

PREVENTION (NONPHARMACOLOGICAL)

Social engagement intervention increases dorsal attention network functional connectivity in socially-isolated older-old adults: I-CONNECT

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Abstract

Background: Social engagement represents a promising intervention to improve or maintain cognitive function, however the neurobiological mechanism through which social engagement impacts cognitive aging remains unclear. Large-scale cognitive brain networks facilitate cognitive function and represent a set of likely candidates for being affected by social engagement interventions.

Using resting-state functional magnetic resonance imaging (rs-fMRI) data from the Internet-Based Conversational Engagement Clinical Trial (I-CONNECT), we investigated the effect of social engagement intervention on functional connectivity within large-scale cognitive brain networks, specifically the default mode network (DMN), salience network (SAL), frontoparietal network (FPN), and dorsal attention network (DAN).

Method: Due to COVID-19 pandemic, out of 186 randomized participants in the trial, 15 participants were able to complete rs-fMRI both at baseline and six-month follow-up: six participants from the intervention arm (five women; mean age \pm SD: 79.0 \pm 3.8 years) and nine participants from the control arm (six women; 81.2 \pm 5.2 years). Nine participants had mild cognitive impairment; six had normal cognition.

Intervention effect was calculated in separate regression models for within-network connectivity of each brain network, with intervention group predicting connectivity at six-month follow-up, controlling for baseline connectivity, age, sex, site, and in-scanner motion.

Result: In examining the intervention effect on DAN connectivity, the overall regression model was statistically significant ($R^2 = 0.867$, $p = 0.004$; Table 1): The experimental group had significantly higher DAN connectivity at follow-up ($b = 0.25$, 95% CI: 0.03 – 0.47, $p = 0.031$) compared with the control group, (for group \times time graph using residualized connectivity values, see Figure 1). Overall regression models for DMN, SAL, and FPN networks were not statistically significant ($p > 0.1$).

Conclusion: As social engagement interventions emerge as an effective approach to improving cognition in older adults, this work provides novel insight into the impact

of such an intervention on large-scale cognitive brain network connectivity. Specifically, participants who underwent the intervention showed greater DAN connectivity at follow-up than control participants. The voluntary directed attention facilitated by the DAN is an integral part of social engagement, and this work suggests that DAN merits additional focus in investigations of social behavior in cognitive aging. These findings must be interpreted with caution, due to small sample size.

Table 1: Regression model predicting Dorsal Attention Network within-network functional connectivity at Month-6 follow-up. (a) The overall model is statistically significant ($p=0.004$). (b) Intervention group is a significant predictor of DAN connectivity at Month 6 follow-up ($t=2.61$, $p=0.031$), with the experimental group showing greater connectivity than control group.

(a) Model		Sum of Squares	df	Mean Square	F	p	R ²
H ₁	Regression	0.910	6	0.152	8.691	0.004	0.867
	Residual	0.140	8	0.017			
	Total	1.049	14				

(b) Model		Unstandardized	SE	Standardized	t	p
H ₀	Intercept	0.48	0.07		6.79	<0.001
H ₁	Intercept	-1.69	0.64		-2.65	0.029
	Group: Experimental (vs control)	0.25	0.10		2.61	0.031
	Sex: Female (vs male)	-0.19	0.09		-2.04	0.076
	Site: U-M (vs OHSU)	0.63	0.11		2.45	0.040
	Age	0.03	0.01	0.539	3.94	0.004
	In-scanner motion	-1.31	0.40	-0.48	-3.31	0.011
	Baseline DAN connectivity	0.46	0.21	0.35	2.23	0.057

U-M: University of Michigan site, OHSU: Oregon Health & Science University site

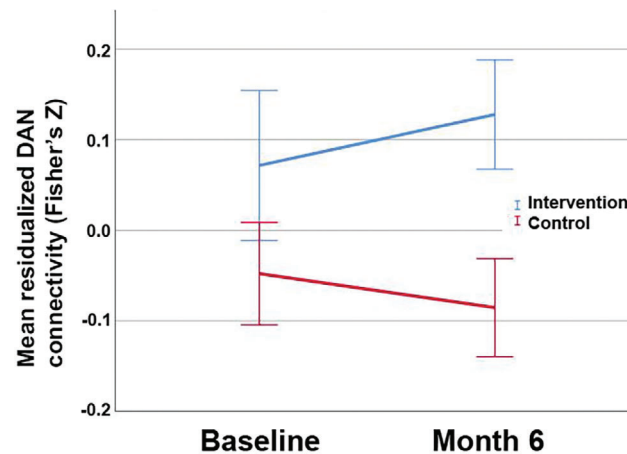


Figure 1: Intervention effect on DAN connectivity. After residualizing DAN connectivity with nuisance covariates (age, site, sex, in-scanner motion), the intervention group show greater DAN connectivity at follow-up compared to control group. Error bars reflect standard error.