

# Is Anxiety an Adverse Effect of TMS for Depression? A Retrospective Analysis

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## Introduction

- Repetitive Transcranial Magnetic Stimulation (rTMS) therapy is an effective treatment for patients with treatment-resistant MDD, with evidence suggesting it may also alleviate comorbid anxiety (O'Reardon, 2007), (George, 2007)
- Common side effects include headache, discomfort at the stimulation site, and lightheadedness (Mayo Clinic)
- Anxiety symptoms are highly prevalent among patients with depression:
  - Approximately 60% of individuals with MDD experience clinically significant anxiety (National Alliance on Mental Illness)
  - In patients with MDD, rTMS often improves both depressive and anxiety symptoms, particularly when protocols target the left dorsolateral prefrontal cortex (Cohen et al. 2009) (Diefenbach et al. 2013) (White and Tavakoli, 2015) (Hutton et al. 2023)
- However, anecdotal and clinical observations suggest that **some individuals experience worsening anxiety during the course of rTMS treatment**
- These cases raise a critical but understudied question: Can anxiety worsening be considered a potential adverse effect of rTMS?

To address this, we conducted a retrospective chart review examining anxiety symptom trajectories in a naturalistic sample of rTMS patients

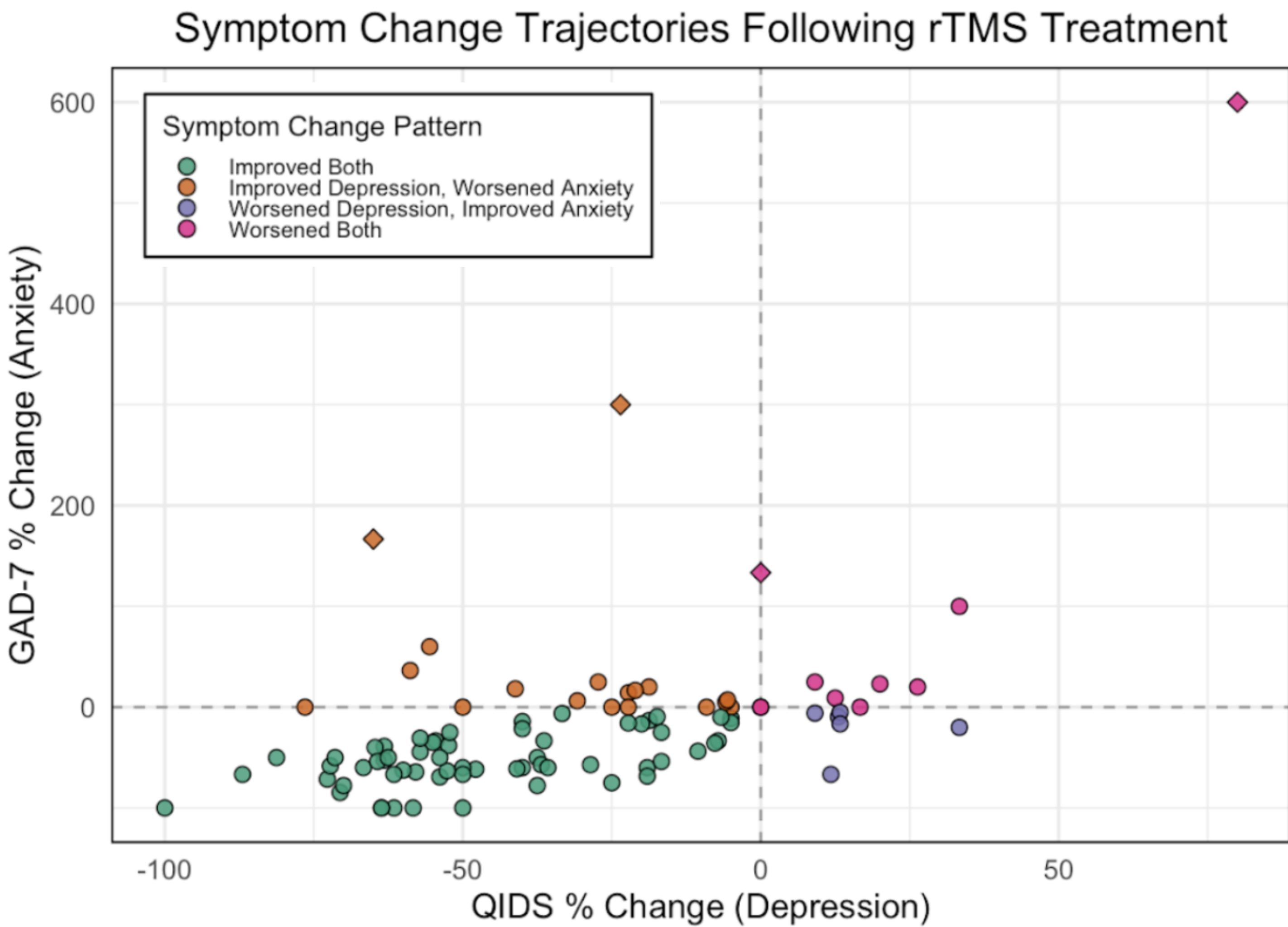
**Note:** Preliminary findings were based on a subsample of 23 patients. This poster reflects updated analyses from the full sample (N = 94), which expands and refines our original results.

## Methods

n	94
Sex (% female) <sup>1</sup>	31.40%
Age (years) <sup>1</sup>	44.16 ± 17.68
Responders (%)	40.40%
Remitters (%)	19.10%
Number of Treatments (mean ± SD)	42.20 ± 28.57
Treatment Protocol Breakdown	B70 coil cTBS (7.4%)
	B70 coil iTBS (17%)
	B70 coil iTBS/cTBS (7.4%)
	H1 coil 1980 pulses (61.7%)
Pre-Tx QIDS Score (mean ± SD)	16.21 ± 4.07
Post-Tx QIDS Score (mean ± SD)	10.79 ± 5.38
QIDS Percent Change (mean ± SD)	-32.11 ± 0.32
Pre-Tx GAD-7 Score (mean ± SD)	10.83 ± 5.94
Post-Tx GAD-7 Score (mean ± SD)	7.88 ± 5.64
GAD-7 Percent Change (mean ± SD)	-17.53 ± 0.86

- A retrospective chart analysis was undertaken for patients who underwent rTMS treatment for MDD at the McLean TMS clinic from January 2017 to June 2024
- Inclusion criteria:
  - >20 sessions
  - Primary diagnosis of MDD
  - Valid pre and post GAD-7 and QIDS scores
- Stepwise multiple linear regressions identified predictors of anxiety change.
- Residualized change scores and quadrant-based plots were used to clarify whether anxiety trajectories were independent of depression improvement.

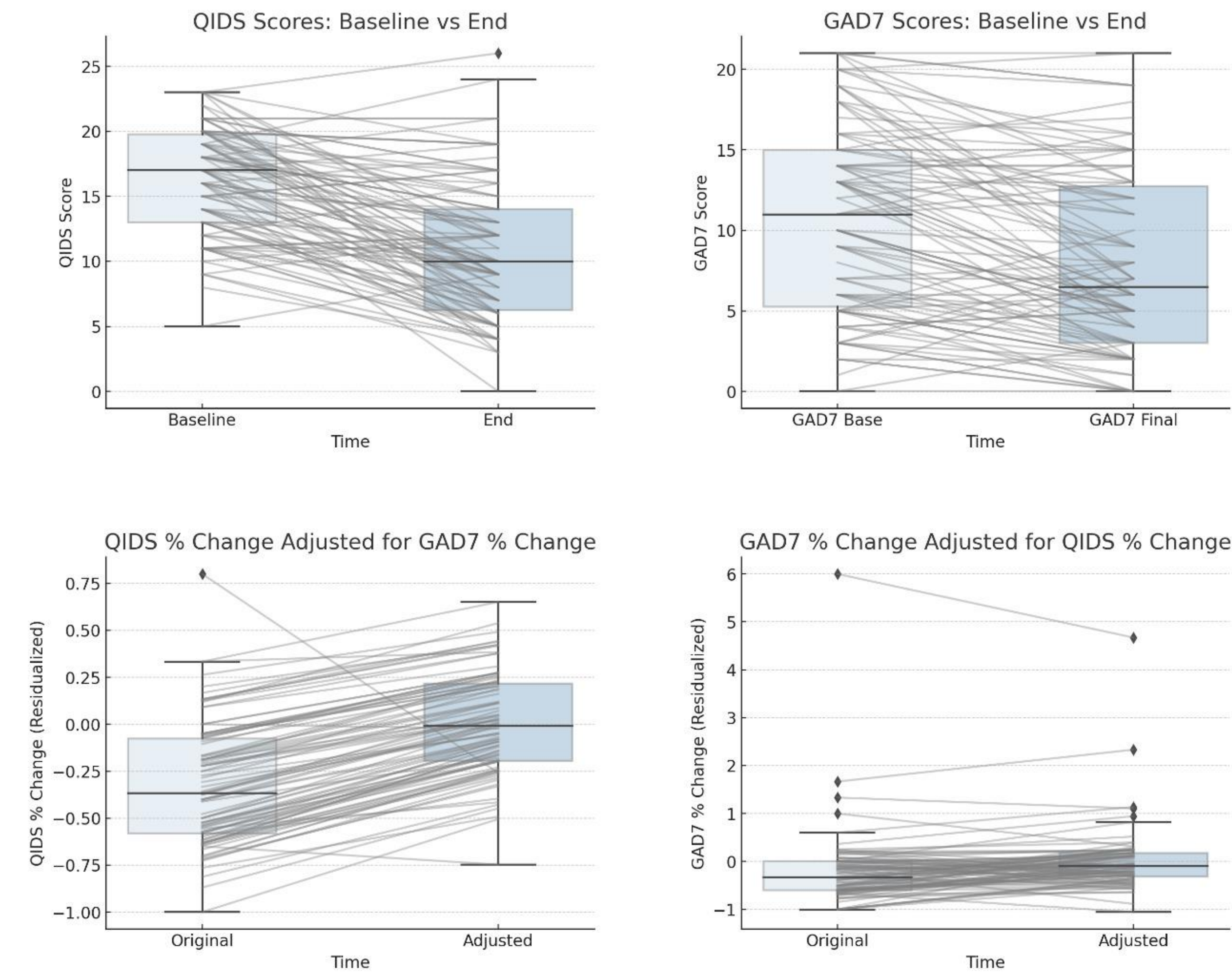
## Results



**Figure 1.** Percent change in QIDS and GAD-7 symptoms following rTMS, with points colored by symptom change pattern: green = improvement in both, orange = depression improved/anxiety worsened, purple = depression worsened/anxiety improved, pink = worsening in both. Outliers are shown as filled diamonds.

**Takeaway:** The majority of patients improved in both depression and anxiety symptoms, but nearly one in five patients experienced increased anxiety despite improvement in depression.

**Regression analysis** revealed that greater depression improvement and higher baseline anxiety predicted greater anxiety reduction. Female gender significantly predicted anxiety worsening, and age showed a trend toward improvement with older age (Adj. R<sup>2</sup> = 0.53).



**Figure 2:** Note: Diamonds indicate statistical outliers

(A) QIDS scores at baseline and end of treatment. Each line represents an individual patient.  
(B) GAD-7 scores at baseline and end of treatment.  
(C) Residualized QIDS percent change after adjusting for GAD-7 change. Values closer to zero suggest symptom change shared with anxiety. Values farther from zero reflect depression-specific improvement.  
(D) Residualized GAD-7 percent change after adjusting for QIDS change.

**Takeaway:** Anxiety symptoms can worsen independently of depression.

## Discussion

- While rTMS consistently improved depressive symptoms, anxiety responses varied widely—with **some patients showing clinically meaningful worsening of anxiety**.
- Residualized analyses suggest depression improvement was largely independent of anxiety, while **anxiety changes were more variable and not fully explained by depression trajectories**.
- Multiple regression identified female gender and lower baseline anxiety as predictors of anxiety worsening, indicating that certain subgroups may be more vulnerable to adverse anxiety outcomes during rTMS.
- These findings underscore the need to **recognize and monitor anxiety worsening as a possible adverse effect of rTMS**, with implications for screening and treatment planning.