



# Case Report on the Efficacy and Safety of Repetitive Transcranial Magnetic Coil Stimulation (rTMS) in Aphasia in Alzheimer's disease

Gayatri Devi, MD<sup>1, 2, 3</sup>, Elizabeth Shin, BA<sup>1</sup>, James Halper, M.D.<sup>3</sup>, Sandy Lowe, M.D.<sup>3</sup>, Henning U. Voss, Ph.D.<sup>4</sup>

<sup>1</sup>The New York Memory and Healthy Aging Services, New York, NY; <sup>2</sup>New York University School of Medicine, Department of Neurology, New York, NY; <sup>3</sup>New York University School of Medicine, Department of Psychiatry, New York, NY; <sup>4</sup>Citigroup Biomedical Imaging Center, Weill Cornell Medical College, New York, NY



## BACKGROUND

Aphasia is a common symptom of Alzheimer's disease (AD). Between 36%-82% of patients with mild to moderate AD have aphasia.<sup>[1]</sup> Repetitive transcranial magnetic stimulation (rTMS) is a safe and noninvasive technique of modulating cortical activity on focal areas of the brain and can inhibit or excite the brain depending on the frequency of stimulation.<sup>[2]</sup>



In treating aphasic stroke patients, inhibition of the hemisphere contralateral to the language area improved language deficits, with benefits lasting for up to 8 months after treatment.<sup>[3]</sup> In a single case of primary progressive aphasia patient, there were immediate and lasting benefits on activating the prefrontal cortex.<sup>[4]</sup> In healthy patients, stimulation of the prefrontal cortex increased speed of naming.<sup>[5]</sup> High frequency stimulation of the dorsolateral prefrontal cortex (DLPFC) improved language performance in aphasic AD patients immediately after stimulation, although no long term follow up data was available.<sup>[6]</sup>

## OBJECTIVE

In this case report, we investigated the short and longer term effects of rTMS in treating aphasia in a patient with AD.

## METHODS

The case was a 75 year old journalist who noticed progressively increasing difficulty with language and word finding over the preceding seven years. In addition, there was some difficulty with memory and other cognitive functions. He was diagnosed with probable Alzheimer's disease using NINCDS-ADRDA criteria (National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association).

He was placed on memantine and donepezil and observed for a period of two years. He was then enrolled as the first patient into an ongoing, open-label, uncontrolled trial of rTMS in treating aphasia in Alzheimer's disease.

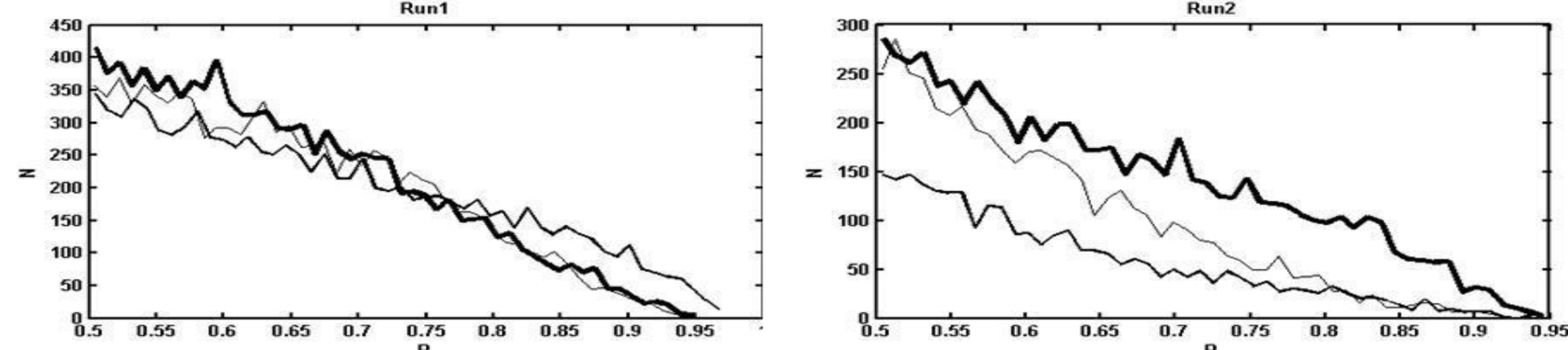
At baseline, a brief cognitive battery and an fMRI study were performed. He then underwent 4 courses of rTMS stimulation over two weeks. Both dorsolateral prefrontal cortices were stimulated at 10 Hz frequency at 90% of the motor threshold using a Magstim Rapid<sup>2</sup> stimulator. The fMRI and cognitive battery were repeated at the end of the two weeks to assess immediate effects, and again 4 weeks after completion of the stimulation to assess long term effects.

## RESULTS

**Tolerability:** The patient was able to tolerate the rTMS treatments well without any adverse effects. **Efficacy:** Subsequent to the rTMS treatments, the patient demonstrated improved performances in specific subtests of the abbreviated cognitive battery. The improvement was seen after 2 weeks of rTMS and sustained 4 weeks post-treatment. His fMRI studies showed increased bilateral activation for language and motor tasks, seen after 2 weeks of rTMS and sustained 4 weeks post-treatment. At 2 months follow up, the patient was noted to have become more verbal and communicative. Specifically, he began writing his memoirs and began leading a group on Alzheimer's disease in his community.

Table 1: Performance on Cognitive Test Battery Over Time

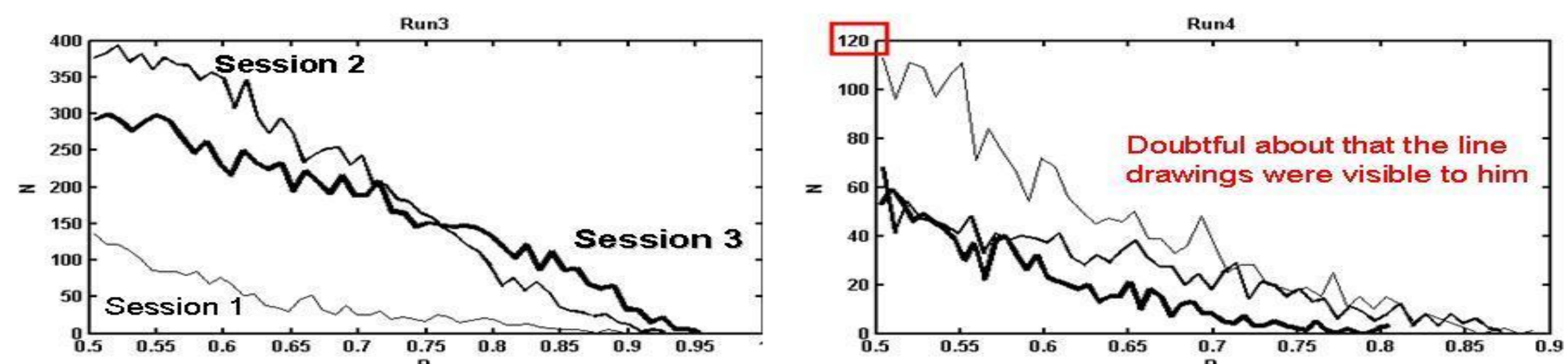
Tests	Baseline (raw score)	Post-treatment (raw score)	4 weeks Post-treatment (raw score)
BDAE (spontaneous)	15/15	15/15	15/15
CFL category naming	15	17	17
Oral expression (nonverbal agility)	8/12	11/12	12/12
Oral expression (verbal agility)	12/14	14/14	14/14
Complex ideational material	7/8	8/8	8/8
Responsive naming	20/20	20/20	20/20
Commands	15/15	15/15	15/15
Mini-mental status score	27/30	28/30	29/30



Histograms of correlation coefficients > 0.5 over the whole brain

rTMS graphs

Session 1 Session 2 Session 3

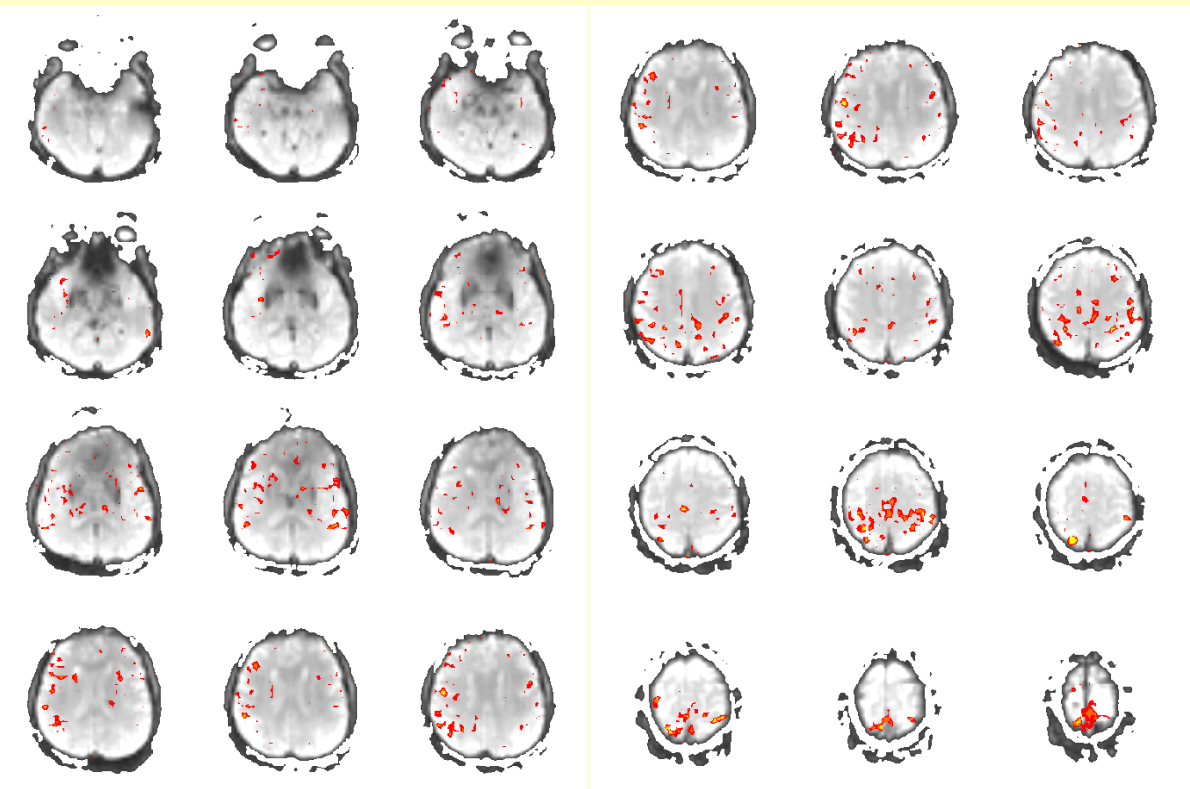


## RESULTS

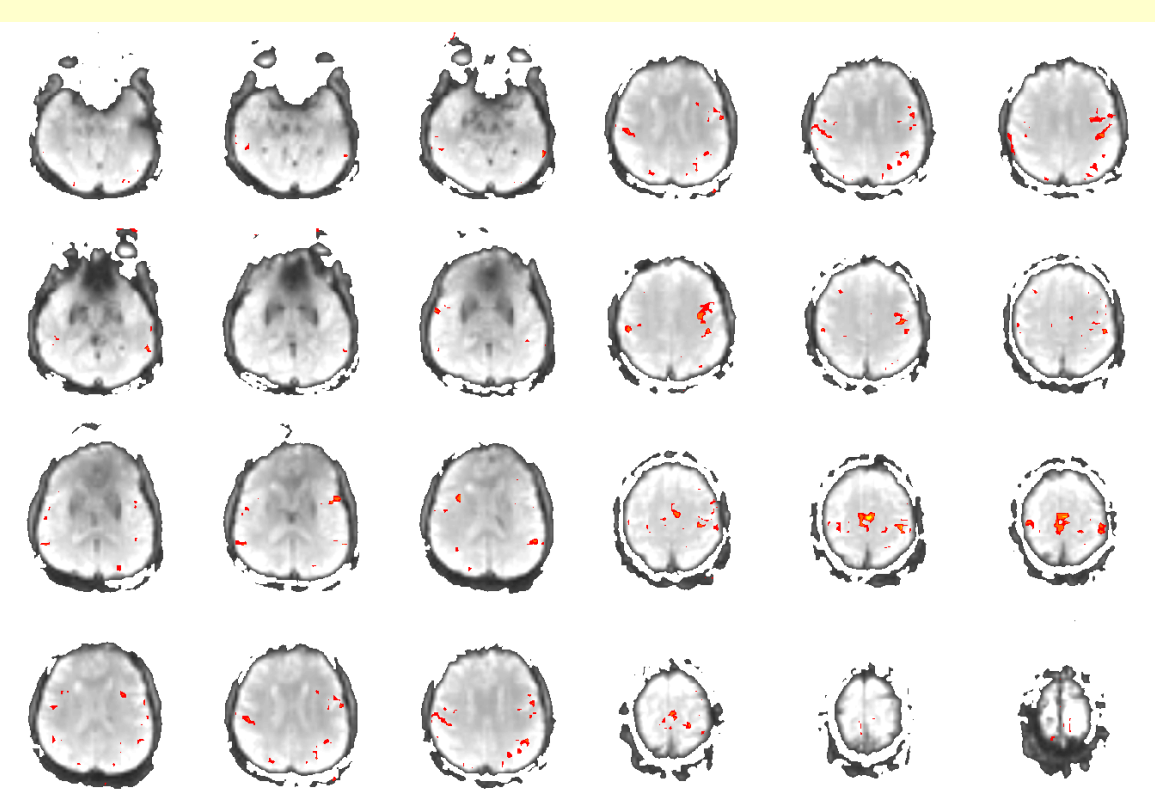
Time of Scan

fMRI scans on specific tasks

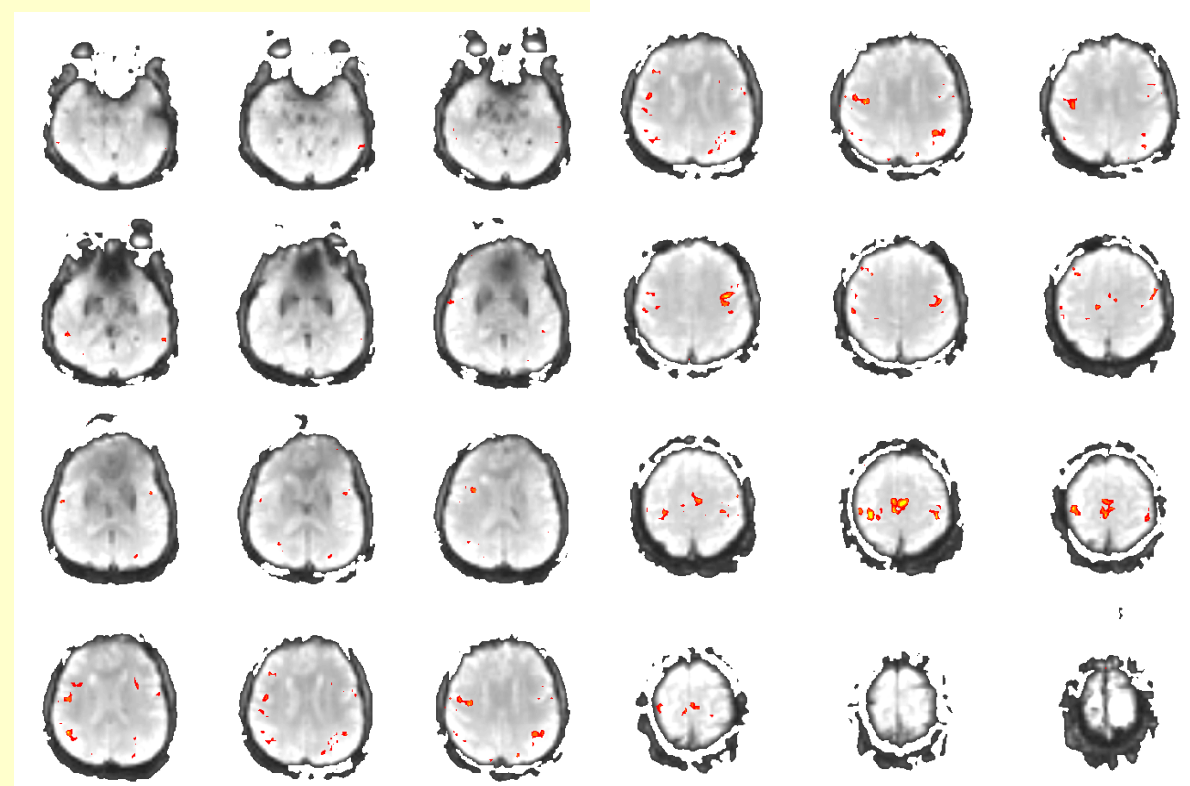
Baseline – Session 1



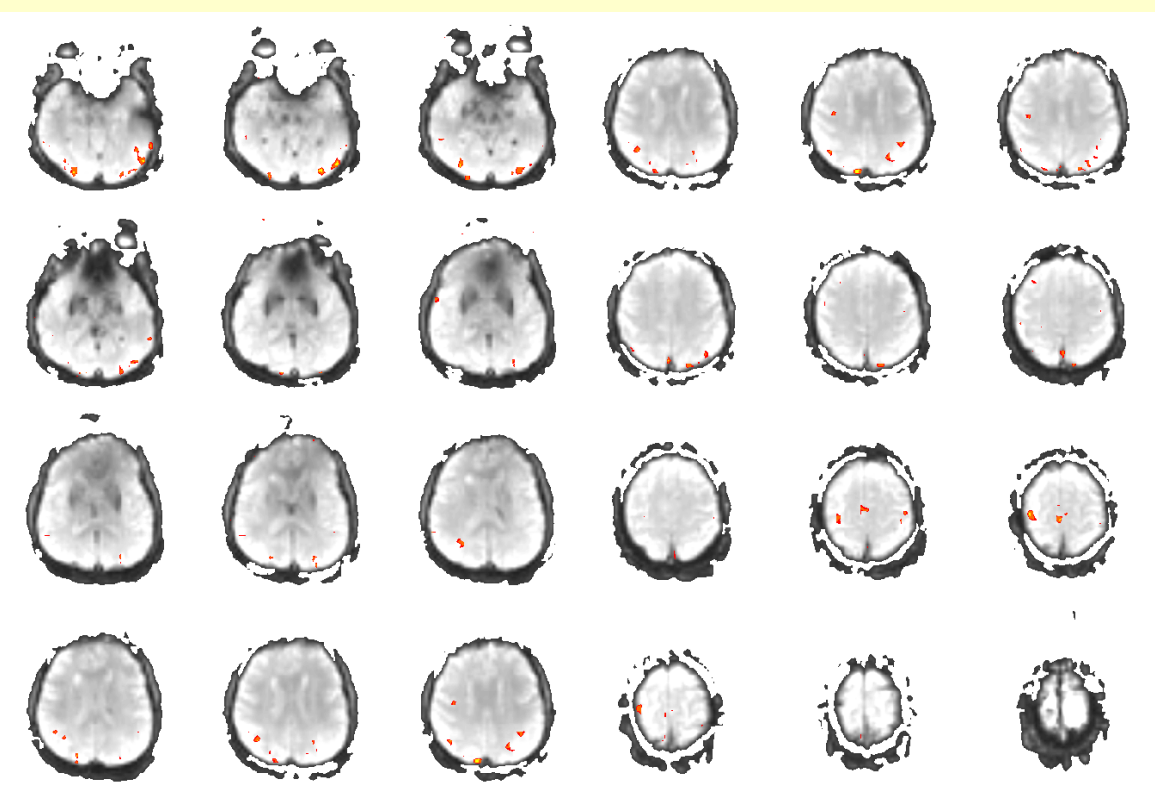
1. motor



2. word generation

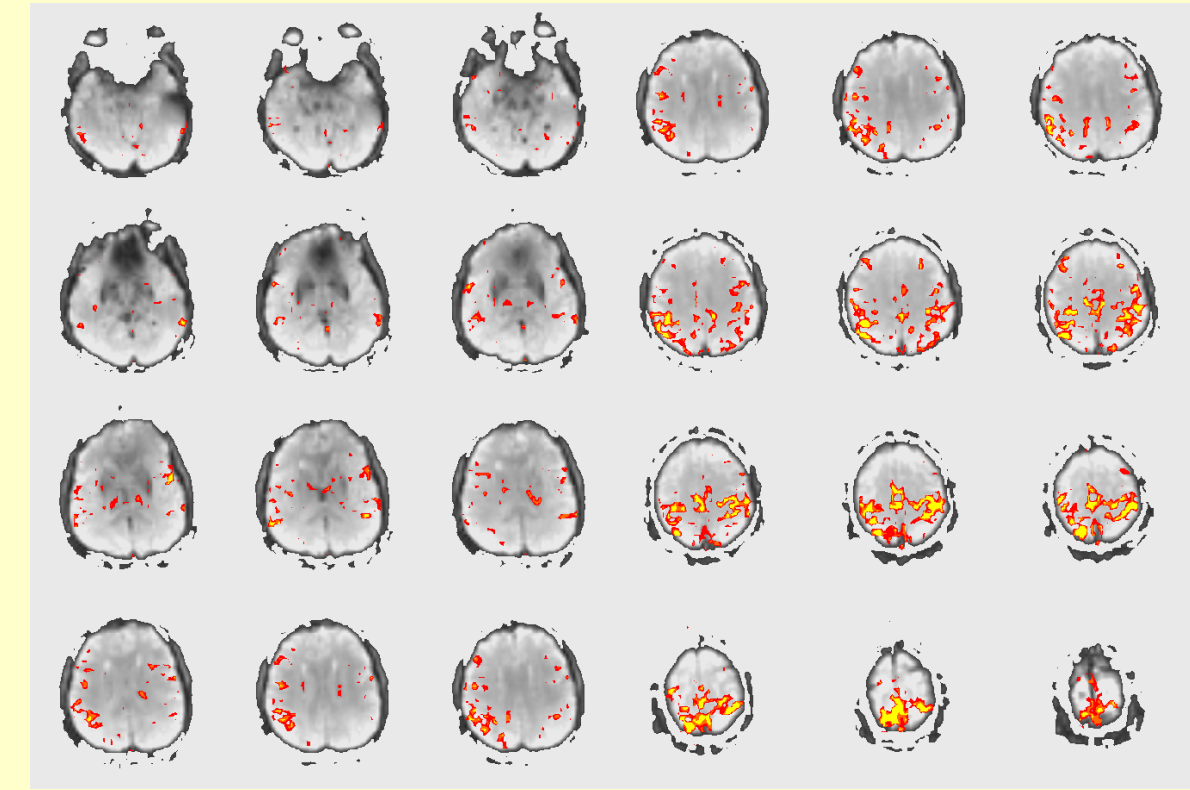


3. rhyming

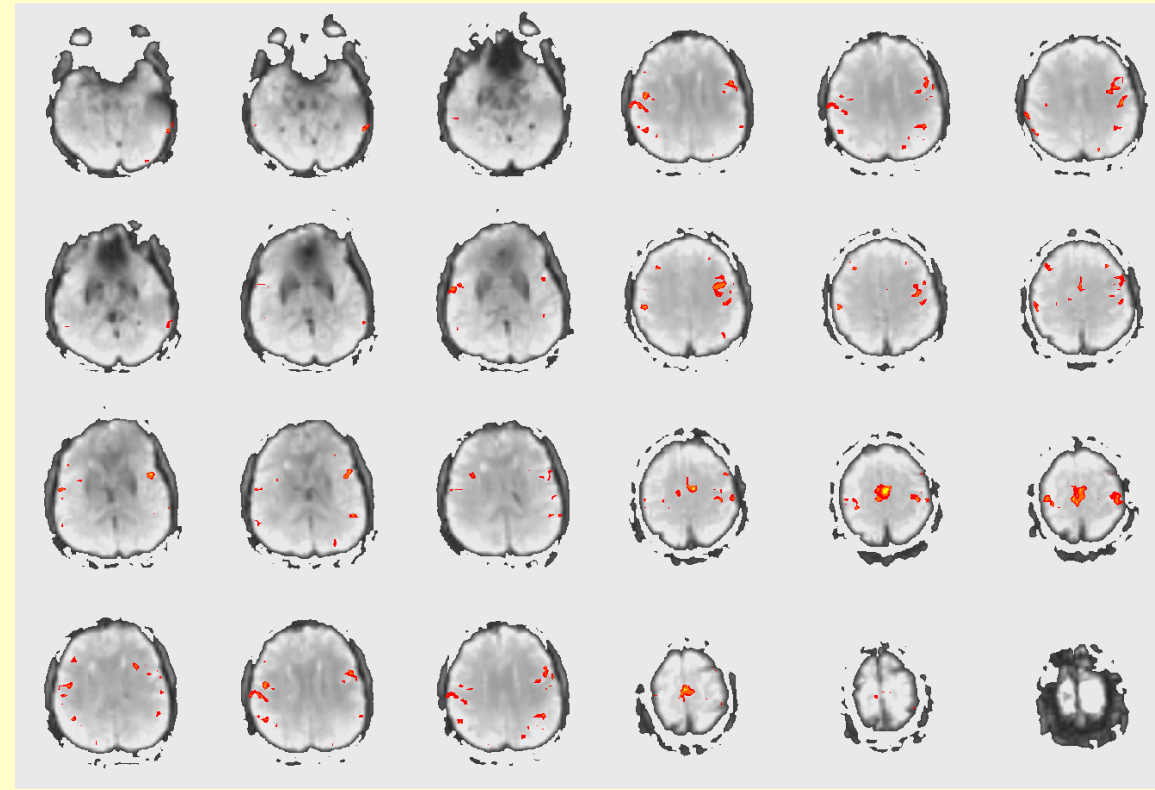


4. picture naming

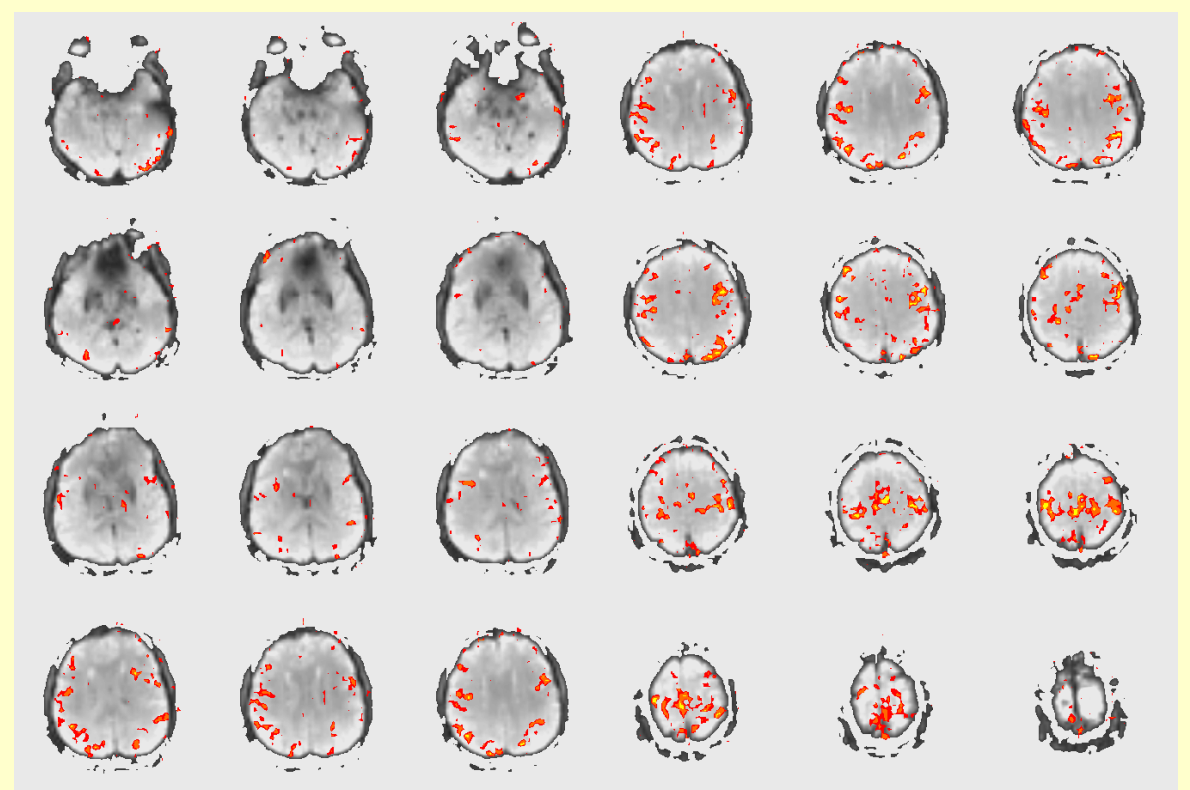
Post treatment – Session 2



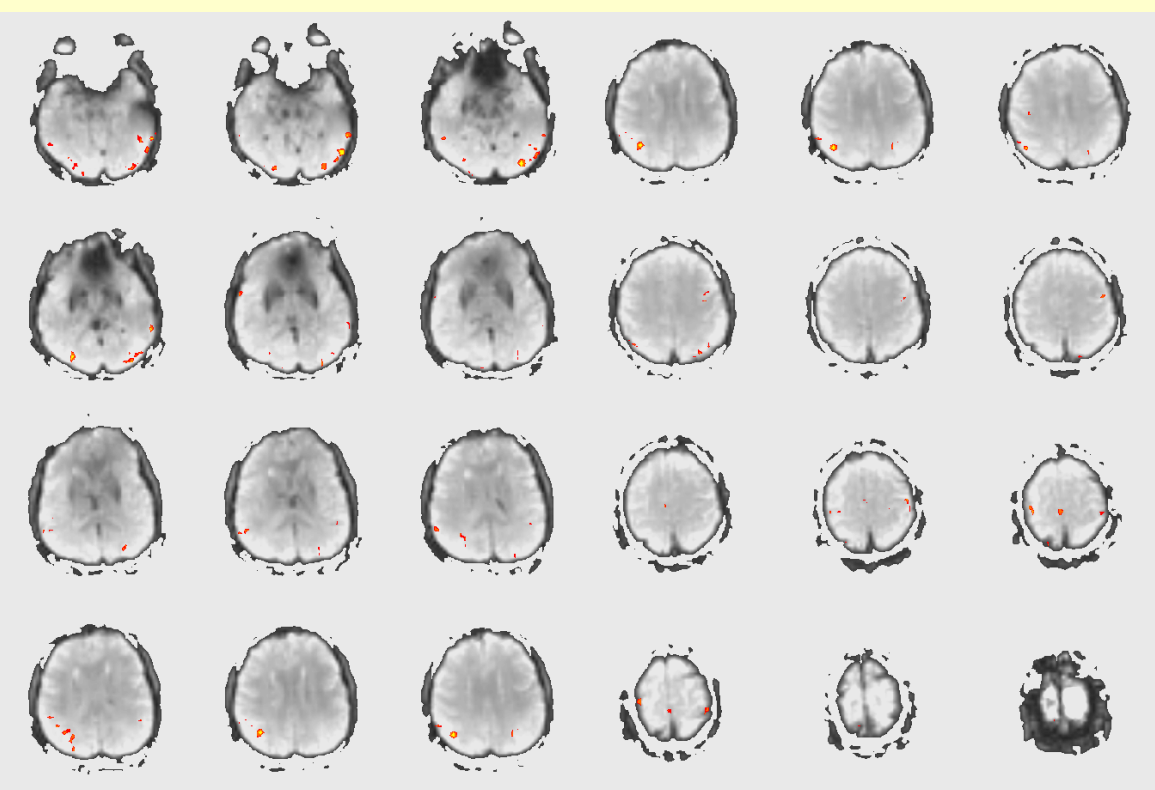
1. motor



2. word generation

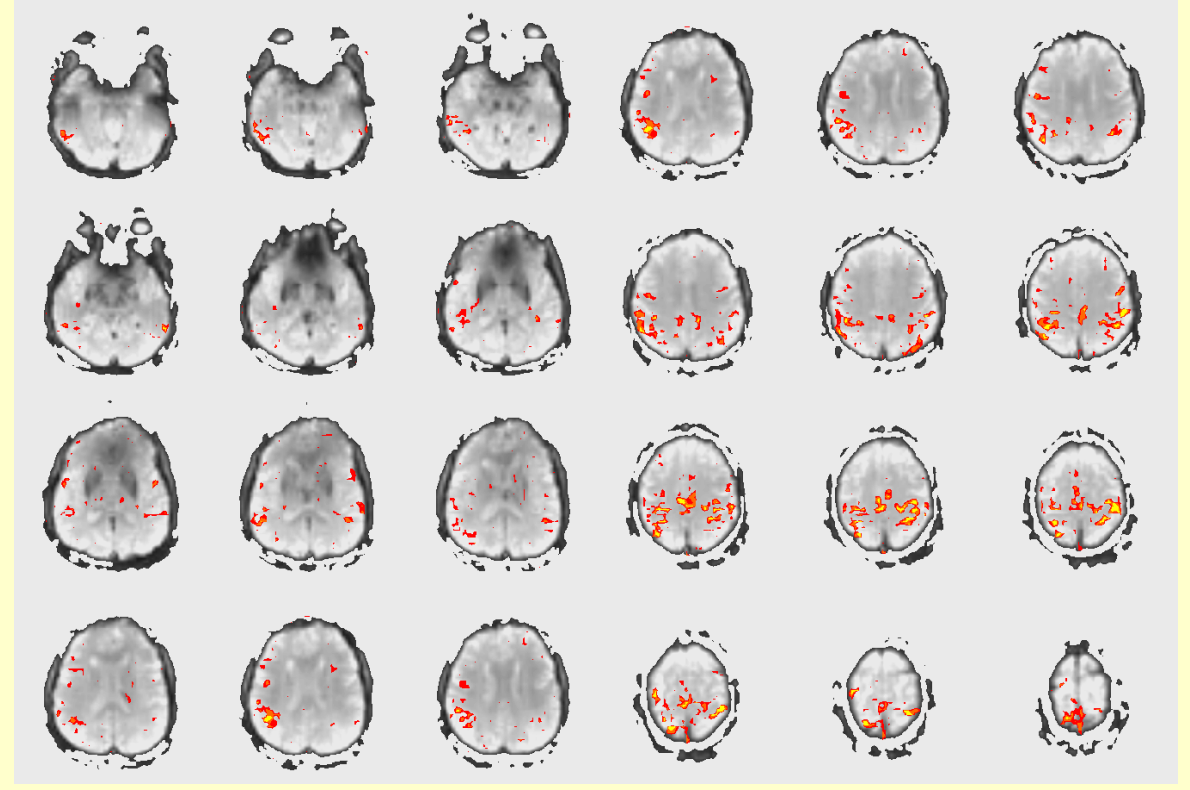


3. rhyming

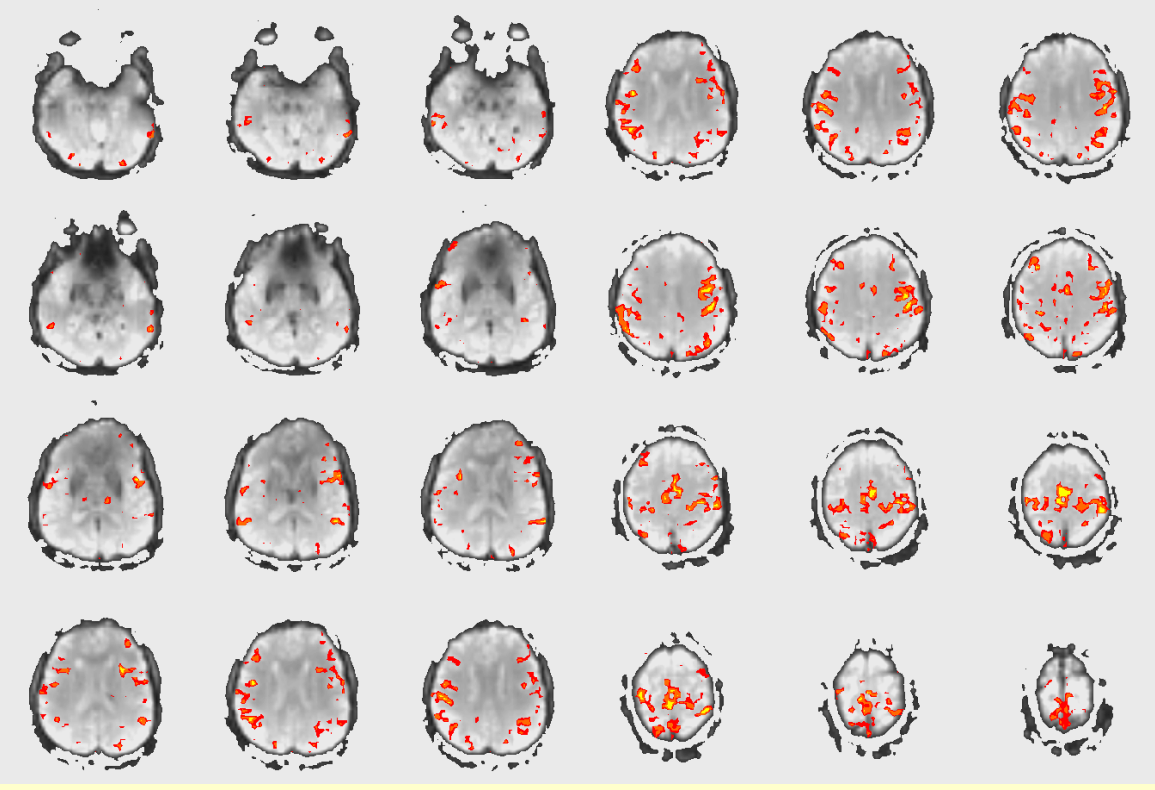


4. picture naming

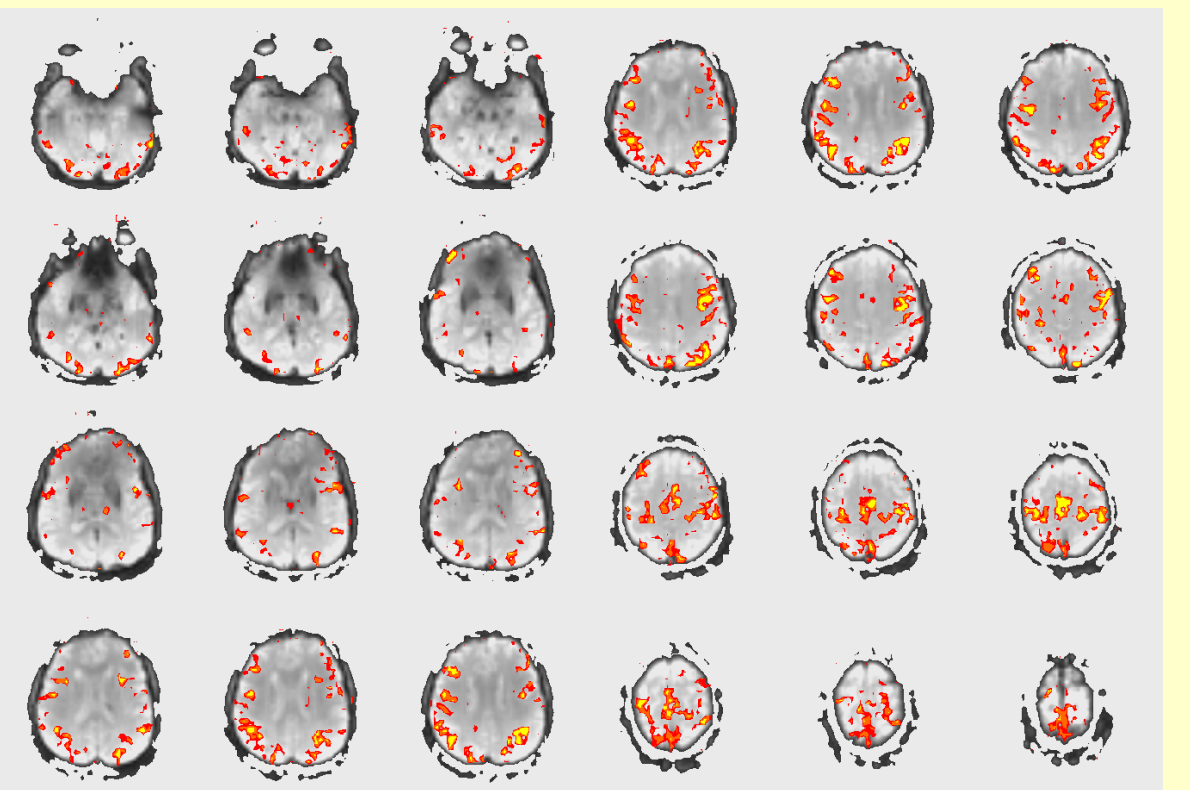
4 weeks post treatment – Session 3



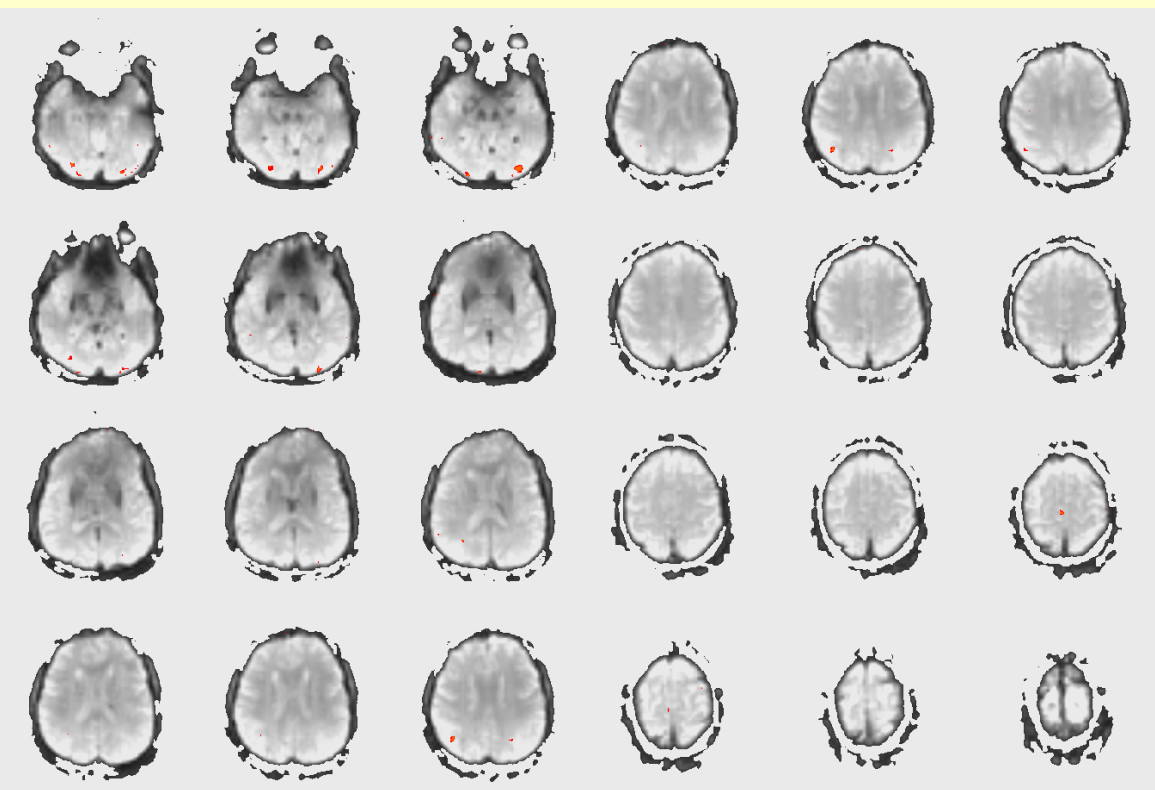
1. motor



2. word generation



3. rhyming



4. picture naming

## CONCLUSIONS

Repetitive transcranial magnetic stimulation was well tolerated in this 75 year old man with mild Alzheimer's disease with aphasia. Stimulation effects were sustained 4 weeks after the final stimulation and were associated with improvement in clinical scores and accompanied by a more robust brain activation on fMRI.

## REFERENCES

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## CONTACT

Gayatri Devi, MD; Director, New York Memory Services;  
Clinical Associate Professor of Neurology and Psychiatry, NYU School of Medicine;  
65 East 76<sup>th</sup> Street, NY NY 10021, USA [gd@nymemory.org](mailto:gd@nymemory.org)