



PRIFYSGOL  
**BANGOR**  
UNIVERSITY

# **PATTERN OF EXECUTIVE IMPAIRMENT IN MILD TO MODERATE PARKINSON'S DISEASE**

Dr Ola Kudlicka

Bangor University, UK

# Executive functions

“[EF is] a shorthand description of a complex set of processes that have been broadly and variously defined”

(Strauss et al., 2006)

“The executive functions consist of those capacities that enable a person to engage successfully in independent, purposive, self-serving behavior” (Lezak, 1995, p. 42).

“[EF is] a set of interrelated control processes involved in the selection, initiation, execution, and monitoring of cognition, emotion, and behaviour, as well as aspects of motor and sensory functioning” (Roth, Isquith & Gioia, 2005)

# Executive functions in PD

- Impairment of executive functions (EF) is reported as a distinctive characteristic of cognitive impairment in PD (Owen, 2004; Zgaljardic, et al., 2003)
- Reports on executive dysfunction are accompanied by studies reporting normal performance in EF tests (e.g. Dalrymple-Alford et al., 1994; Uekermann et al., 2004 *versus* Colman et al., 2019; Fournet et al., 1996)
- Varying prevalence rates of impairment are reported for different aspects of EF (Muslimovic et al., 2007)
- In a systematic review of 33 studies, EF were operationalized in terms of 30 abilities, tested by 60 different tasks and variously interpreted (Kudlicka et al., 2011)

# Study aims

**Dementia**  
and Geriatric  
Cognitive Disorders

---

Dement Geriatr Cogn Disord 2013;36:50–66

DOI: 10.1159/000348355  
Accepted: January 14, 2013  
Published online: June 15, 2013

© 2013 S. Karger AG, Basel  
1420–8008/13/0362–0050\$38.00/0  
www.karger.com/dem

---

Original Research Article

---

## Pattern of Executive Impairment in Mild to Moderate Parkinson's Disease

Aleksandra Kudlicka<sup>a</sup> Linda Clare<sup>a</sup> John V. Hindle<sup>b, c</sup>

<sup>a</sup>School of Psychology, and <sup>b</sup>School of Medical Sciences, Bangor University, Bangor, and  
<sup>c</sup>Department of Care of the Elderly, Betsi Cadwaladr University Health Board, Llandudno  
Hospital, Conwy, UK

- Which areas of executive functioning are particularly problematic in mild to moderate PD?
- What is the clinical significance of executive deficits?

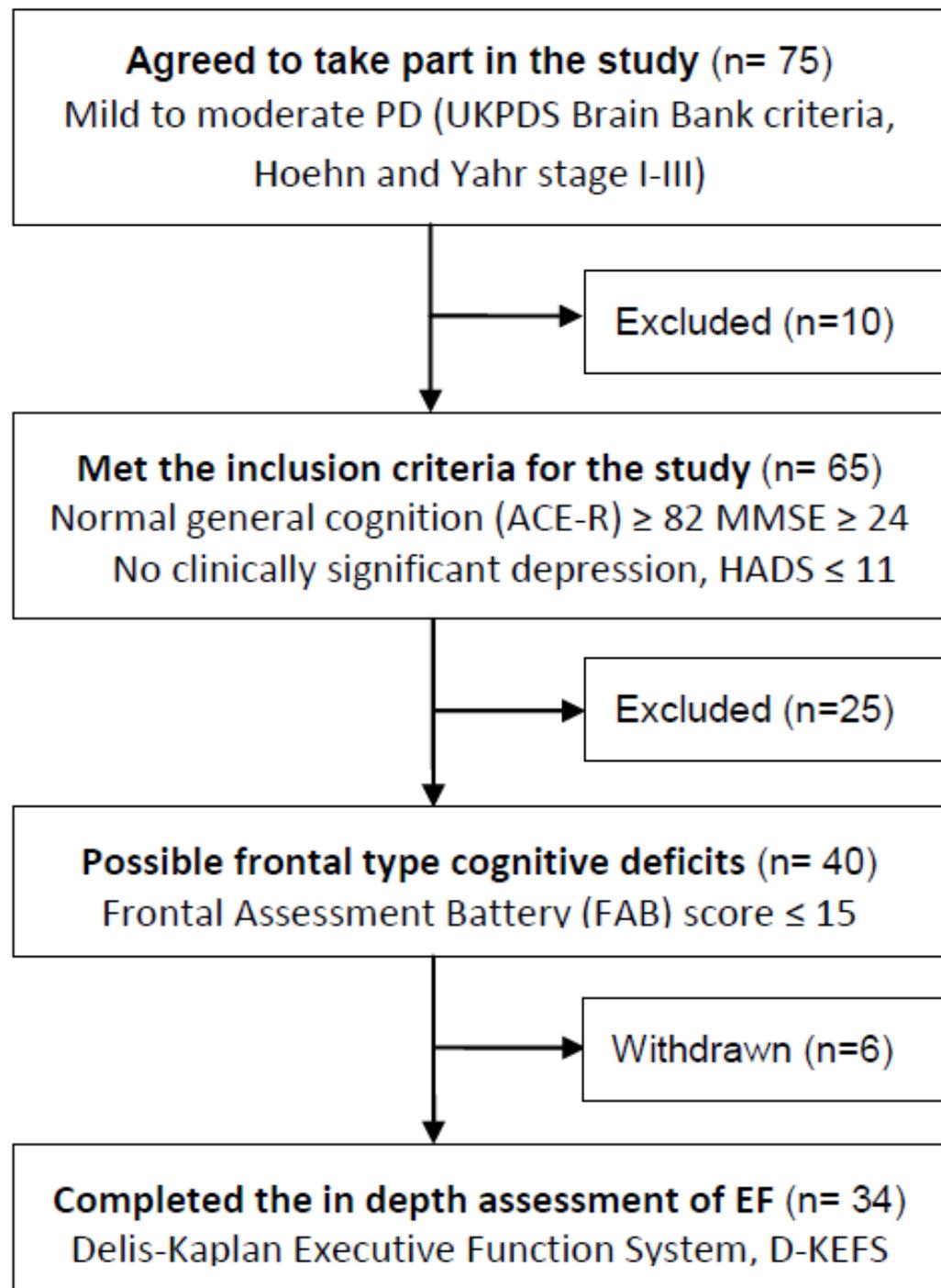
# Assessment

## Screening:

- The Addenbrooke's Cognitive Examination-Revised, ACE-R
- Hospital Depression and Anxiety Scale, HADS
- The Frontal Assessment Battery, FAB

## In depth assessment of EF:

- Delis-Kaplan Executive Function System, D-KEFS



# Participants

<b>N=34 (15 men)</b>	<b>M (SD)</b>	<b>Range</b>
<b>Age</b>	72.62 (8.27)	48 – 89
<b>Hoehn and Yahr stage</b>	1.42 (0.56)	1 – 3
<b>PD duration (months)</b>	68.21 (52.39)	10 – 204
<b>LED n = 33</b>	596.21 (626.55)	100 – 3125
<b>MMSE</b>	29.41 (1.10)	25 – 30
<b>ACE-R</b>	94.18 (4.65)	82 – 100
<b>FAB</b>	13.74 (0.96)	12 – 15
<b>HADS-Depression</b>	4.18 (2.04)	1 – 9

# Assessment of Executive Functions

## Delis-Kaplan Executive Function System, D-KEFS

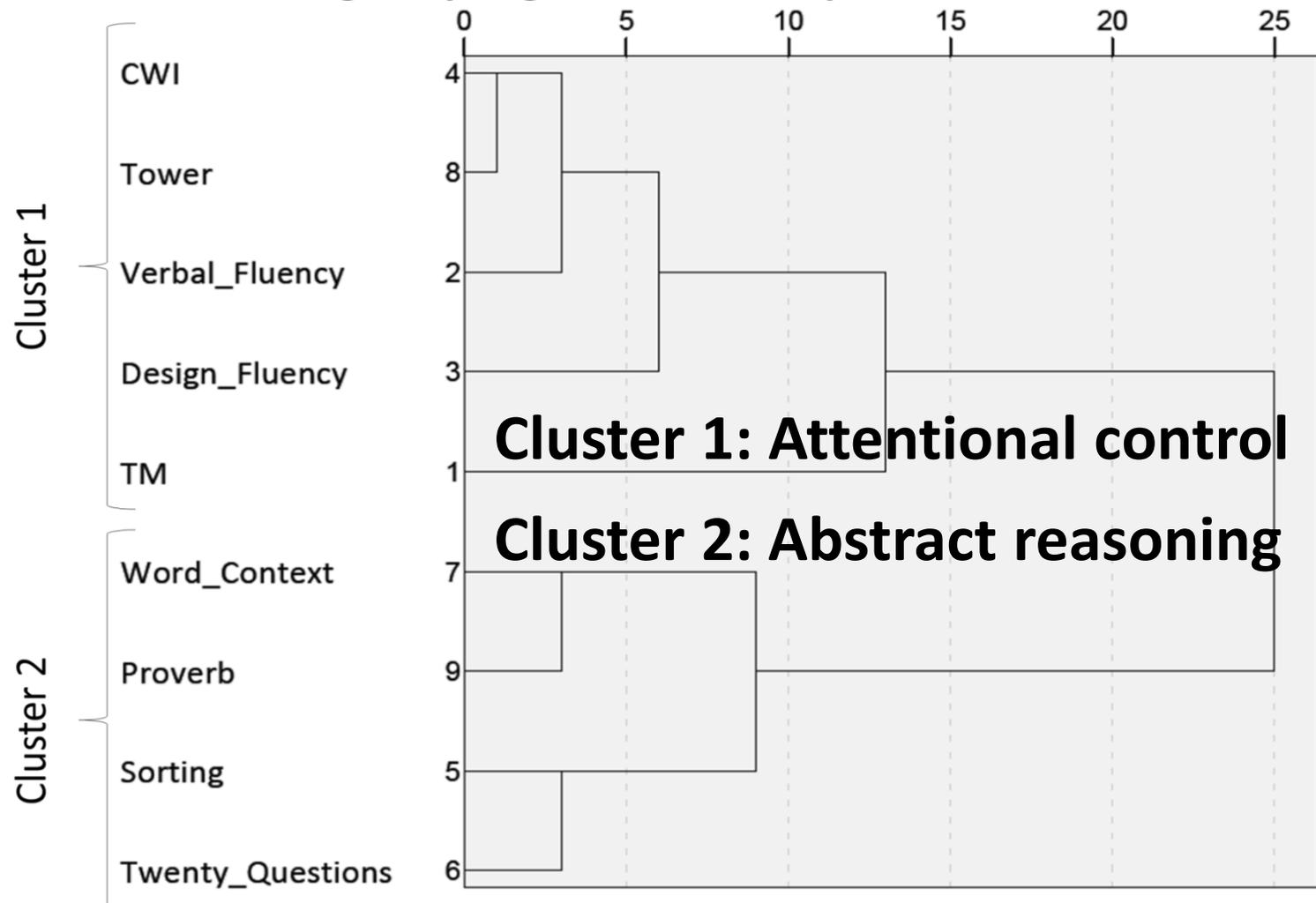
1. Trail Making (TM)
2. Verbal Fluency (VF)
3. Design Fluency (DF)
4. Colour Word Interference (CWI)/ Stroop paradigm
5. Sorting
6. 20 Questions
7. Word Context
8. Tower
9. Proverb

Scaled scores: 1 - 19

- **Normal:** scaled scores  $> 7$
- **Poor:** scaled scores of 6 and 7; comparable to the 9 - 24 percentile and 1.3-0.7 SD below the mean
- **Impaired:** scaled scores  $\leq 5$ ; comparable to  $\leq 5$ th percentile and  $\leq 1.5$  SD below the mean

# Pattern of performance: Cluster Analysis

Ward hierarchical grouping based on squared Euclidean distance



Average performance was significantly better on the Cluster 2 tests (mean = 11.33, SD = 1.81) than on the Cluster 1 tests (mean = 9.86, SD = 2.71) ;  $t(26) = -2.53$ ,  $p = .018$

# Pattern of performance: Discussion

- Progression of dopaminergic depletion in PD

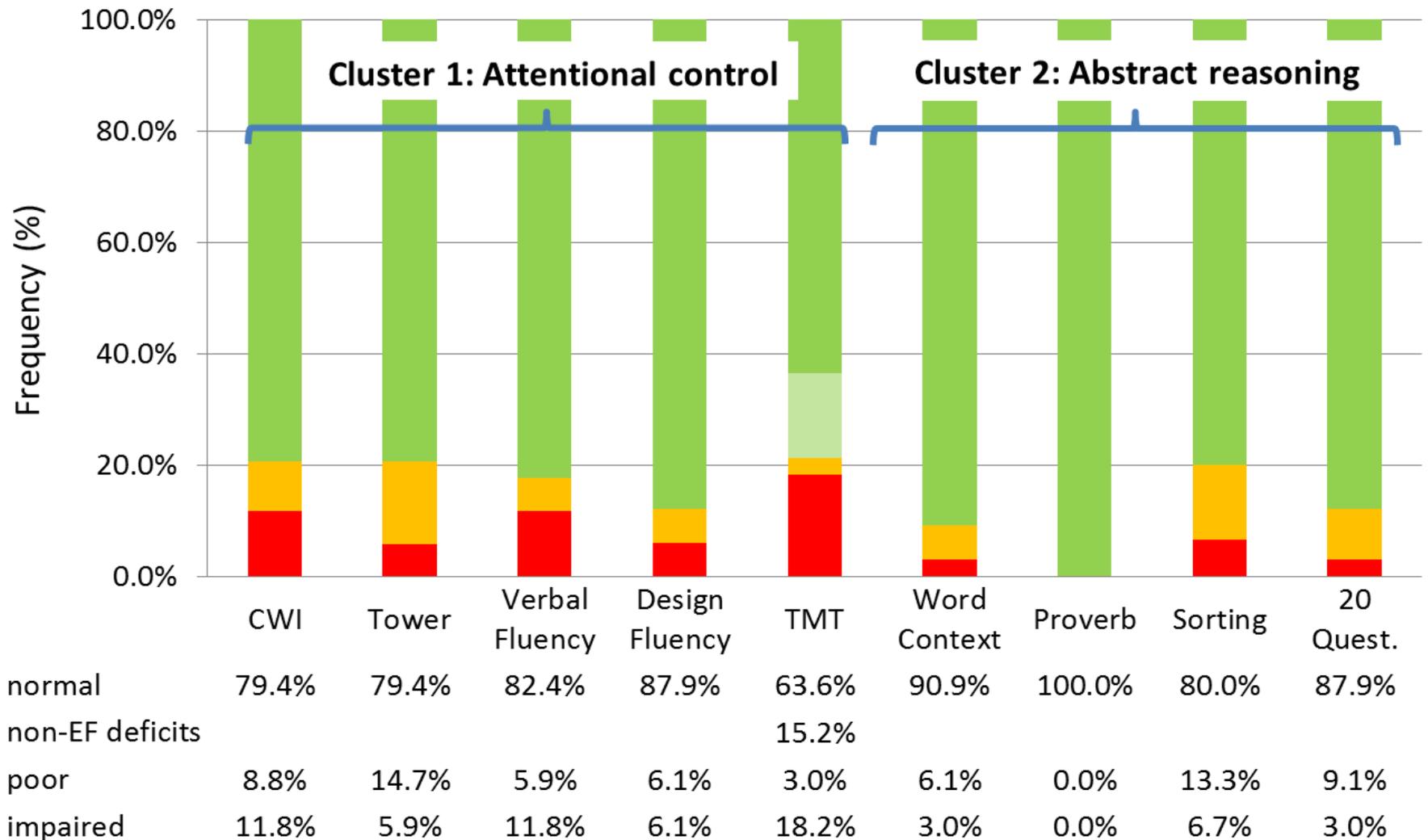
**Attentional control cluster:** Striatal dopaminergic depletion

→ disturbances in the inhibitory control and attentional shifting

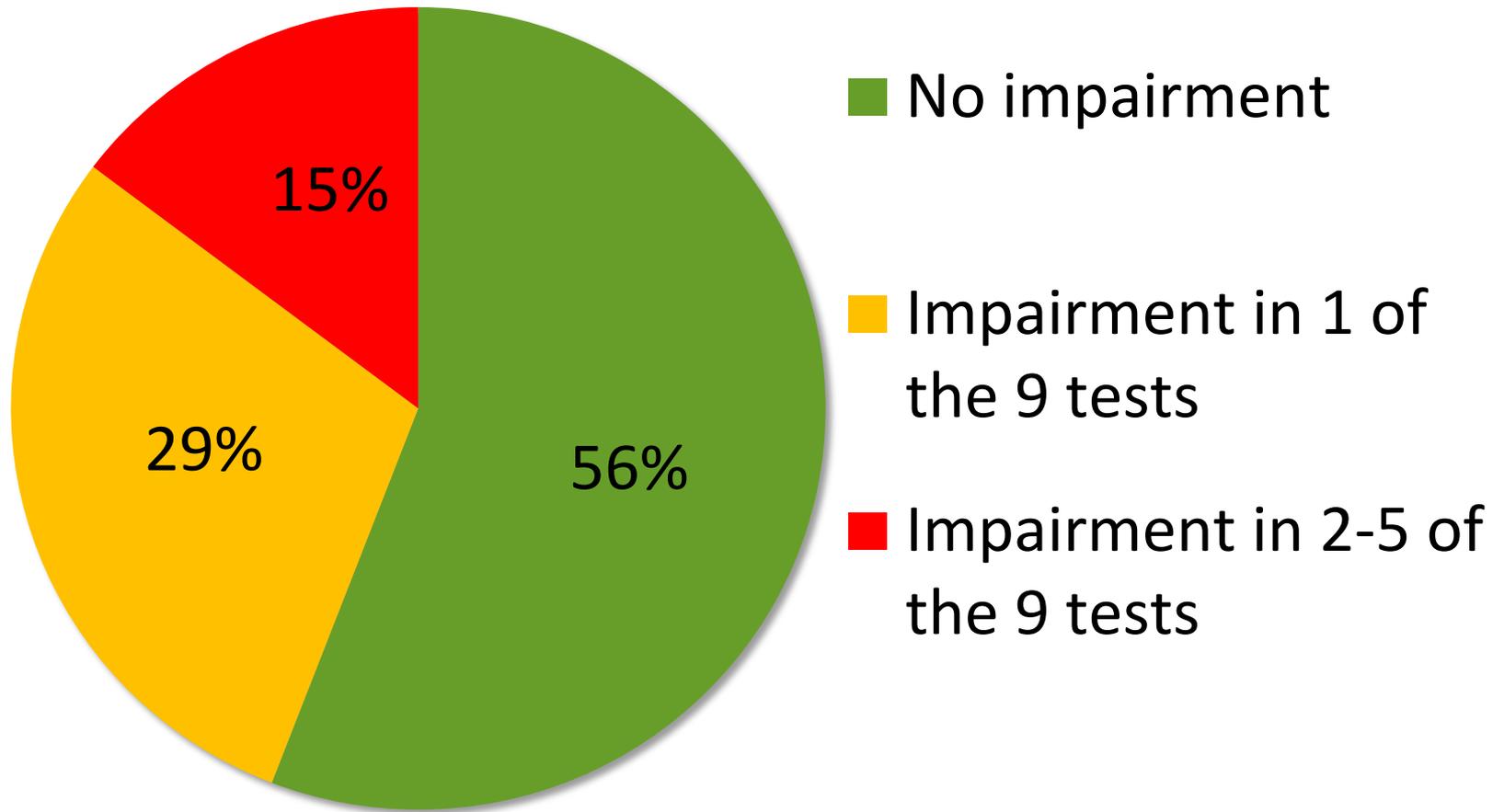
**Abstract reasoning cluster:** Anterior and frontopolar regions of the PFC and interconnections with other cortical sensory systems

→ difficulties in perceiving conceptual relationships and adopting different interpretations and understandings

# Frequency of impairment in D-KEFS tests (1)



## Frequency of impairment in D-KEFS tests (2)



# Frequency of impairment: discussion

- EF impairment in 15% of PwPD in the study group
  - Varying ways to define cognitive impairment [Liepelt-Scarfone et al., 2011]
    - 1SD vs. 2SD below mean
    - 1 impaired score vs. 2 or more impaired scores
  - 1 score 1.5 SD below mean (29%): area of possible difficulty
  - 2 or more scores 1.5 SD below mean (15%): estimate of the frequency of EF impairment in our group of PwPD

# Limitations

- The frequency rates may apply only to the subgroup of PwPD who underperformed in the screening test (FAB)
- The FAB may have distinguished PwPD with a specific profile of executive abilities

# Conclusions

- It seems that PD in the mild to moderate stages affects the attentional control to a greater extent than the abstract reasoning aspect of EF
- More than half of PwPD in the sample performed within the normal range on all nine EF tests
- 15% of PwPD in the study had significantly impaired scores in more than 1 test of D-KEFS.

# Acknowledgements

- Professor Linda Clare
- Dr John Hindle
- Dr Paloma Mari-Beffa
- Staff of the Movement Disorders Clinic at Llandudno Hospital and NEURODEM team who have helped greatly with recruitment of study participants

*THANK YOU*