

# A Telehealth-enabled Multidisciplinary Care Model Improves Behavioral Health Outcomes In Patients With Neurodegenerative Disease

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## Introduction

In Alzheimer's disease, pooled depression prevalence is approximately 42% under dementia-specific criteria while reported anxiety varies between 31-39%.

Neuropsychiatric symptoms such as anxiety and depression are increasingly recognized as common, serious yet frequently under-detected and under-treated problems that contribute to accelerated functional decline and substantial caregiver burden.

Few interventions have demonstrated systematic, measurable improvement in neuropsychiatric symptoms in this population. We evaluated longitudinal depression, anxiety, and caregiver-burden outcomes in patients with neurodegenerative disease receiving a virtual-first, multidisciplinary care model incorporating measurement-based tracking.

## Objective

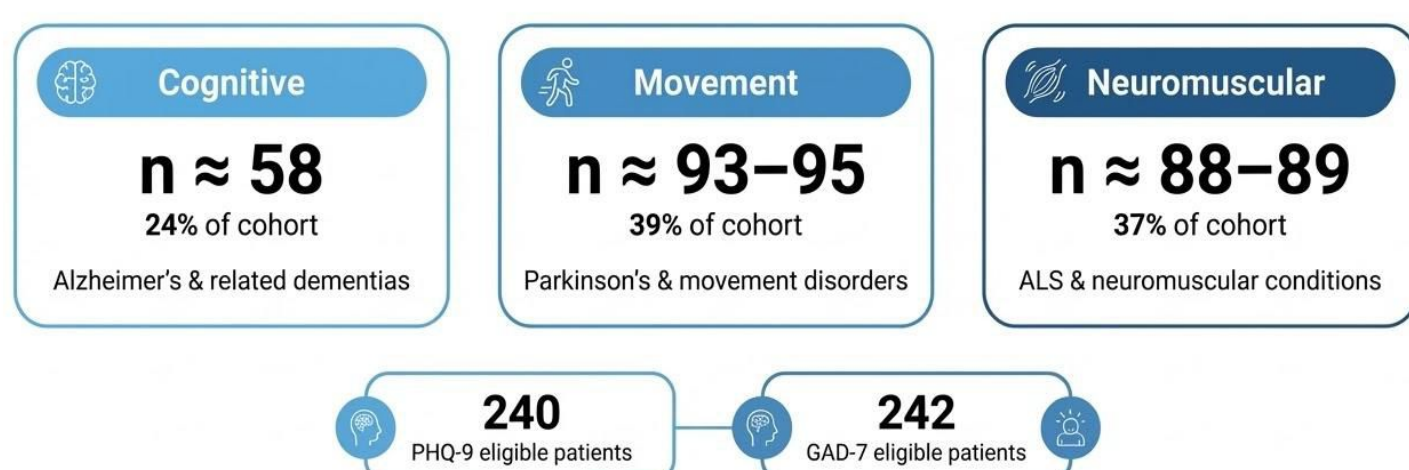
Characterize longitudinal change in depression (PHQ-9), anxiety (GAD-7), and caregiver burden (Zarit Burden Inventory, ZBI) among patients with neurodegenerative disease engaged with a virtual-first multidisciplinary care model, and to assess whether observed changes meet established thresholds for clinical significance across cognitive, movement, and neuromuscular neurodegenerative populations.

## Methods

**Design.** Retrospective longitudinal analysis of real-world, measurement-based outcomes from a teleneurology practice delivering subspecialty care with integrated behavioral health support across dementia, movement, and neuromuscular disease. Depression and anxiety were assessed with the PHQ-9 (0–27) and GAD-7 (0–21); caregiver burden was assessed with the ZBI. All instruments are validated and public-domain.

**Population.** Eligible patients had ≥4 PHQ-9 or GAD-7 observations spaced ≥15 days apart, excluding transient engagements. Median observations per patient, 10; mean follow-up span, ~378 days. 240 patients met PHQ-9 and 242 met GAD-7 eligibility, distributed across cognitive (24%), movement (39%), and neuromuscular (37%) diagnoses.

**Outcomes & analysis.** The primary outcome was change in mean PHQ-9 and GAD-7 from first to last observation. The temporal pattern of change was examined using paired t-tests between consecutive observations among patients with all 7 observations (PHQ-9, n=177; GAD-7, n=176). Pre-specified secondary analyses examined change by disease population, comparison against established minimal clinically important difference (MCID) thresholds, and ZBI change overall and by population (patients with ≥2 ZBI observations ≥90 days apart, n=221).



## Results

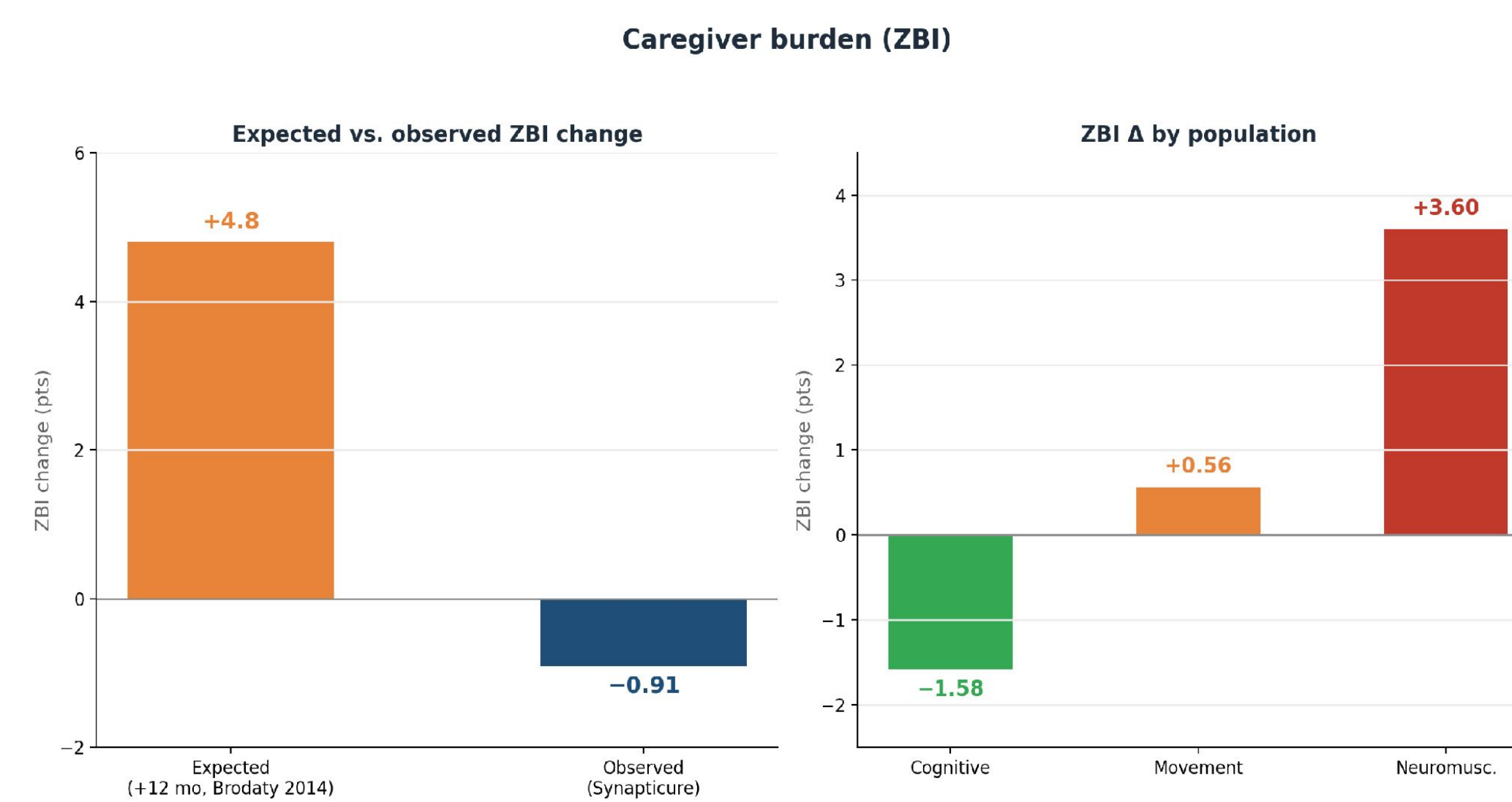
### Primary outcome: reduction in depressive and anxiety symptoms

Mean symptom scores decreased significantly from first to last observation. PHQ-9 declined from 9.1 to 6.25 (mean change –2.85; p<0.001) and GAD-7 from 7.38 to 4.63 (mean change –2.73; p<0.001). Improvement was temporally front-loaded: paired t-tests demonstrated statistically significant reductions across the first two inter-observation intervals (1→2 and 2→3; both p≤0.001) and no significant change thereafter (steps 3→7, all p>0.05). Scores plateaued rather than regressed, indicating durable improvement sustained despite ongoing disease progression.



Figure 1. Longitudinal neuropsychiatric outcomes. (A) Mean PHQ-9 and (B) mean GAD-7 by observation number; shaded region denotes intervals with statistically significant change (steps 1→2, 2→3). Sample size declines at later observations as the cohort matures. (C) Paired t-tests by inter-observation interval. (D) Mean change from first to last observation by disease population.

### Secondary Outcome: Caregiver Burden (ZBI)



### Clinical Significance



## PHQ-9 and GAD-7 : Gold Standard Screening

### PHQ-9

Patient Health Questionnaire — Depression

9 items mapping to DSM-5 criteria for major depressive disorder. Scored 0–27.



### GAD-7

Generalized Anxiety Disorder Scale

7 items assessing anxiety severity over the past 2 weeks. Scored 0–21.



## Discussion

In this real-world longitudinal cohort, engagement with a virtual-first multidisciplinary care model was associated with **statistically significant reductions in depression and anxiety** across cognitive, movement, and neuromuscular neurodegenerative disease (PHQ-9 –2.85, GAD-7 –2.73; both p<0.001). Improvement was directionally consistent across all three disease populations (largest in the movement subgroup: PHQ-9 –3.08, GAD-7 –3.09), although subgroup analyses were not powered for significance at current sample sizes. Caregiver burden, which characteristically increases over time in neurodegenerative disease (reported ~+4.8 ZBI points over 12 months in dementia caregivers), instead declined modestly in this cohort (–0.91; n=221; p=0.07), with the greatest reduction in the cognitive sub-cohort (–1.56; n=178). This directional reduction contrasts with the published natural history of progressively rising burden.

**These findings demonstrate that coordinated, multidisciplinary virtual care can improve patient- and caregiver-reported outcomes despite disease progression in patients with neurodegenerative disease.**

## References

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