

## Rationale

- Depressive symptoms and signs are often comorbid with dementia and exacerbate cognitive deficits (Gutzmann & Qazi, 2015).
- Depressive affect is known to generally impede cognitive function (Austen et al., 1992); increased neural recruitment in depressed patients compensates for cognitive deficits to maintain performance outcomes (Harvey et al., 2005).
- Music interventions are successful in mitigating depressive symptoms in persons with dementia (PwD), but corresponding neural correlates are unknown (Tamburri, Trites, Sheets, Smith, & MacDonald, 2019)

## Research Objectives

- Does neural activation (proxied by frontocortical oxygenation) differ between solo and social singing conditions?
- Can extent of frontocortical oxygenation in social vs. solo singing conditions be predicted by cognition (processing speed) and level of depressive affect?
- Can mild vs. severe cognitive impairment be differentiated as a function of a linear combination of predictors (oxygenation, caregiver distress, processing speed)?

### A priori hypotheses:

- Solo singing will facilitate increased neural oxygenation relative to social singing
- PwD with higher depressive affect will show worsened cognitive performance and increased neural recruitment during singing conditions relative to minimally depressed peers.

## Participants

- A subsample of N=12 PwD were recruited from the Voices in Motion study (8 female, *M-age*=78.67 years, *SD*=9.67).

## Design

Functional near-infrared spectroscopy (fNIRS) was administered to PwD to index cortical activation during social and solo singing conditions

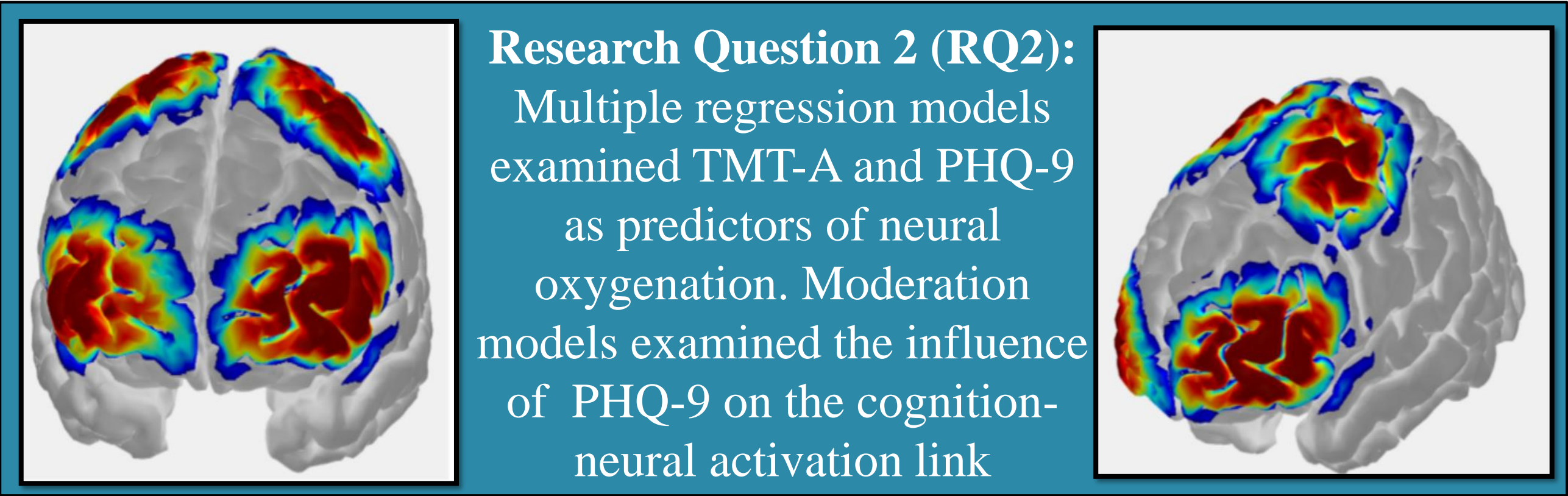
- the social condition involved singing with peers to the well-practiced, well-known song “I Love a Piano”.
- for the solo condition, participants were accompanied on the piano by the choir director singing a medley of proceduralized childhood songs including: “Twinkle Twinkle”, “ABC’s”, and “BaBa Black Sheep”.

## Measures

Inventory	Construct	Range
Patient Health Questionnaire-9 (PHQ-9; Kroenke, Spitzer, & Williams, 2001)	Depressive symptoms and signs	0-9
Trail Making Test A (TMT-A; Reitan, 1958)	Cognition (processing speed)	Up to 2.5 mins. for task completion
Mini-Mental State Examination (MMSE, Folstein, Folstein, & McHugh, 1975)	Global cognition	0-30
Zarit Burden Interview (ZBI; Zarit, Reever & Bach-Peterson, 1980)	Caregiver distress	0-88

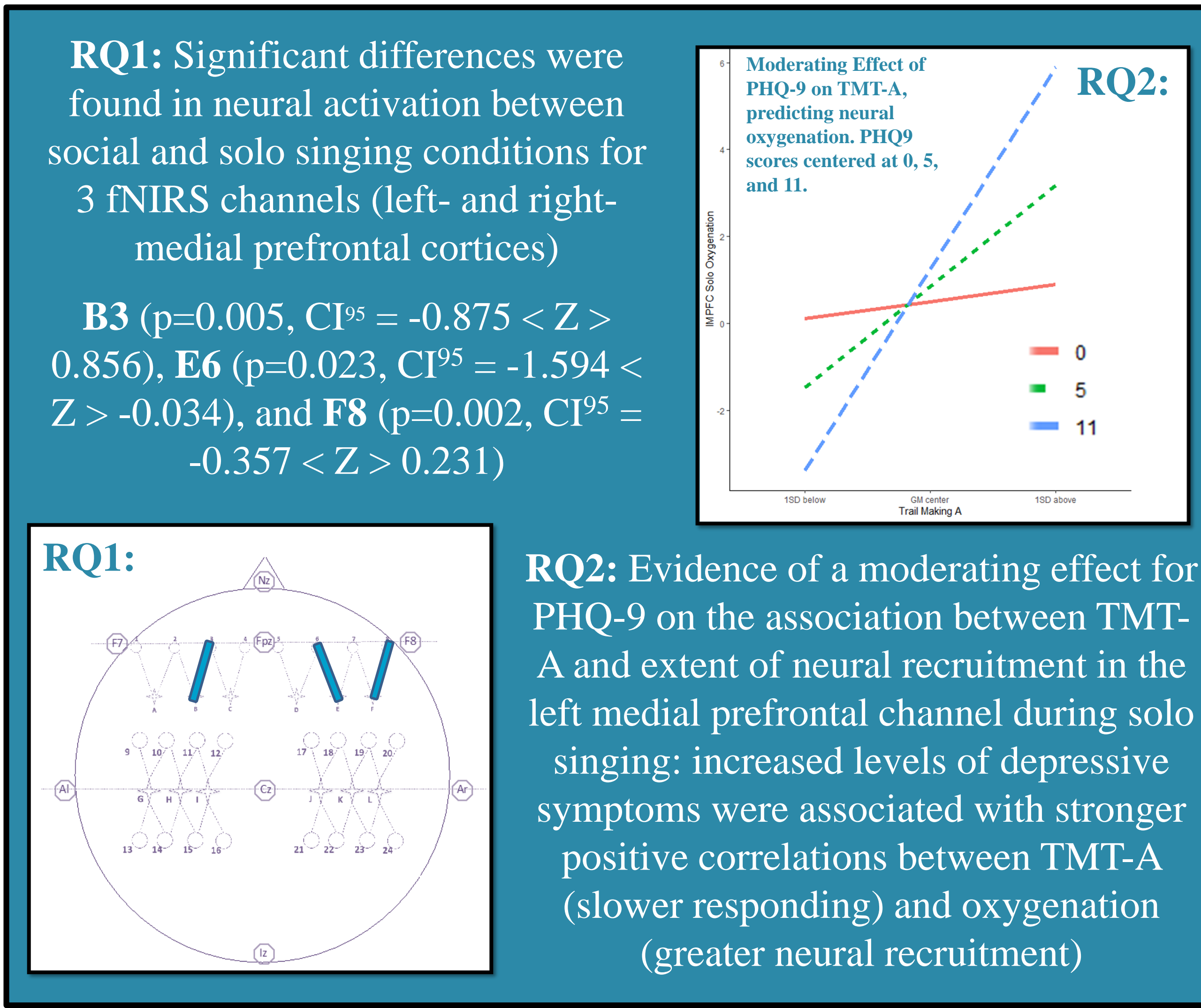
## Analyses

**Research Question 1 (RQ1):** Paired sample t-tests investigated within-person differences between solo and social singing



**Research Question 3 (RQ3):** Discriminant Function Analysis evaluated whether cognitive status (proxied by MMSE scores; dichotomized into two groups – mild vs. moderate/severe impairment) could be predicted by a variate of neural oxygenation, TMT-A, and ZBI scores.

## Results



### RQ3: Canonical Discriminant Functions

The association between the linear function of variables and cognitive status outcome (.85) was significant ( $p < .012$ )

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	2.594 <sup>a</sup>	100.0	100.0	.850

Classification Results					Structure Matrix		
Original Count		0=mild 1=mod /severe	Predicted Group Membership		Total		Function
			0	1			1
		0	6	0		6	TMT-A
	%	1	0	6	6	rMPFC (solo)	.475
					100	ZBI	.051

The single discriminant function (characterized by slower processing speed, greater oxygenation, and more caregiver distress) accurately classified cognitive impairment (mild vs. moderate/severe) for 100% of participants

## Conclusions

- Frontocortical oxygenation significantly differed between solo and social singing conditions; social singing may lead to greater proceduralization/less burden than solo singing. This bolsters previous findings on the importance of social engagement for PwD (e.g., McDermott et al., 2019; Tamburri, Trites, Sheets, Smith, & MacDonald, 2019)
- Depressive affect moderated the relationship between cognition and neural recruitment for PwD; individuals with greater depressed affect showed worsened cognition and greater neural recruitment in solo singing
- Discriminant function analysis accurately classified cognitive status of 100% of PwD using a combination of neural oxygenation during solo singing, TMTA, and ZBI scores.

This study provides insight into the neural correlates of both social and solo singing, and into how increases in depressive affect might result in compensatory recruitment during solo singing, as indexed by increased oxygenation relative to less depressed peers.

## Limitations and Future Research

- Although typical for neuroscience studies, the small sample size limited statistical power and generalizability of our findings
- In future research, additional cohorts will be added to Voices in Motion

### More Information

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