University of California
San Francisco

Capstone Defense

The Role of Bilingualism in Cognitive Reserve Among Behavioral Variant Frontotemporal Dementia (bvFTD) vs Primary Progressive Aphasia (PPA) Disorders

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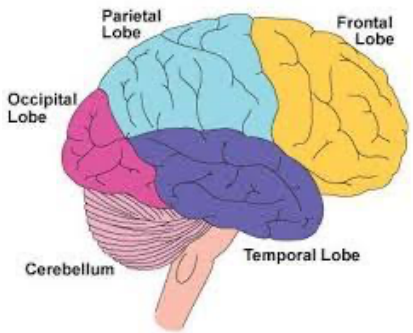
Background

Frontotemporal Dementia (FTD)

Behavioral Variant Frontotemporal Dementia

- Affects the frontal & temporal regions of the brain
- Increasing trouble in controlling behavior, especially in social situations
- Lack of judgement



Primary Progressive Aphasias

- Affects regions of the brain that control language and speech
- Semantic Variant Primary Progresive Aphasia (svPPA)
  - Trouble with naming
- Nonfluent Aggramatic Variant Primary Progresive Aphasia (nfvPPA)
  - Difficulty pronouncing words
- Logopenic Variant Primary Progressive Aphasia (lvPPA)
  - Word-finding difficulties

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Bilingualism & Cognitive Reserve

- *Cognitive reserve:* Differences between individuals that allow them to be more resilient to brain changes
- Education & occupation are significant protective factors
- Bilingualism appears to be a protective factor by being associated with better cognitive performance & later onset of symptoms

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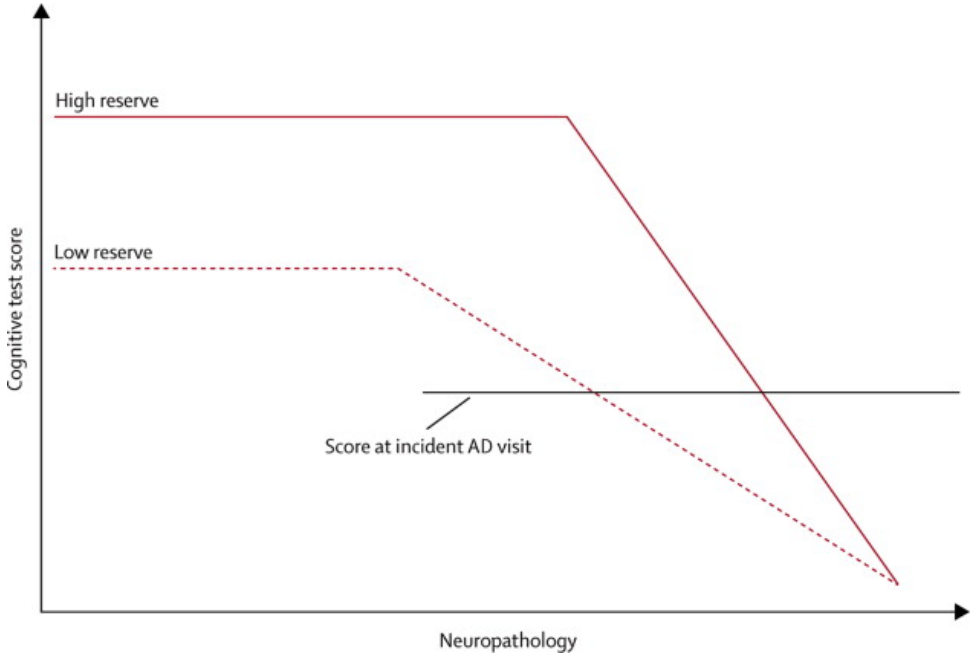

(Stern, 2012)

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Does the impact of bilingualism on cognitive performance vary in language-related PPAs versus non-language related bvFTD?

Methods

Patient Cohort

Total *N* = 316

bvFTD *N* = 80	nfvPPA *N* = 79	svPPA *N* = *85*	lvPPA *N* = *72*
Mono *N* = 56	Mono *N* = 55	Mono *N* = 56	Mono *N* = 57
Bi *N* = 24	Bi *N* =24	Bi *N* = 29	Bi *N* = 18

Neuropsychological Measures

General (2)

- Mini Mental State Exam (MMSE)
- Global Deterioration Assessment (GDS)

Memory (2)

- California Verbal Learning Test (CVLT)
- Rey Recall

Language (7)

- Sentence Repetition
- Verbal Agility
- Irregular Word Reading
- Sentence Comprehension
- Peabody Picture Verbal Test (PPVT)
- Animal Fluency
- Boston Naming Test (BNT)

Frontal Executive (8)

- Trails (Lines/ Second)
- Design Fluency
- Digits Forward
- Digits Backward
- D Words
- Abstraction
- Stroop Color Naming
- Stroop Inhibition

Visuospatial (3)

- Rey Copy
- Calculations
- Visual Object Space Perception Battery (VOSP)

Baseline Analysis

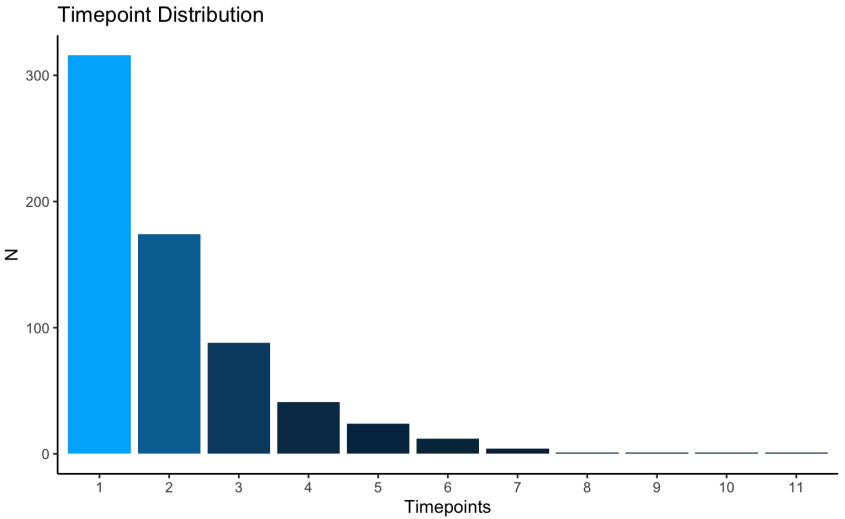
- Initial Models
  - Linear regression
    - Gender (Categorical), Education (Continuous, years), Age (Continuous, Years), ***Lingual status (Categorical)***
  - 4 separate models separated by diagnosis
    - Sample size issue
- Revised models
  - Models using ALL data
    - Disease variant was included as a categorical predictor (binary & multiple levels)

      Neuropsychological Task ~ Gender + Education + Age + Lingual Status + Disease Variant + ***Lingual Status * Disease Variant***

Longitudinal Analysis

- Initial Models
  - 4 separate models separated by diagnosis
  - Same covariates @ baseline with the addition of Timepoint
  - Linear Mixed Effects Model
  - Linear Regression
    - Outcome was the difference between neuropsychological measure
- Revised models
  - Models using ALL data
    - Linear Mixed Effect Model
    - Disease variant was included as a categorical predictor (binary & multiple levels)
    - Timepoint was included as a continuous variable, measured in years

Neuropsychological Task ~ Gender + Education + Age + Lingual Status + Disease Variant + ***Lingual Status * Disease Variant*** + (1 | PIDN)



Results

Demographics ~ Table 1

- The monolingual/bilingual groups within variants did not differ in age, sex, and education, and FDR Box Scores
- The monolingual/bilingual groups in the bvFTD, svPPA, and lvPPA groups did differ in race distribution

	Group 1 Behavioral Variant Frontotemporal Dementia (bvFTD)				Group 2 Semantic Variant Primary Progressive Aphasia (svPPA)				Group 3 Logopenic Variant Primary Progressive Aphasia (lvPPA)				Group 4 Non-Fluent Variant Primary Progressive Aphasia (nfvPPA)			
	Monolingual (N= 56)	Bilingual (N= 24)	P-value	N (mono/bi)	Monolingual (N= 56)	Bilingual (N= 29)	P-value	N (mono/bi)	Monolingual (N= 57)	Bilingual (N= 15)	P-value	N (mono/bi)	Monolingual (N= 55)	Bilingual (N= 24)	P-Value	N (mono/bi)
Age, mean (SD)	62.1 (10.0)	62.3 (9.9)	0.97	-	63.3 (6.2)	64.4 (5.6)	0.40	-	63.8 (7.9)	68.5 (9.9)	0.10	-	68.4 (7.3)	68.3 (7.9)	0.96	-
Sex, N (%)			0.73	-			0.25	-			0.30	-			1.00	-
Male	32 (57.1)	12 (50%)			28 (50)	10 (34.5)			27 (47.4)	10 (66.7%)			21 (38.2%)	9 (37.5%)		
Female	24 (42.9)	12 (50%)			28 (50)	19 (65.5)							34 (61.8%)	15 (62.5%)		
Education, mean (SD), y	16.0 (2.3)	16.2 (3.4)	0.80	54/24	16.0 (2.6)	16.5 (3.2)	0.46	-	16.5 (2.5)	17.3 (2.2)	0.26	56/15	16.0 (3.1)	16.6 (2.3)	0.38	54/24
Race			<0.001	51/24			0.02	54/29			0.02	53/12			0.51	54/24
White	50 (89.3%)	13 (54.2%)			51 (91.1%)	21 (72.4%)			52 (91.2%)	9 (60%)			49 (89.1%)	20 (83.3%)		
Asian	0 (0%)	9 (37.5%)			1 (1.7%)	5 (17.2%)			1 (1.8%)	2 (13.3%)			2 (3.6%)	2 (8.3%)		
Black/African American	0 (0%)	0 (0%)			0 (0%)	0 (0%)			0 (0%)	0 (0%)			1 (1.8%)	0 (0%)		
Native American	0 (0%)	0 (0%)			0 (0%)	0 (0%)			0 (0%)	0 (0%)			0 (0%)	0 (0%)		
Mixed	1 (1.8%)	2 (8.3%)			2 (3.6%)	1 (3.4%)			0 (0%)	1 (6.7%)			1 (1.8%)	2 (8.3%)		
Other	0 (0%)	0 (0%)			0 (0%)	2 (6.9%)			0 (0%)	0 (0%)			1 (1.8%)	0 (0%)		
Unknown	5 (8.9%)	0 (0%)			2 (3.6%)	0 (0%)			4 (7%)	3 (20%)			1 (1.8%)	0 (0%)		

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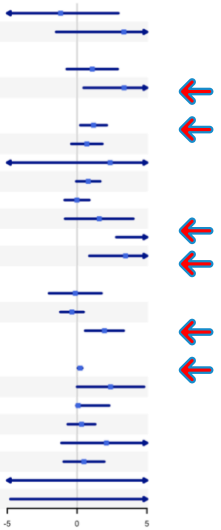
Baseline Analysis

Neuropsychological Task ~ Gender + Education + Age + Lingual Status + Disease Variant + ***Lingual Status * Disease Variant***

- bvFTD bilingual group scored lower on tasks in the memory, language, visuospatial, and frontal executive domains
- svPPA bilingual group scored higher on tasks in the memory, language, visuospatial, and frontal executive domains
- lvPPA bilingual group scored higher on tasks in the memory, language, and visuospatial domains
- nfvPPA bilingual group scored higher on tasks in the memory and language domains

Semantic Variant Primary Progressive Aphasia (svPPA) Baseline Regression Results

Neuropsychological Measure	Monolingual Mean (SD)	Bilingual Mean (SD)	Estimate (95% CI)
General Tasks			
MMSE	23.7 (5.6)	21.6 (7.8)	-1.18 (-5.34 to 2.96)
GDS	9.4 (6.1)	9.3 (7.8)	3.35 (-1.50 to 8.19)
Memory Tasks			
CVLT	1.8 (2.2)	1.4 (2.3)	1.09 (-0.74 to 2.91)
Rey Recall	6.5 (4.6)	6.6 (4.8)	3.37 (0.47 to 6.27)
Language Tasks			
Sentence Repitition	3.7 (1.3)	3.4 (1.4)	1.18 (0.23 to 2.13)
Verbal Agility	5.2 (1.4)	5.1 (1.2)	0.70 (-0.41 to 1.81)
WRAT-4	52.8 (11.2)	56.6 (10.4)	2.37 (-6.31 to 11.05)
Irregular Word Reeding	4.4 (1.4)	4.6 (1.5)	0.80 (-0.06 to 1.66)
Sentence Comprehension	4.5 (0.9)	4.0 (1.3)	-0.01 (-0.89 to 0.88)
PPVT	8.4 (3.9)	8.5 (4.6)	1.59 (-0.86 to 4.03)
Animal Fluency	7.9 (4.6)	11.2 (8.4)	7.40 (2.81 to 11.98)
BNT	4.9 (3.9)	5.3 (3.9)	3.47 (0.88 to 6.07)
Visuospatial Tasks			
Rey Copy	15.2 (1.5)	15.5 (1.0)	-0.13 (-2.01 to 1.75)
Calculations	4.4 (1.2)	4.4 (0.9)	-0.37 (-1.20 to 0.47)
VOSP	9.0 (1.8)	9.0 (1.5)	1.96 (0.58 to 3.34)
Frontal Executive Tasks			
Trails (lines/second)	0.31 (0.21)	0.41 (0.28)	0.22 (0.06 to 0.37)
Design Fluency	7.1 (3.3)	8.1 (3.4)	2.40 (-0.00 to 4.80)
Digits Forward	6.6 (1.2)	6.3 (1.9)	0.08 (-0.05 to 2.30)
Digits Backward	4.9 (1.2)	5.0 (1.8)	0.32 (-0.67 to 1.30)
D Words	7.4 (4.2)	1.8 (1.6)	2.10 (-1.12 to 5.32)
Abstraction	1.8 (1.3)	1.8 (1.6)	0.49 (-0.96 to 1.95)
Stroop Color Naming	68.7 (19.8)	70.0 (23.7)	7.70 (-9.60 to 24.98)
Stroop Inhibition	37.8 (13.8)	40.1 (19.1)	7.24 (-4.78 to 19.27)



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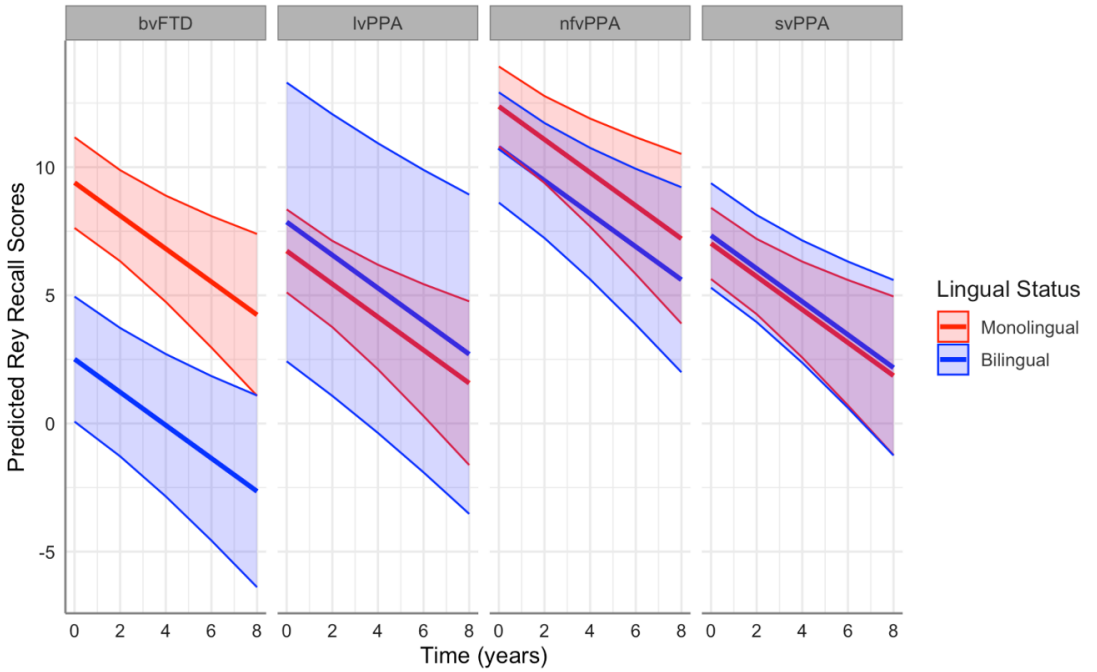
Longitudinal Analysis

Neuropsychological Task ~ Gender + Education + Age + Lingual Status + Disease Variant + ***Lingual Status * Disease Variant +*** (1 | PIDN)

- bvFTD bilingual group scored lower on tasks in the general, memory, language, visuospatial, and frontal executive domains
- svPPA bilingual group scored higher on tasks in the memory, language, visuospatial, and frontal executive domains
- lvPPA bilingual group scored higher on tasks in the memory, language, and frontal executive domains
- nfvPPA bilingual group scored higher on tasks in the memory and language domains



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Discussion

Conclusions, Limitations, & Next Steps

- ***Conclusion***
  - Bilingualism's effects on cognitive performance differ by the FTD variants
- ***Major Limitation***
  - Missing Data
    - Baseline and over time
    - Increase in sample size
- ***Potential Next Steps***
  - Look more closely into the bilingual factor
    - Second language acquisition
    - Number & types of languages spoken

Acknowledgements

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