

# A Novel Set Shifting fMRI Task Identifies Differences in Brain Activation

## in Parkinson's disease and Healthy Matched Controls

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### Objective

To investigate differences in functional brain patterns on a novel event-related attentional set shifting fMRI task in individuals with Parkinson's disease (PD) and age-matched healthy controls (HC).

### Introduction

Cognitive impairment, including executive dysfunction, is a common non-motor symptom of PD and can lead to reductions in quality of life for patients and caregivers. Throughout the course of the disease, approximately 50-80% of PD patients demonstrate cognitive declines, with approximately 30% meeting criteria for dementia. Specific deficits are most often found on executive functioning tasks.

Functional magnetic resonance imaging (fMRI) is a method used to probe brain activity during task performance. We tested PD and Healthy controls on a novel set shifting fMRI task.

### Methods

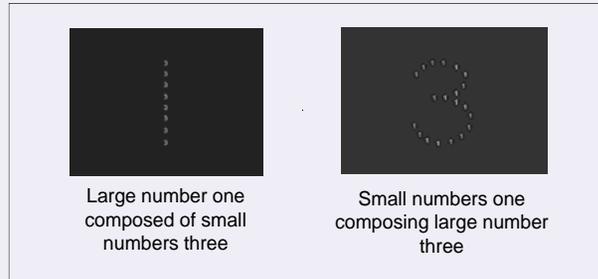
#### Subjects

14 PD patients and 10 healthy controls (HC)

	PD N=14	HC N=10
Gender	67/33	50/50
Age	67.5 (4.3)	65.7 (7.2)
Education	12.8 (2.9)	12.7 (2.3)
H&Y off	2.0 to 3.0	NA

#### fMRI Task

In a visual stimulus, large numbers 1-2 composed of small numbers 3-9 were presented and subjects were asked to switch back and forth between sets by responding to the large number or to the small number. The paradigm contained a total of 256 stimuli with 50 switches occurring randomly. Consecutive axial gradient EPI images (256 phases, 64x64, FOV=220mm, slice thickness 3 mm, duration: 12 min 48 sec) were acquired during task performance. Total number of images for this task was in the order of 12,000.

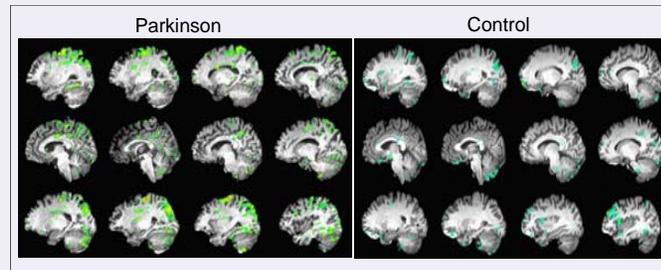


#### Data Analysis

AFNI software (NIH) was utilized to evaluate the differences in activation patterns for the correct switches between the PD and HC groups.

Student t-test was employed to identify statistically significant differences in activation.

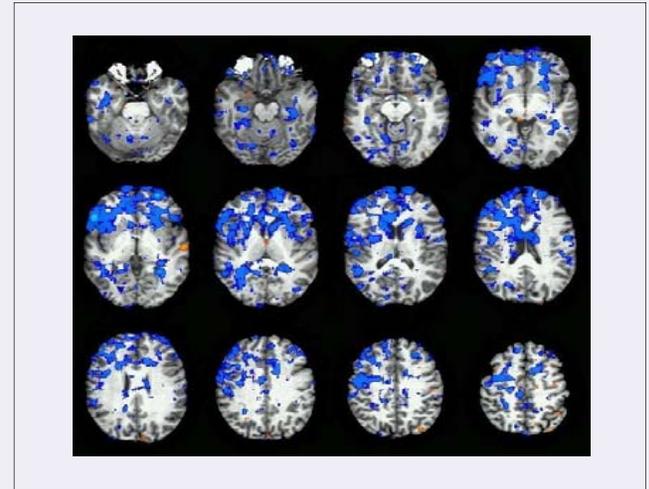
### Results



For only the trials with correct switches:  
 The PD patients demonstrated lower activation than the HC controls in diffuse areas of the brain.

- ❖ Frontal lobe (left/right superior frontal gyrus, right inferior frontal gyrus, left supplemental motor area)
- ❖ Subcortical/medial structures (right caudate, left/right cingulate gyrus)
- ❖ Parietal lobe (right postcentral gyrus, right superior parietal)
- ❖ Temporal lobe (left middle temporal gyrus, right superior temporal gyrus)
- ❖ Cerebellum (left pyramis, left/right lingual, right cuneus).

### Results



### Discussion

- ❖ The PD patients' brain activation patterns differed significantly in diffuse brain regions from the HC on a novel executive functioning set shifting task.
- ❖ The differences in activation patterns were localized to the frontal, subcortical, parietal, temporal and cerebellar regions.
- ❖ These preliminary findings suggest that fMRI is capable of measuring functional differences in PD patients and age-matched controls during the performance of a set-shifting task.



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