

Relationship of Behavioral Compensation and Cognitive Reserve in Survivors of Primary Brain Tumors

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Background & Significance

Adult survivors of primary brain tumors:

- Report cognitive impairment as the most distressing symptom
 - Feeling distracted, unorganized, forgetful, slower thinking or ability to perform tasks, inability to keep up with conversations, not being able to multi-task
- Many are not “diagnosed” with cognitive impairment on standardized cognitive testing
 - Cognitive impairment defined as z score of -1.0 or more below normative scores in one or more domains

Thus we observed a discrepancy between subject self-report and objective cognitive performance

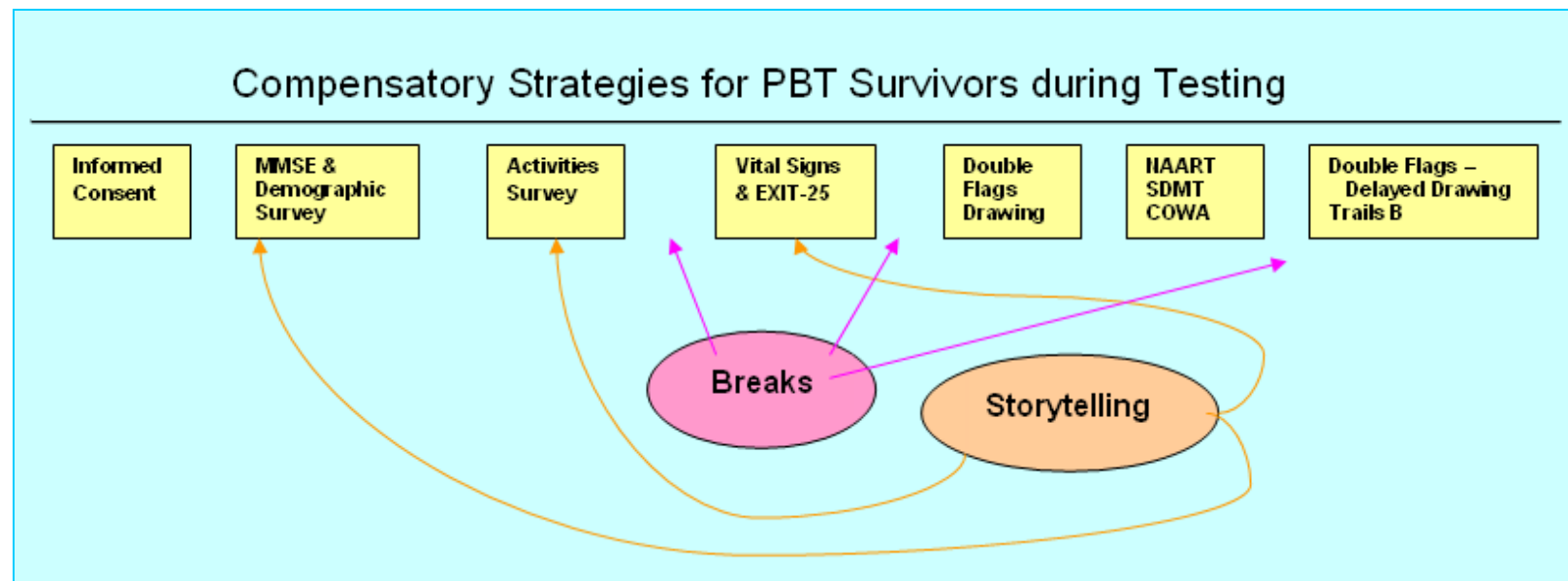




Explanation for discrepancy?

- Behavioral Observations

- Indicated that some individuals use compensatory techniques to maintain function
- Others use compensatory techniques that are less successful and may worsen function





Theory of Cognitive Reserve

- Posits that levels of cognitive reserve may explain differences in cognitive function despite similar brain dysfunction
- Comprised of a lifetime of engagement in cognitive activities
- Often measured by intelligence, education, or occupational attainment





Study Aims

1. To describe compensatory behaviors that survivors with primary brain tumors use for cognitive function
2. To explore the relationship of compensatory behaviors and cognitive reserve



Study Description

- Cross-sectional design
- Recruitment and study procedures at 2 sites
 - UNC Lineberger Cancer Center
 - Preston Robert Tisch Brain Tumor Center at Duke
 - Community recruitment for healthy controls
- Study procedures performed once over 1.5 hours
 - MMSE and eligibility confirmation
 - Consent
 - Study battery
 - Subjective surveys
 - Objective testing



Variables & Measurement

Variable	Measurement
Executive Control Function	EXIT-25, CTB Composite, TMT Difference
Memory	HVLT subscales
Attention	Trails A, Trails B, SDMT
Verbal Fluency	Controlled Oral Word Association test
Self-reported cognitive function	Everyday Cognitions Scale
Cognitive reserve	Hollingshead Index, NAART
Observed compensatory behaviors	Field notes
Descriptive measures	Demographics , health information survey, CESD-R, OARS, MDASI-BT, FACT-BT
Self-reported compensatory behaviors (Exemplars, n=7)	Structured interview Florida Cognitive Activities Scale



Eligibility

- Completed chemotherapy &/or radiotherapy 1 year prior to study participation for survivors of primary brain tumor
- Mini Mental Status Examination (MMSE) score > 24
- Multiple exclusions
 - Comorbidities (e.g. other neurologic conditions, seizure activity in last 6 months, sleep disorders, diagnosis of depression or psychiatric disorder)
 - Medications (e.g. antipsychotics, antidepressants, chemotherapy)





Analyses

- Performance scores converted to z-scores using age and education based normative data
 - Z-scores of 1.3 or more below norm indicated cognitive impairment
- Everyday Cognitions Scale (ECog): 4 point scale; cutpoint 2
 - 1=no change since diagnosis
 - 2=noticed some change since diagnosis
 - 3=persistent change since diagnosis
 - 4=much worse since diagnosis
 - Able to identify some items as “not applicable”
- Box plots, scatterplots, correlations, kruskal wallis and chi-square tests when appropriate

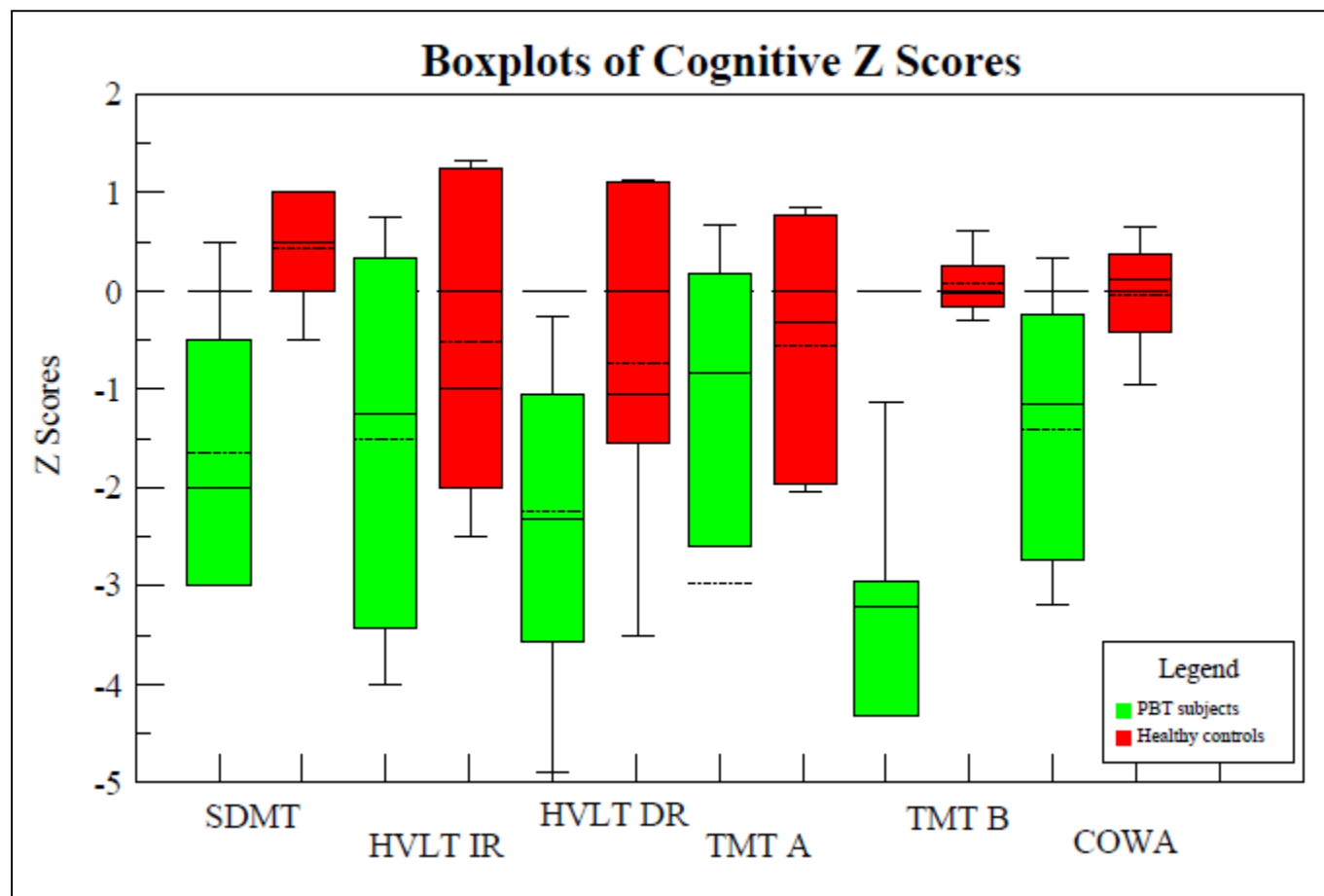




Demographics	PBT Subjects Mean (SD)	Healthy Controls Mean (SD)
Age in years	52.3 (6.6)	53.1 (7.2)
Education in years	14.9 (2.3)	15.1 (2.3)
WHO Grade	III-IV	
Diagnosis, months	151 (63.4)	
OARS	27.4 (1.1)	28.0 (0.0)
CESD	11.1 (7.3)	21.4 (1.6)
MDASI-Br		
Symptoms	1.8 (1.9)	0.3 (0.2)
Interference	0.9 (1.3)	0.2 (0.4)
FACT-Brain	130.6 (27.2)	168.0 (9.8)



Objective cognitive function: Boxplots of z-scores





Objective cognitive function: differences

Battery	PBT Subjects Mean (SD)	HC Mean (SD)	T-test (df 12), p<.05
MMSE	27.4 (1.7)	29.3 (1.1)	-2.40, .034
FSIQ	100.4 (13.2)	117.3 (5.7)	-3.11, .01
EXIT-25	7.7 (3.1)	3.3 (1.8)	3.23, .01
	Z scores	Z scores	
HVLT IR	-1.51	-0.52	NS
HVLT DR	-2.23	-0.7	NS
HVLT RDI	-2.20	-0.40	NS
TMT Part A	-2.97	-0.56	NS
TMT Part B	-5.02	0.07	-2.62, .02
COWA	-1.41	-0.04	-2.63, .02
SDMT	-1.64	0.43	3.46, .01



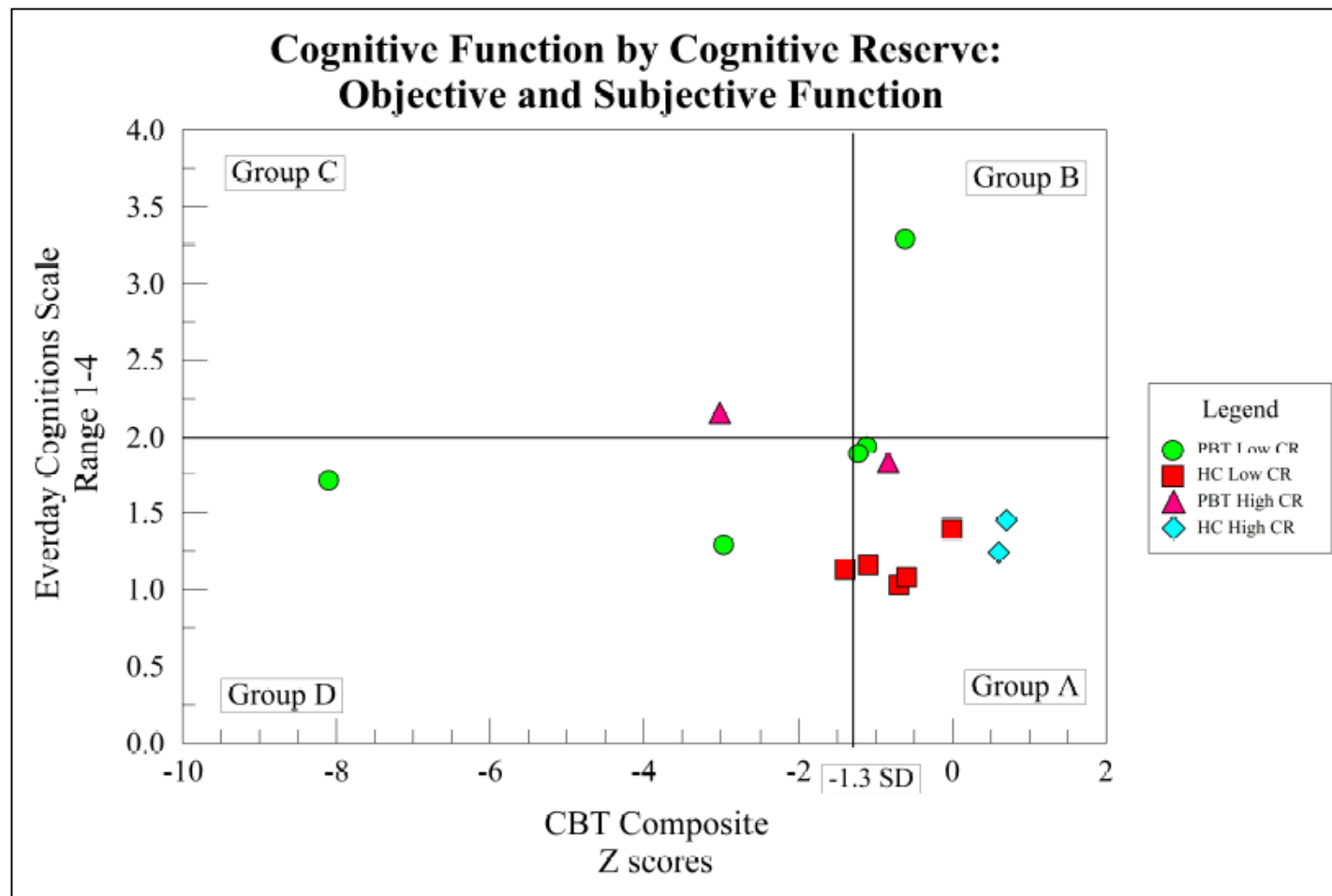
Cognitive Reserve

- Hollingshead 2-Factor Index for Social Classification
 - Categorizes educational attainment and occupational achievement to derive a score
 - Range of scores 11 to 77
- Sample mean = 31.75
 - Served as the cutpoint for cognitive reserve (CR)
 - High CR < 31.75 (n=21)
 - Low CR \geq 31.75 (n=19)





Cognitive Reserve



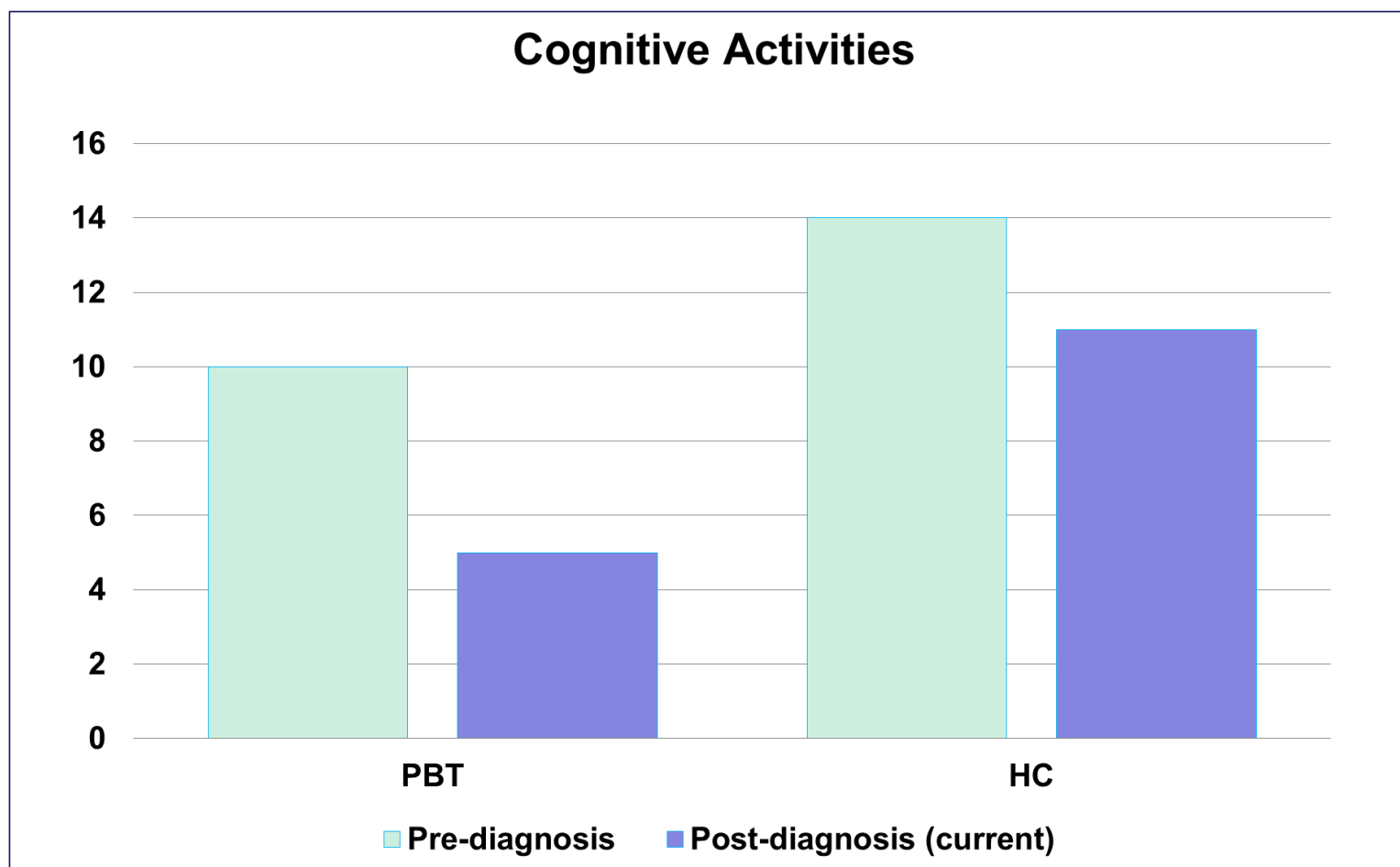


Compensatory Behaviors

BEHAVIORS	PBT Subject	Healthy Controls
Study time	Required more time	Did everything to finish
Breaks during testing	Took advantage of breaks	None
Report of fatigue	Every subject, surveys and computer tests	None
Delayed testing	Told stories during testing	None



Engagement in Cognitive Activities





Compensatory Behaviors Exemplars

Congruent: Group A		Incongruent: Group B	
High CR	Low CR	High CR	Low CR
CTB: -0.8 ECog: 1.8	CTB: -1.1 ECog: 1.9	CTB: -1.2 ECog: 2.1	CTB: -0.6 ECog: 3.3
Subject 33 51 year old lady	Subject 16 64 year old lady	Subject 41 62 year old man	Subject 1 47 year old lady
7.5 year survivor	12 year survivor	11 year survivor	12 year survivor
Stated activities unchanged but “less often”	Reduced 3 activities: sewing, dancing, shopping	Reduced 6 activities: reading, games, puzzles, social engagement, financial records, home repairs	Changed 18 activities: less social activities, more puzzles, less driving, less reading & gardening
Allows more time to get things done	Tells stories to make things personal	Uses memos, lists to keep organized	Protects herself by staying home
Leaves memos to keep organized	Writes everything down	Repeated instructions , read out loud	Repeated words, instructions read for a 2 nd time
Repeated instructions back	Read instructions out loud		



Compensation and Cognitive Reserve

- Those with low CR tended to reduce more activities than those with high CR
- Those with low CR did not incorporate successful compensatory strategies into everyday function
- Those with high CR failed to recognize their use of compensatory strategies
 - “Just felt like the right thing to do” to maintain function
- Healthy controls tended to retain cognitive activities but with less frequency
 - If they stopped an activity, they replaced it with another activities
- PBT survivors reduced 4-12 activities since diagnosis





Limitations

- Small sample size
- Cross-sectional, not longitudinal to indicate when change may occur
- Instrumentation issues



Implications for Practice

- Identifying compensatory behaviors use by adult cancer survivors may help us identify those that aid or hamper cognitive and everyday function
- We have opportunities to identify those at risk for cognitive decline at time of diagnosis for earlier intervention





With gratitude

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Questions?

- For more information or discussion, you may contact me at

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