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► **To cite this version:**

Hugo Câmara-Costa. Executive functioning and attention seven years after severe childhood traumatic brain injury: results of the TGE cohort. 31st European Academy of Childhood Disability Conference, May 2019, Paris, France. inserm-03908645

HAL Id: inserm-03908645

<https://inserm.hal.science/inserm-03908645>

Submitted on 20 Dec 2022

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Executive functioning and attention seven years after severe childhood traumatic brain injury: results of the TGE cohort



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Introduction

Severe childhood traumatic brain injury (TBI) leads to severe and long-standing executive functions (EF) deficits, with negative consequences on participation, academic outcome and later independence and integration in the workforce.

Aims:

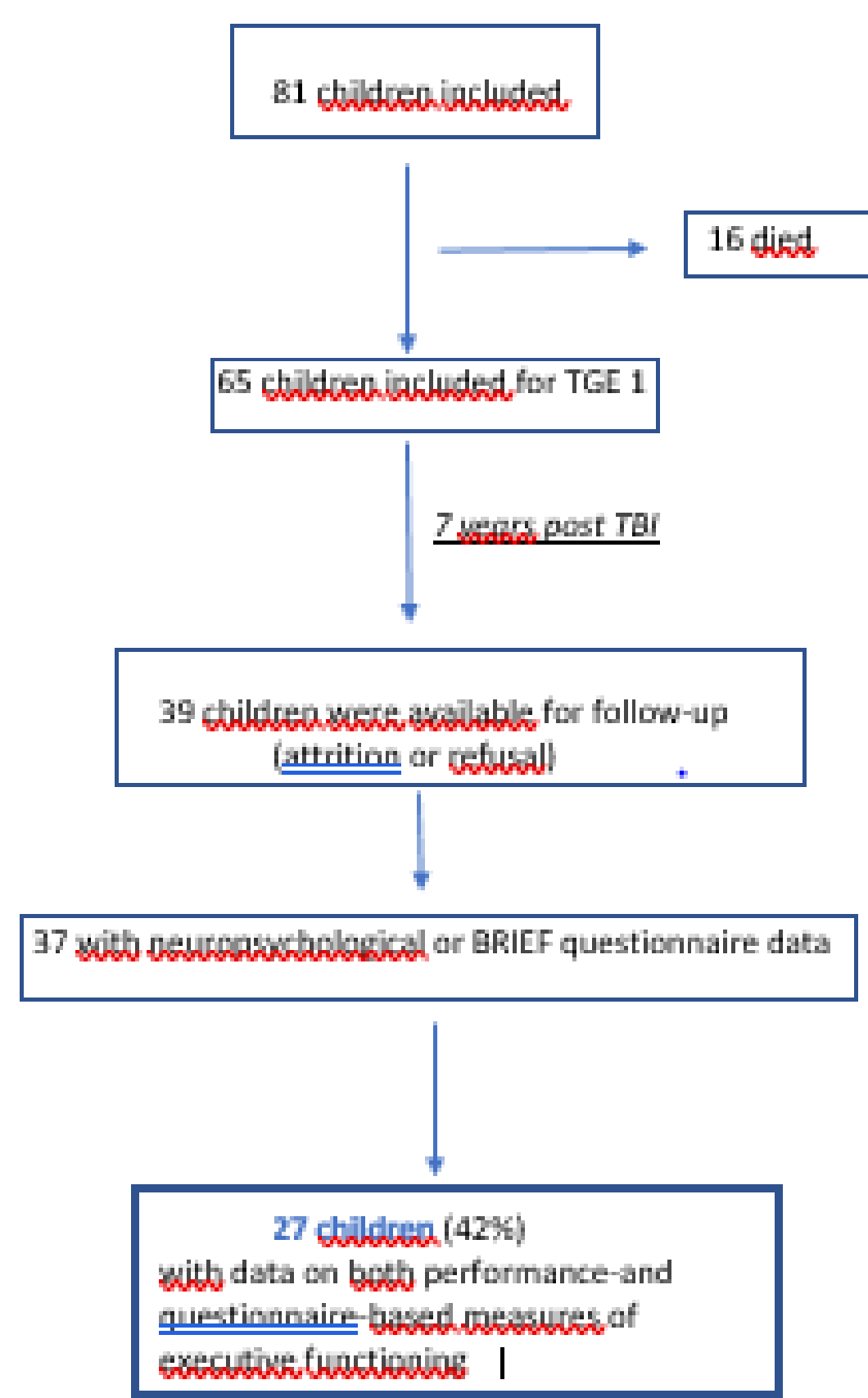
- To study executive functioning and attention seven years following severe childhood TBI in the prospective longitudinal TGE cohort study, in comparison with a closely matched uninjured control group, using a combination of standardized tests, and a more ecological evaluation of EF deficits in everyday life
- To assess demographic, medical/TBI severity factors, and other post-TBI outcomes associated with both standardized tests and questionnaire assessments of EF.

Methods

- Prospective longitudinal study**
- Population**
 - TBI group:** Children (0 – 15 years) consecutively admitted in a single trauma center for severe non-inflicted TBI (Glasgow Coma Scale ≤ 8 and/or Injury Severity Score >16) over a 3-year period
 - Control group,** matched for age, gender, and parental education level.
- Assessment at 7 years post-injury**
 - Executive functions:** combination of computerised tasks (Inhibition and Flexibility subtests of the Test of Attentional Performance -TAP), paper-pencil tests (Errands Test or Six-part test according to age), and the Behavioral Rating Inventory of Executive Functions (BRIEF) questionnaire (8 subscales, 3 composite indices, assessing behavioural and cognitive aspects of EF in everyday life)
 - Attention:** Dual Task (simple visual and auditory, and divided attention) subtest of the TAP
 - Full-Scale Intellectual Quotient (FSIQ)** was considered in the analyses.

Results

- TGE cohort participants



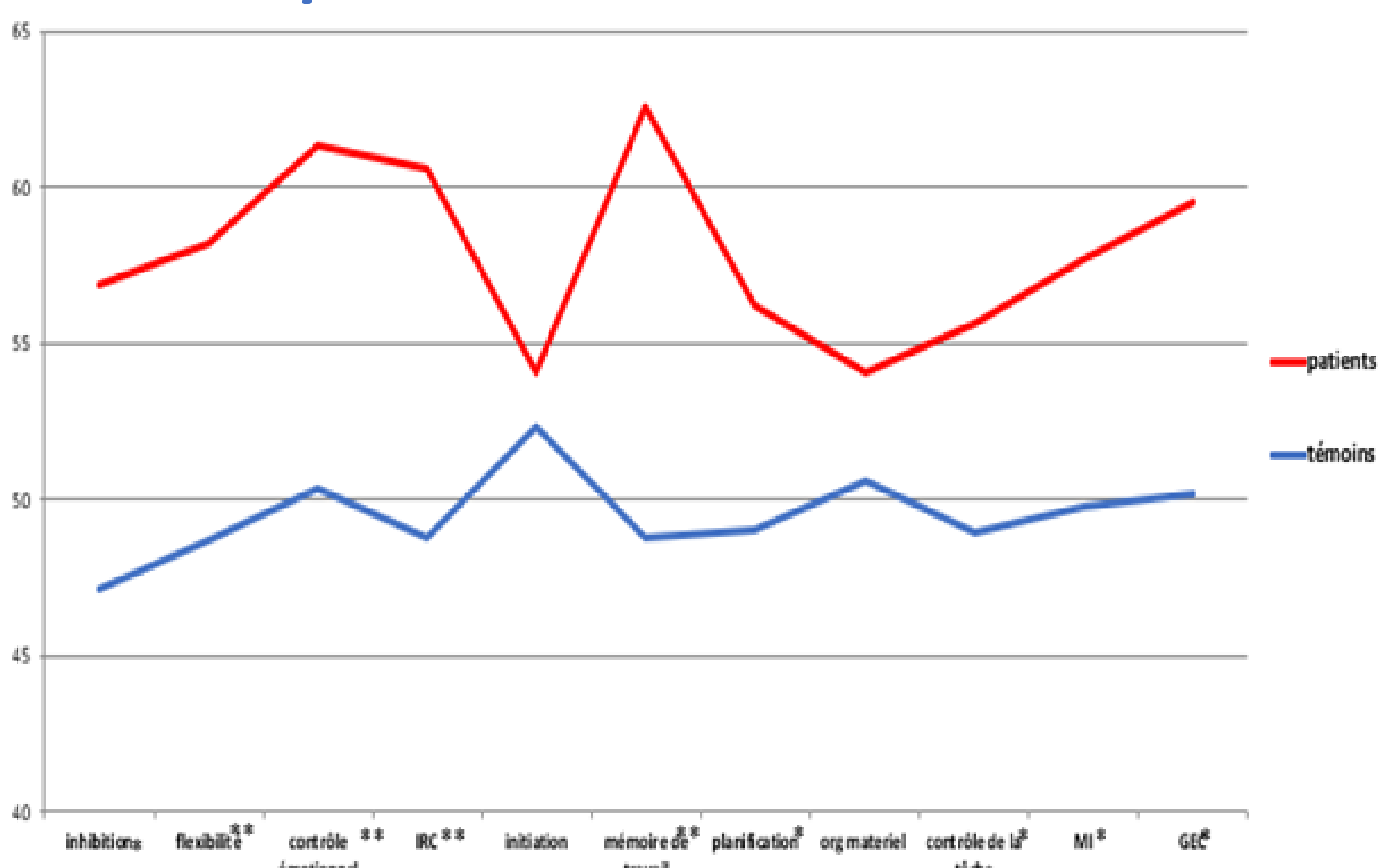
TBI group characteristics:

Mean time since injury 7.9 years (SD=0.8)
 Mean age at injury 7.7 years (SD=4.6)
 Mean age at assessment 15.6 years (SD=4.5)
 Mean lowest GCS=6 (SD=1.7),
 Mean length of coma=5.6 days (SD=4.6)

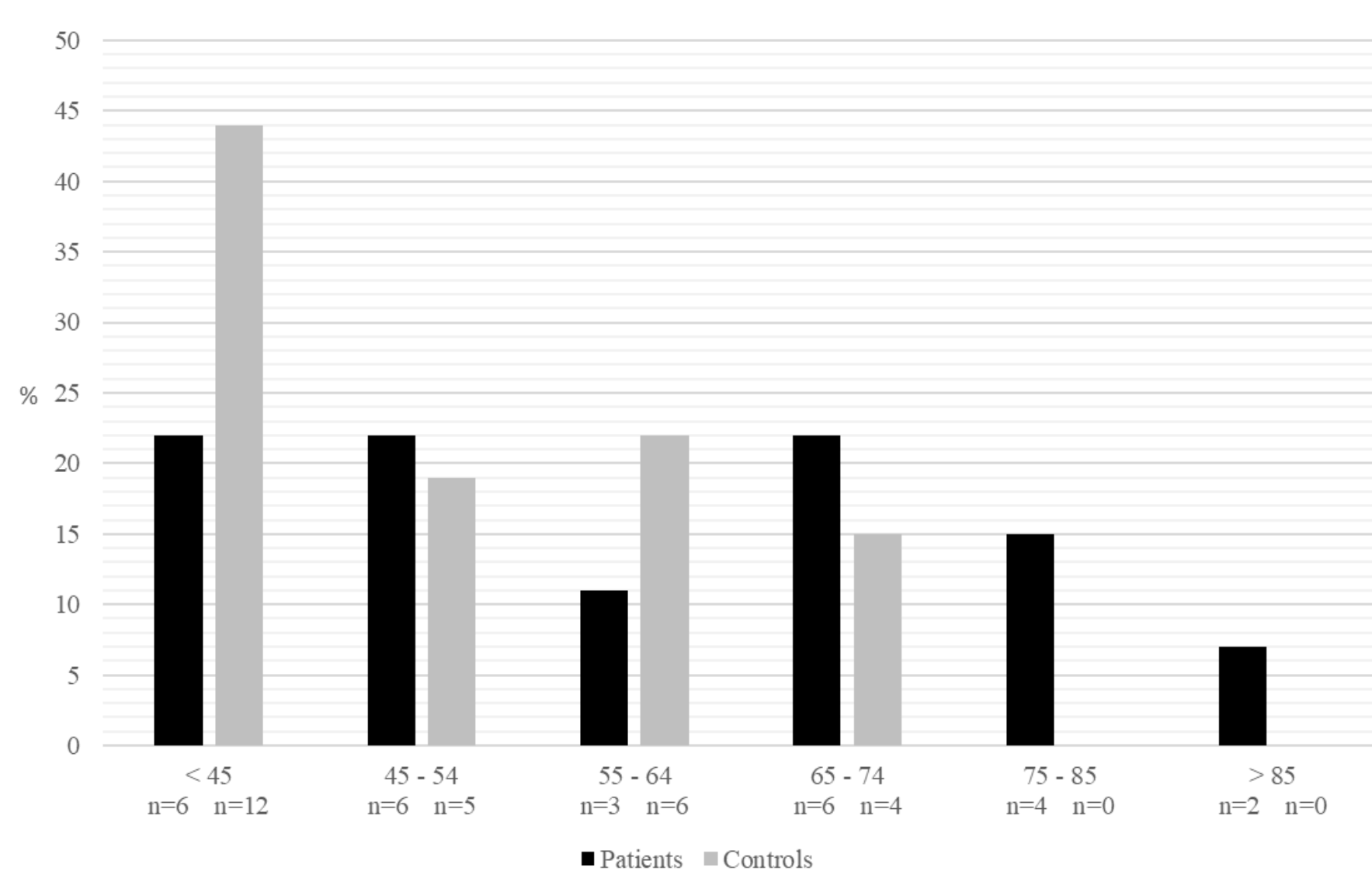
No significant difference between participants and non-participants at the 7-year follow-up

27 individually matched controls
 No difference between TBI and control groups

- BRIEF questionnaire



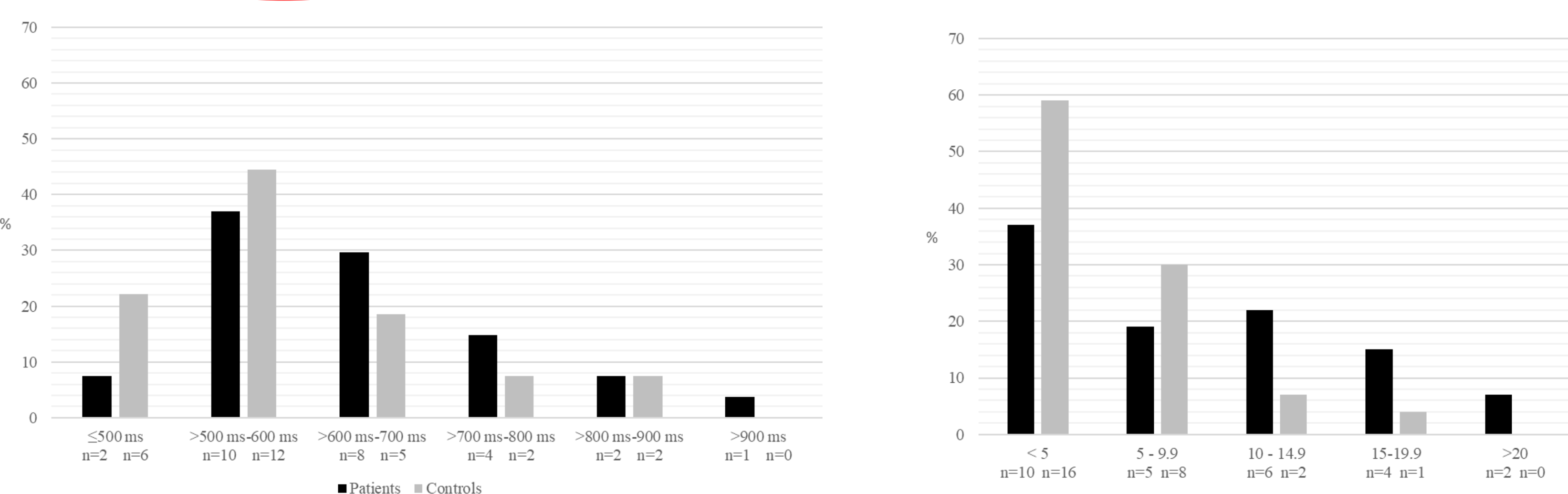
* : p<0,05 ** : p<0,01



Distribution of the Global Executive Composite score of the BRIEF questionnaire in patients and controls

- Test of Attentional Performance results

	TBI					Controls					t	p'
	N	M	SD	Min	Max	N	M	SD	Min	Max		
Test of Attentional Performance												
Divided Attention												
Visual Attention - Mean RT (ms)	27	944.0	241.4	559	1502	27	848.0	177.2	559	1242	-1.7	.102
Visual Attention - False alarms		2.4	4.2	0	19		0.7	1.0	0	4	-2.02	.053
Visual Attention - Omissions		3.0	2.6	0	8		2.5	2.5	0	8	-0.7	.489
Auditory Attention - Mean RT (ms)		614.8	88.8	434	773		588.2	103.5	425	795	-1.01	.315
Auditory Attention - False alarms		1.4	2.0	0	7		0.4	1.0	0	4	-2.3	.028
Auditory Attention - Omissions		0.6	0.8	0	3		0.1	0.3	0	1	-2.9	.006
Dual Task - Auditory RT (ms)		667.2	200.3	405	1244		623.0	156.6	309	991	-0.9	.370
Dual Task - Visual RT (ms)		901.3	231.4	620	1747		791.2	160.5	532	1195	-2.03	.047
Dual Task - False alarms		3.2	4.4	0	14		0.6	1.6	0	8	-2.9	.006
Dual Task - Auditory Omissions		1.9	2.6	0	9		0.9	1.7	0	6	-1.7	.105
Dual Task - Visual Omissions		3.2	2.9	0	10		1.8	2.1	0	8	-2.01	.049
Dual Task - Total Omissions		5.1	4.3	0	14		2.7	3.3	0	12	-2.3	.024
Flexibility												
Digits - Mean RT (ms)		607.0	139.1	418	959		540.1	154.5	322	967	-1.7	.100
Digits - Errors		2.0	2.0	0	6		2.3	2.4	0	9	0.6	.543
Letters - Mean RT (ms)		561.1	155.9	365	861		530.5	183.6	351	1133	-0.6	.512
Letters - Errors		2.2	1.8	0	6		1.6	1.2	0	4	-1.4	.162
Digits & Letters - Mean RT (ms)		891.7	276.4	477	1488		755.1	266.6	400	1249	-1.8	.070
Digits & Letters - Errors		12.1	8.4	0	29		6.1	5.7	0	23	-3.1	.004
Inhibition												
Go - No Go - Mean RT (ms)		445.7	100.1	302	679		419.7	82.4	292	609	-1.04	.302
Go - No Go - False alarms		3.0	2.8	0	8		1.9	2.7	0	10	-1.5	.135
Go - No Go - Omissions		0.7	1.8	0	7		0.3	1.2	0	6	-0.9	.328
Total scores												
Reaction time (ms)		704.1	137.6	498.4	1029.9		636.9	136.1	453.5	942.8	-1.8	.077
Errors		9.8	6.4	0.5	22.5		5.4	3.7	0.7	15.9	-3.1	.003



Distribution of the total Reaction Time and Errors scores of the TAP in patients and controls
 ms: milliseconds

- Factors associated with EF and attention outcomes

TAP computerized tests

- Reaction Time total score

- Post-traumatic epilepsy
- Intellectual ability
- 1-y functional outcome
- 7-y self-reported quality of life
- Type of ongoing education

- Errors Total score

- Initial GCS score
- Intellectual ability
- 7-y parent-reported quality of life and externalizing behavior problems

BRIEF summary GEC score

- Length of coma
- 1-y functional outcome
- Concurrent 7-y post-injury parent-reports of fatigue, quality of life and behavior
- Family functioning

Conclusion

Cognitive and behavioural aspects of EF and attention were significantly impaired seven years after severe childhood TBI, with consequences evident on everyday life. Deficit severity was associated with worse injury severity and 1-y post-injury functional outcomes, with other concurrent outcomes, and with the type of ongoing education. These results should lead to systematic long-term follow-up of this vulnerable population, adequate and timely implementation of interventions aiming at promoting optimal development and achievement throughout childhood and adolescence, until transition to adult services.