verbal Fluency (VF) Category Switching Accuracy (CSA)	Cognitive Flexibility, Working Memory, Rapid Retrieval
	D-KEFS Color Word Interference Inhibition (CWI)	Impulse Control
Parental Reports of EF	Behavior Rating Inventory of Executive Functions (BRIEF or BRIEF-2) Global Executive Composite (GEC)	Parental View of Overall EF
	Conners 3 Parent Report Executive Functioning Score	Another Measure of Parental View of General EF
Verbal Memory	Rey Auditory Verbal Learning Test (RAVLT) Delayed Recall (DR)	Rote Memorization: Recall of A List of 15 Unrelated Words
	Wide Range Assessment of Memory & Learning-2nd Edition (WRAML-2) Story Memory DR	Recall of Contextual Information
Visual Memory	Brief Visuospatial Memory Test-Revised (BVRT-R) DR	Recall of Visual Information

Statistics:

- Independent samples t-tests were used to compare groups by age, mean parent education, and IQ.
- Chi-square tests were used to compare sex, race, and hand dominance.
- Multiple linear regression analyses were used to examine the independent contributions of each performance-based EF measures and parental reports of EF to each of the memory recall scores separately for children with LRE or GGE.
- Performance-based EF measures were entered first into each model and the parental reports of EF were entered in a second block to determine their additional contribution of EF to memory.

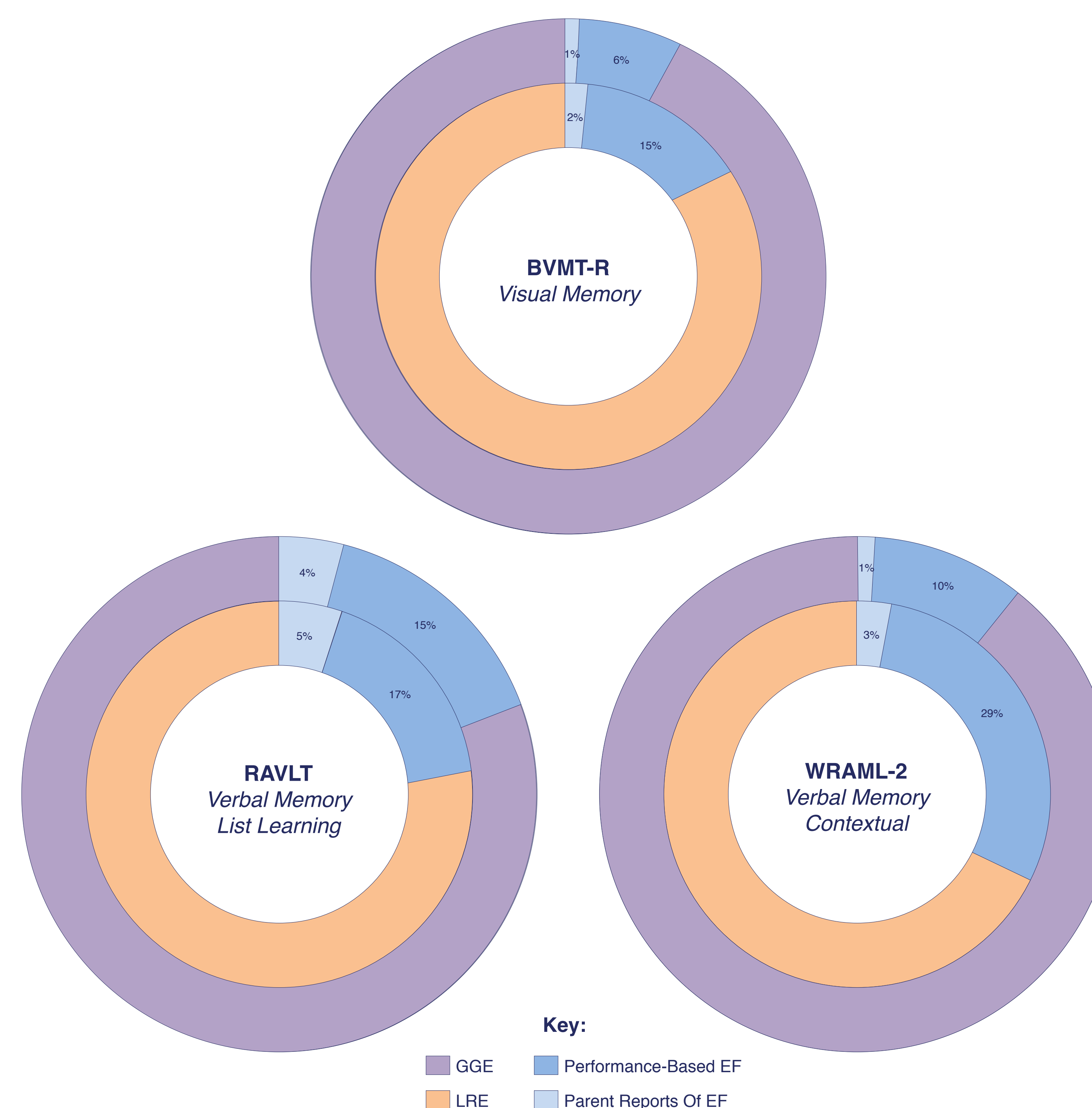
Results:

- The two groups did not statistically differ with regard to sociodemographics or IQ ($p > 0.05$). Effect sizes were small for all comparisons. (Table 2)

Table 2- Sociodemographics & Effect Sizes

	LRE (n= 88)	GGE (n= 86)	Effect Size
Age (Years)	12.04 ± 3.24	12.54 ± 3.07	$d = 0.16$
Sex (% Males)	55.81%	50.00%	$V = 0.06$
Handedness (% Right Hand Dominant)	82.75%	82.35%	$V = 0.05$
Race (% Caucasian)	76.13%	79.06%	$V = 0.15$
Mean Parent Education (Years)	13.36 ± 2.15	13.43 ± 1.81	$d = 0.04$
Overall IQ (Standard Score)	83.10 ± 17.11	85.09 ± 11.92	$d = 0.13$

Figure 1- R² Change Value Comparisons Between GGE & LRE Groups



- The LRE group performed worse on the TMT-LNS when compared to the GGE group ($p = .03$).
- Parents endorsed greater overall executive dysfunction on the BRIEF GEC ($p = .04$) and Conners ($p = .03$) in the GGE group than in the LRE group.
- Figure 1 visually demonstrates how much performance-based measures of EF explained memory scores in each group, as well as the additional contribution of parental reports of EF to memory scores.
- Performance-based EF measures better explained BVMT-R (visual memory) and WRAML-2 (story memory) scores in the LRE group than the GGE group.
- RAVLT (list learning) performance was comparably explained by the performance-based EF measures in both groups (15-17%).
- Parental EF reports minimally explained any memory performances in either group.

Big Picture Summary of Results:

Overall, performance-based EF measures better explained memory performance in the LRE group (15-29%) compared to the GGE group (6-15%). Parent reports of EF minimally explained memory performance in both groups (<5%).

Conclusions:

- Contrary to our hypothesis, parental EF reports only negligibly explained memory performance in either group. Potential explanations for this include:
 - Self-reported cognitive deficits do not correlate well with actual performance on objective measures of EF.
 - Parent reports of global EF may simply be too broad to capture the components influencing memory.
- While the two groups differed on one performance-based EF and two parent reports of EF, it is unlikely that these differences explain the varying contribution of EF to memory in each group.
- It is possible that EF better explained memory in the LRE group because of the composition of the specific seizure foci in our sample, whereas patients with GGE do not necessarily have disproportionately affected cognition in specific domains.
- Clinical implications for these findings include:
 - helping predict post-surgical outcomes, particularly when executive circuits are impacted by neurosurgery,
 - assisting in the interpretation of neuropsychological test scores by being cognizant that memory deficits in pediatric epilepsy can be at least partially explained by EF deficits,
 - and assisting in identifying the nature of effective interventions for differing pediatric epilepsy syndromes with similar neuropsychological profiles. For example,
 - EF-focused treatment in children with LRE who experience memory deficits may be more helpful than memory strategies alone.
 - Memory strategies may be more helpful in those with GGE.
- Future research is needed to:
 - Further understand the interaction between EF and memory neural substrates in each LRE and GGE,
 - Identify which specific aspects of EF most strongly contribute to different types of memory,
 - and develop patient-specific interventions based on epilepsy syndrome and neuropsychological status.



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