A Systematic Review of Stakeholder Perspectives on Cognitive Effects of Brain Stimulation

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Introduction

Brain stimulation (e.g., DBS, tDCS, etc) is an emerging technique for the treatment of neurological and psychiatric conditions. Despite its promise, there is an accumulating body of literature on unintended motor, psychiatric or psychosocial effects of neurostimulation. Changes to language, memory, and other cognitive processes, on the other hand, have been relatively understudied and underreported by patients, caregivers, and healthcare providers. This trend parallels an increased scientific and medical interest in the use of brain stimulation to treat disorders of cognition, such as dementia.

Systematic reviews of brain-computer interface (BCI) studies using social research methods have proven useful to guide further qualitative research on patient experience. However, brain stimulation and its cognitive effects have not been the focus of such reviews.

Aim: Characterize actual and expected cognitive effects reported in previous qualitative literature on brain stimulation.

Methods

A PubMed database search for qualitative studies on brain stimulation yielded 34 unique datasets from 41 publications that include quoted responses to open-ended interview or survey questions.

Primary Search: (brain stimulation) AND (perspective OR perspectives) OR (opinion OR opinions) OR (view OR views) OR (interview OR interviews) OR (qualitative)

Secondary Search: ((“responsive neurostimulation”) OR (brain computer interface OR brain computer interfaces) OR (brain machine interface OR brain machine interfaces) OR transcranial direct current stimulation OR transcranial magnetic stimulation OR transcranial alternating current stimulation)) AND ((perspective OR perspectives) OR (opinion OR opinions) OR (view OR views) OR (interview OR interviews) OR (qualitative))

Of these 34 datasets, 14 (41%) had at least one associated publication addressing actual or expected cognitive effects. Only cognitive effects were analyzed.

Main Results

Data Collection

Patient-reported cognitive effects or expectations were identified in 7 (50%) of the 14 datasets. Only 1 (14%) of these datasets were sourced by asking patients about cognitive effects. Provider-reported cognitive effects were identified in 5 (36%) of the 14 datasets. 4 (80%) of these datasets asked providers about expectations/experiences related to cognitive enhancement (Fig. 2).

Indicated Treatment Effect

Quoted patients (primarily treated for Parkinson’s disease) indicate that brain stimulation worsens cognition more than it restores. Quoted providers indicate that brain stimulation worsens, restores, and enhances cognition with equal frequency.

Discussion

Our findings suggest that previous qualitative literature on brain stimulation lacks focused attention to patient perspectives on cognitive effects. This leads to underreported cognitive impairment experienced by patients and a lack of knowledge about patient experience/experiences related to restorative or enhance cognitive effects.

Future studies of neurostimulation should aim to more consistently and rigorously evaluate patient perspectives on potential cognitive effects. Researchers and clinicians involved in existing studies may also benefit from development of qualitative tools that assess cognitive effects on device users.

Next Steps

Over the next year, we will develop a cognition-specific qualitative interview guide as we conduct semi-structured interviews with (1) epilepsy patients undergoing targeted hippocampal stimulation for memory enhancement, (2) individuals with mild amnestic cognitive impairment, and (3) individuals with elevated biomarkers for Alzheimer’s disease.