

Dance improves affective state in individuals with **Parkinson's Disease**

/ision Research APNET NSERC CRSNG

Centre for



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INTRODUCTION

Parkinson's Disease (PD) is a neurodegenerative disease marked by the death of dopaminergic neurons in the substantia nigra pars compacta. It is characterized by both motor and non-motor symptoms (NMS).



F = 19.442 **PD Negative Affect Depression PANAS-X Negative Affect Depression PANAS-X** p = 1.921e-11 df = 3 $\eta^2 = 0.18$; "very small" Pre Post Tukey multiple comparisons of means HCpre-HCpost p<0.05 = 0.0004564 PDpre-HCpost p<0.05 = 0.0000000 20 PDpre-PDpost p<0.05 = 0.0000004 HC = healthy controls Controls PD = people with Parkinson's Participants

Significant improvements (p<0.05) in PANAS-X depression scores were found when conducting an ANOVA using four groups; HCpre, PDpre, HCpost, PDpost. With a post-hoc Tukey test, significant differences were also found between

RESULTS

Depression and **anxiety** are common mental illnesses. Depression is considered both a premotor marker and NMS of PD¹. Depressive symptoms are apparent in 35%² and anxiety disorders are apparent in 31% of individuals with PD³.

Previous research by Bearss and DeSouza (2021) used the UPDRS-III to demonstrate slowing of the progression of both motor and NMS in PD, but without distinguishing between the two⁴. No research has focused on both depression and anxiety, in people with PD after **dance** classes.

Current Aims:

- 1. Support dance as a form of neurorehabilitation to improve depression and **anxiety** symptoms
- 2. Observe changes in **BOLD signals** in fMRI data associated with **dance** classes



METHODS

Group (N=55) PANAS-X	Individual Data Points	Mean Age (SD)	Age range	Group (N=10) fMRI
PD (n=37)	PD ($n_{session} = 94$)	70.34 (8.12)*	52 – 87*	PD (n=10)

HCpre and HCpost; PDpre and HCpost; PDpre and PDpost.



Significant improvements (p<0.05) in PANAS-X anxiety scores were found when conducting an ANOVA using four groups; **HCpre, PDpre, HCpost, PDpost.** With a post-hoc Tukey test, significant differences were also found between **PDpost &** HCpost; PDpre & HCpost; PDpre & HCpre.

Significant changes (*p*<0.05) in BOLD signal were found in the **ventral tegmental** area (VTA) in between the Sept & Dec recordings (p=0.023067) and Dec & Jan

HC (n=18) HC ($n_{session} = 43$) 65.62 (10.85)* $22 - 80^*$

*13 ages not reported

Participants: completed 1.25-hour long **Dance for PD**® classes from 2013 – 2019.

Measures: affective data was collected from 2014 – 2019 pre and post dance class, and functional data was collected from 2013 – 2014. Statistical analysis was conducted using R Studio Version 2023.06.1+524, Brain Voyager 22.0 and MATLAB.

PANAS-X

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way during the past few weeks. Use the following scale to record your answers:	Table 2 Item Composition of the L	DANAS V Scales		
1 2 3 4 5 very slightly a little moderately quite a bit extremely or not at all		PANAS-X Scules		
	General Dimension Scales Negative Affect (10) Positive Affect (10)	afraid, scared, nervous, jittery, irritable, hostile, guilty, ashamed, upset, distressed active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, strong		
strong timid hostile frightened scornful alone proud astonished relaxed alert jittery interested irritable upset lively loathing delighted angry ashamed confident inspired bold at ease energetic	Basic Negative Emotion Scales Fear (6) Hostility (6)	afraid, scared, frightened, nervous, jittery, shaky angry, hostile, irritable, scornful, disgusted, loathing		
fearless scared concentrating disgusted shy drowsy dissatisfied with self with self with self	Guilt (6) Sadness (5)	guilty, ashamed, blameworthy, angry at self, disgusted with self, dissatisfied with self sad, blue, downhearted, alone, lonely		
PANAS-X other affective states	Basic Positive Emotion Scales Joviality (8) Self-Assurance (6)	happy, joyful, delighted, cheerful, excited, enthusiastic, lively, energetic proud, strong, confident, bold, daring, fearless		
were sorted into generalized	Attentiveness (4)	alert, attentive, concentrating, determined		
anxiety disorder (GAD-related)	Shyness (4)	shy, bashful, sheepish, timid		
symptoms and major	Serenity (3) Surprise (3)	calm, relaxed, at ease amazed, surprised, astonished		
depressive disorder (MDD-	<i>Note.</i> The number of terms compr	rising each scale is shown in parentheses.		
related) symptoms, based on	Tables 1 and 2 retrieved from: Watson, D., & Clark, L. A. (1994) https://doi.org/10.17077/48vt-m4t2			
DSM-IV diagnostic criteria.				

(p=0.02434) recordings.

Significant changes (*p*<0.05) in BOLD signal were found in the **subcallosal** cingulate gyrus (SCG) in between Dec & Jan (p=0.029667), Sept & Jan (p=0.030261), **Dec** & **May** (p=0.007934) and **Sept** & **May** (p=0.020389).

Significant changes (*p*<0.05) in BOLD signal were found in the **superior temporal** gyrus (STG) in between the Sept & Jan recordings (p=0.015397) and a change in between Jan & May (p=0.082193).

DISCUSSION

fMRI collection

Participants were scanned over an 8month period of dance classes, with a minimum of 1-4 imaging sessions in September, December, January and April.

Procedures: Participants visualized learned dance in scanner; 30 s OFF and 60 s *ON*

Retrieved from: https://mri.info.yorku.ca/equipment/3t-prism

This study provides insights into the affective benefits of attending dance classes for individuals with PD. The significant change in PANAS-X and BOLD signal is likely due to the integration of physical, cognitive, emotional and sensory processes that occur while dancing. It is important to note that the PANAS-X and fMRI collection do not overlap in time and cannot be correlated together. The significant changes found at these two time points allows for further investigations to collect the PANAS-X and conduct neuroimaging at the same time.

¹Miller DB, O'Callaghan JP. Biomarkers of parkinson's disease: Present and future. *Metabolism*. 2015;64(3). doi:10.1016/j.metabol.2014.10.030 ²Reijnders JSAM, Ehrt U, Weber WEJ, Aarsland D, Leentjens AFG. A systematic review of prevalence studies of depression in parkinson's disease. Movement Disorders. 2007;23(2):183-189. doi:10.1002/mds.21803 ³Broen MP, Narayen NE, Kuijf ML, Dissanayaka NN, Leentjens AF. Prevalence of anxiety in parkinson's disease: A systematic review and meta-analysis. *Movement Disorders*. 2016;31(8):1125-1133. doi:10.1002/mds.26643 ⁴Bearss KA, DeSouza JF. Parkinson's disease motor symptom progression slowed with multisensory dance learning over 3-years: A preliminary longitudinal investigation. Brain Sciences. 2021;11(7):895. doi:10.3390/brainsci11070895