Instrumental activities of daily living improve in Parkinson's disease after subthalamic deep brain stimulation

Josef Mana[1], Ondrej Bezdicek[1], Filip Růžička[1], Anna Fečíková[1], Evžen Růžička[1], Jan Roth[1], Pavel Filip[1,2], Petra Štofániková[1], Jan Peregrín[1], Markéta Volfová[1], Kateřina Zárubová[3] & Robert Jech[1]

[1]First Faculty of Medicine and General University Hospital in Prague, Charles University, Department of Neurology and Centre of Clinical Neuroscience, Prague, Czech Republic
[2]St. Anne's Hospital and Masaryk University, Medical Faculty, First Department of Neurology, Brno, Czech Republic
[3]Second Faculty of Medicine and Motol University Hospital, Charles University, Department of Neurology, Prague, Czech Republic

FIRST FACULTY OF MEDICINE
Charles University

Introduction

- Instrumental activities of daily living (IADL) represent cognitively demanding tasks such as following instructions or doing more than one thing at a time [1,2].
- While the effect of subthalamic deep brain stimulation (STN DBS) in Parkinson's disease (PD) on basic activities of daily living such as dressing or hygiene is well described, research on IADL is limited.
- This study aimed to assess post-surgery change in self-reported IADL of PD patients treated with a combination of STN DBS and levodopa replacement therapy.

Methods

- Thirty-two patients with PD (aged 55.5 ± 7.8 years, 56% males) were assessed before (4.9 ± 5.6 months) and one year after the surgery (12.4 ± 0.9 months).
- At both time-points, self-reported IADL was assessed by Penn Parkinson's Daily Activities Questionnaire-15 (PDAQ-15), cognition was assessed by Mattis Dementia Rating Scale (DRS-2) and levodopa equivalent daily dose (LEDD) was calculated for each patient.
- Statistical analyses were based on causal assumptions represented in Fig. 1: (i) to estimate the **total effect** of DBS in our sample, PDAQ was predicted by the time of assessment (pre- vs. post-surgery) alone, (ii) to estimate the **direct effect** of DBS in our sample, PDAQ was predicted by the time of assessment as well as DRS-2 and LEDD as covariates. Bayesian ordered-logit generalized linear models (GLMMs) with item- and person-specific varying effects were used to account for ordinal nature of PDAQ responses.

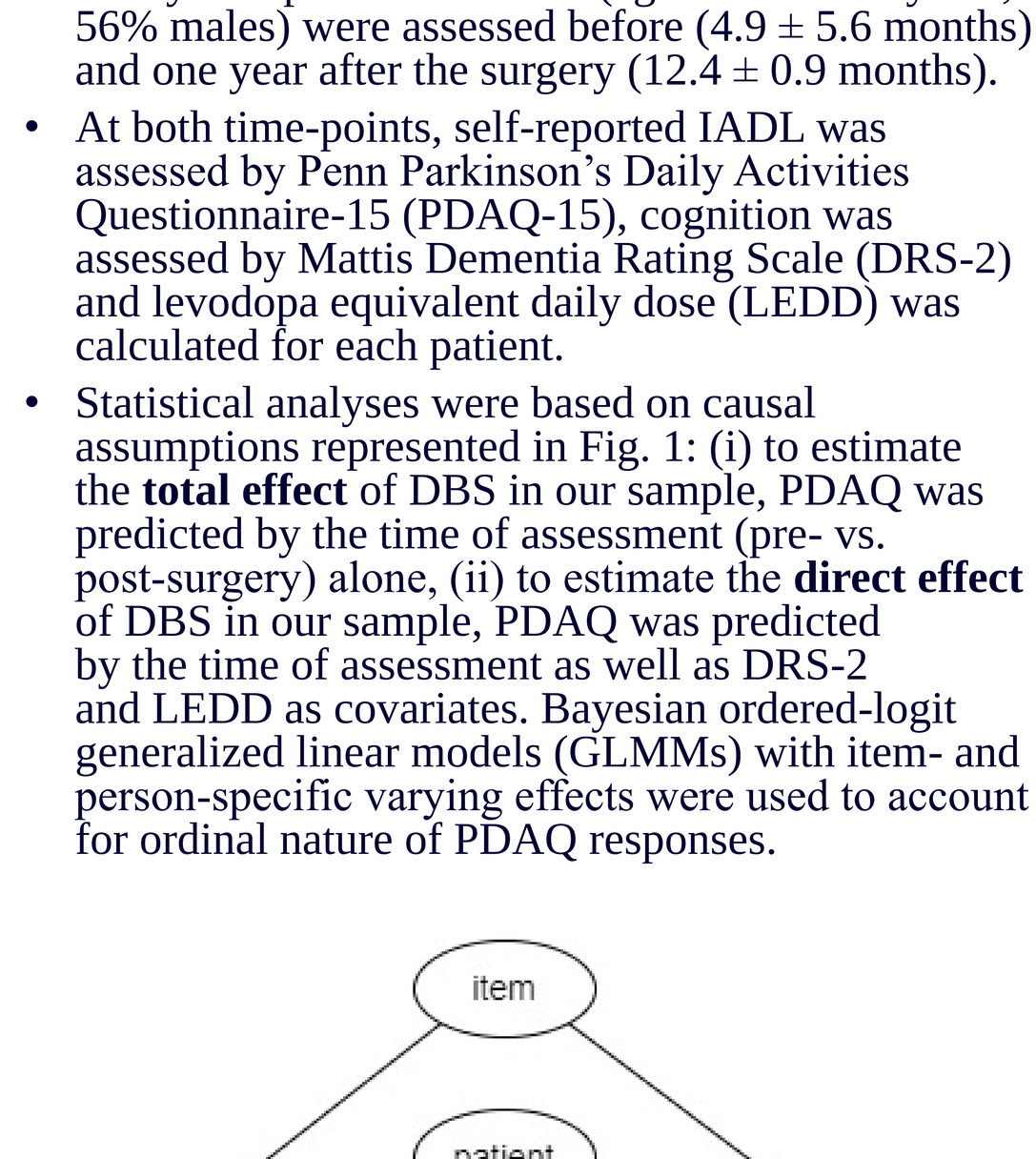

Fig. 1 Directed acyclic graph representing causal assumptions of current study, STN DBS is assumed to be adjusted for in all analyses due to the lack of a control group.

Results

- There was a significant **positive direct effect** of DBS on improvement in IADL. However, the total effect of DBS was less pronounced and non-significant (see Table 1).
- In a post-hoc analysis, percentual LEDD reduction after STN DBS predicted IADL. More LEDD reduction led to less post-surgery improvement in IADL (*b* = -0.32, 95% PPI [-0.59, -0.06]).

Table 1 Summary of generalized linear models' parameters estimating total and direct effects of STN DBS on IADL.

Predictor	Total effect	Direct effect
Time of assessment	0.21 [-0.07, 0.48]	0.56 [0.13, 0.99]
DRS-2	–	0.26 [-0.04, 0.55]
LEDD	–	0.23 [-0.08, 0.55]
Time of assessment × DRS-2	–	0.01 [-0.30, 0.32]
Time of assessment × LEDD	–	0.18 [-0.26, 0.60]

Note. × = statistical interaction; DBS = deep brain stimulation; DRS-2 = Dementia Rating Scale, second edition; IADL = instrumental activities of daily living; LEDD = levodopa equivalent daily dose; STN = subthalamic nucleus; Time of assessment = positive values indicate post-surgery improvement, negative values indicate post-surgery decline in IADL. Values are posterior median regression parameters and their 95% posterior probability intervals (PPIs).

Conclusions

- Our results indicate that STN DBS has a **positive effect on self-reported IADL**.
- However, this post-surgery IADL improvement **can be lowered by** a high post-surgery **LEDD reduction**.
- Only limited LEDD reduction after STN DBS is thus recommended to maximize improvement in patient-reported IADL.

References

[1] Brennan, L., Siderowf, A., Rubright, J.D., Rick, J., Dahodwala, N., Duda, J.E., Hurtig, H., Stern, M., Xie, S.X., Rennert, L., Karlawish, J., Shea, J.A., Trojanowski, J.Q., and Weintraub, D. (2016a). Development and initial testing of the Penn Parkinson's Daily Activities Questionnaire. *Mov Disord* 31**,** 126-134.

[2] Brennan, L., Siderowf, A., Rubright, J.D., Rick, J., Dahodwala, N., Duda, J.E., Hurtig, H., Stern, M., Xie, S.X., Rennert, L., Karlawish, J., Shea, J.A., Trojanowski, J.Q., and Weintraub, D. (2016b). The Penn Parkinson's Daily Activities Questionnaire-15: Psychometric properties of a brief assessment of cognitive instrumental activities of daily living in Parkinson's disease. *Parkinsonism Relat Disord* 25**,** 21-26.

Grant Support: AZV NV19-04-00233 offered by the Czech ministry of health, GA UK 254121 offered by Grant Agency of Charles University and JPND 733051123 offered by the EU Joint Programme on Neurodegenerative Disease Research.