

Levels of Evidence and Deep Brain Stimulation for Patients with Parkinson's Disease

Kayla Duffee

University of Wyoming

The Need for High-Quality Research in Speech-Language Pathology

- Many treatments already in use without evidence that they work
- Must know if it's worth the time, effort, and money

Parkinson's Disease (PD)

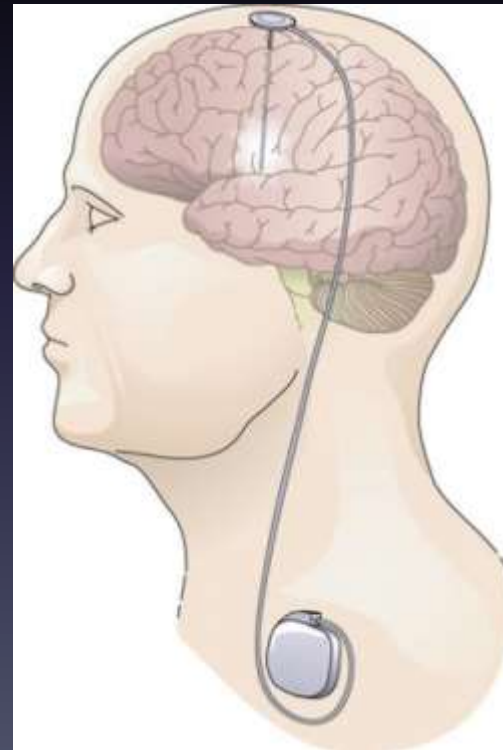
- Neurons that produce dopamine degenerate over time, which adversely affects movement (Rouse, 2016)
- Incidence rates: 0.3% of general population, 1% of population over 60 (Nussbaum & Ellis, 2003)
- Symptoms
 - Tremor, slowed movement, and rigidity
 - Problems walking (gait abnormalities)
 - Dysarthria: slow and stiff speech movements, breathy and monotonous voice (Rouse, 2016)

Walking and Talking: Quality of Life for People with PD

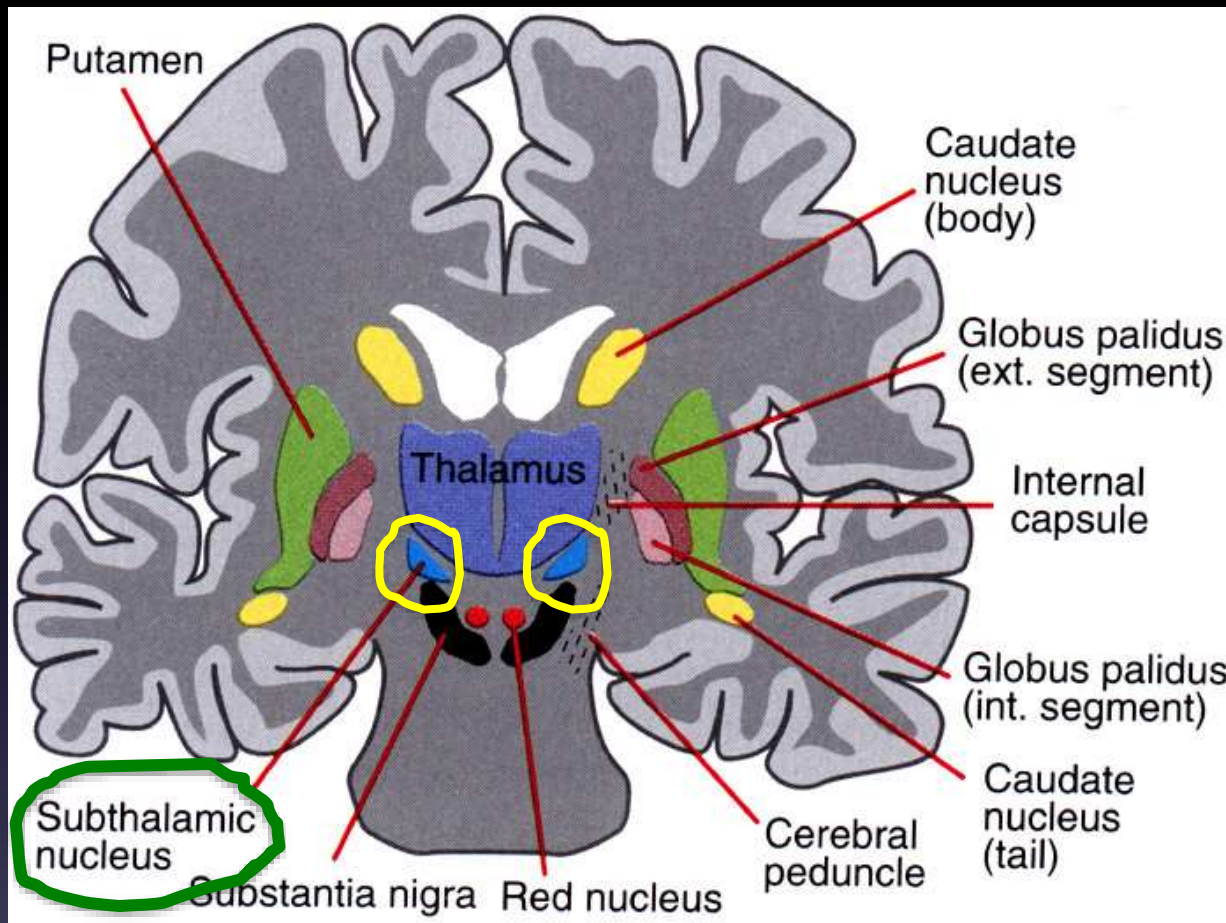
- Daily functioning often rated subjectively on a Likert scale
 - Therefore the goal is not esoteric—the patients must perceive a difference in treatment

Deep Brain Stimulation (DBS)

- Electrical stimulation of the brain using electrodes and a pulse generator (Gielen & Molnar, 2012)



Subthalamic Nucleus (STN)



- Involved in fine-tuning of speech motor plans
- Damage can cause rigidity and tremor (Rouse, 2016)

My Clinical Question

- What is the effect of subthalamic nucleus deep brain stimulation on parkinsonian gait and dysarthria?

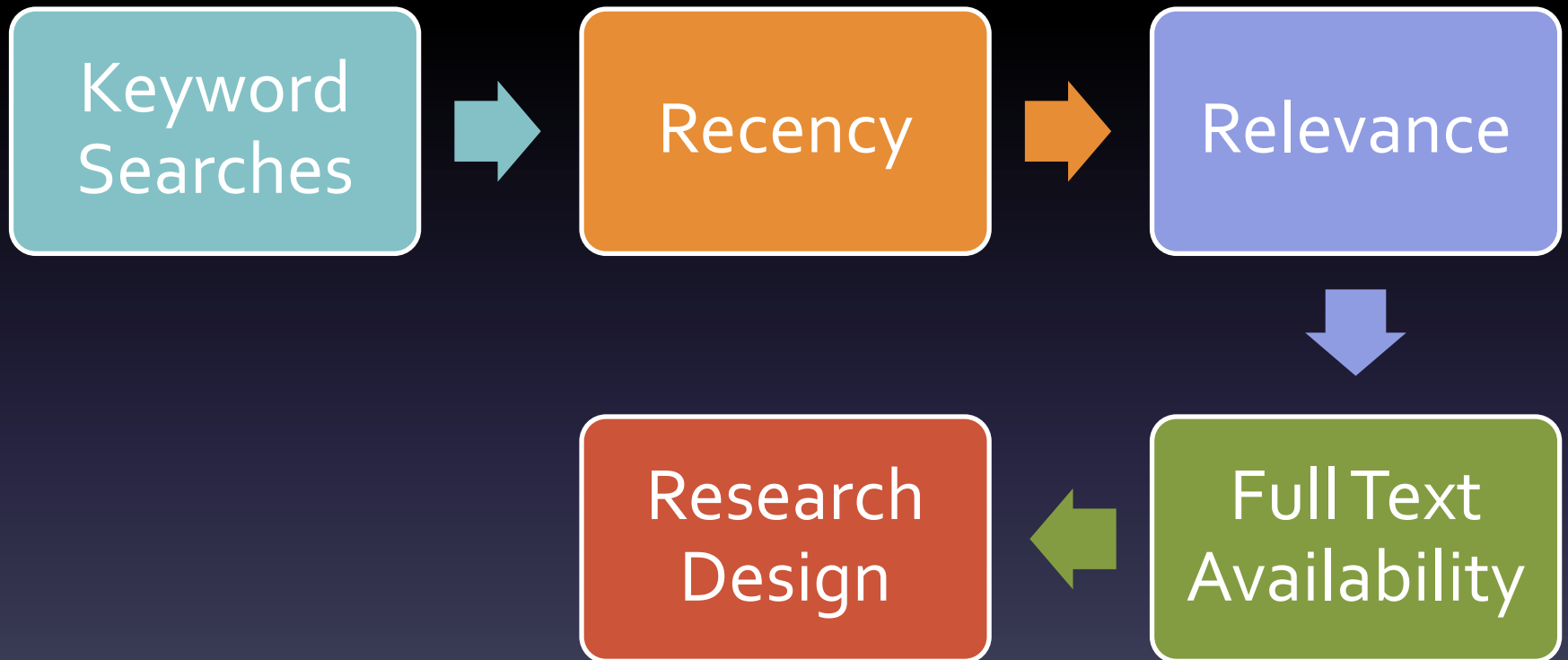
Evidence-Based Practice



The Search for Evidence

- Keywords: *deep brain stimulation, subthalamic nucleus, Parkinson's Disease, gait, dysarthria*
- Three databases used:
 - PubMed, CINAHL, & ComDisDome

Narrowing Results



“Best Available” Research

- Some criteria for high-quality, experimental research:
 - Published in a peer-reviewed journal
 - Specific, testable question
 - Control or alternate treatment condition
 - Testers blind to conditions
 - Statistical analysis of results

Evaluating Level of Evidence

Evaluating the Evidence

	Astrom et al., (2010)	Jones et al., (2010)	Sauvageau et al., (2014)	Schupbach et al., (2005)	Tornqvist et al., (2005)	Rocchi et al., (2012)	Van Nuenen et al., (2008)	Shivitz et al., (2006)
Published in peer-reviewed journal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Specific testable question	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control or alternate treatment condition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Randomized participant assignment	No	No	No	Yes	No	Yes	No	No
Testers blind to condition assignment	Yes	Yes	No	No	Yes	Yes	No	No
Conditions or phases similar	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tester reliability reported	No	Yes	Yes	No	Yes	No	No	No
Treatment well described	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Treatment fidelity reported	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Outcome measures appropriate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Statistical significance reported	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Effect size or other measure of practical significance	No	No	No	No	No	No	No	No
Score:	Mod.	High	High	High	High	High	Mod.	Mod.

Level of evidence scores: Low (1-4 “yes” answers), Moderate (5-8 “yes” answers), High (9-12 “yes” answers)

High Level of Evidence

- Gait
 - Rocchi et al. (2012)
- Dysarthria
 - Jones et al. (2010)
 - Sauvageau et al. (2014)
 - Schupbach et al. (2005)
 - Tornqvist et al. (2004)

Effect of DBS on Step Initiation

Rocchi et al. (2012)

- Patients asked to take two steps from a standing position
- 29 patients randomly assigned to two types of DBS
 - 28 healthy control participants, 9 participants with PD without DBS
- 6 months of DBS (either type) significantly impaired step initiation
- Strengths
 - Control groups, randomization
- Weaknesses
 - Didn't report tester reliability, no measure of practical significance

Motor Program Maintenance vs. Switching

Jones et al. (2010)

- Tested the time it took to program speech sequences
- 12 participants with PD and different types of DBS
 - DBS increased speed of all responses
- Strengths
 - Testers blind to stimulation conditions
 - Randomized response-priming program
- Weaknesses
 - Small sample size → difficult to generalize
 - Self-enrolled

Moderate Level of Evidence

- Gait
 - Shivitz et al. (2006)
 - Van Nuenen et al. (2008)
- Dysarthria
 - Astrom et al. (2010)

Moderate Level of Evidence

- Did not report:
 - Statistical significance
 - Treatment fidelity
 - Tester reliability

Speech Intelligibility During DBS

Astrom et al. (2010)

- Tested intelligibility during different settings of DBS of the STN—
low vs. high frequency stimulation
- 10 participants with PD and DBS of the STN
 - Assessed prolonged “ah” and 60 second free monologue
- 6 of 10 were less intelligible during high frequency stimulation
- Strength
 - Testers and participants blind to stimulation conditions
- Weakness
 - No statistical analysis

The Evidence-Based Decision

- STN DBS tends to worsen gait and dysarthria
 - Mixed evidence concerning gait
 - Improvement in postural stability
 - Impairment in step initiation and gait quality
 - Mixed evidence concerning dysarthria
 - STN DBS seems to usually make dysarthria worse, though the degree varies by parametric setting
- Next steps: research parametric settings and complementary treatments

Conclusion

- STN DBS is not an effective treatment for gait or dysarthria
 - Only improves some aspects of movement
 - Negative effects can be minimized, but not reversed to improve gait or dysarthria

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