Ninet Lab

Are Benzodiazepines and Anticonvulsants Associated with Differential ECT Outcomes?

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Introduction

- **Seizure threshold modulating medications** including benzodiazepines and anticonvulsants are prescribed during ECT for mood and psychotic disorders.
- These medications are **clinically used to prevent or suppress seizures**, with mechanisms that also **raise seizure thresholds and shorten seizure duration** during ECT [1,2].
- Research shows **minimal impact on bilateral ECT outcomes** with benzodiazepines, but potential **efficacy reduction with unilateral ECT** [1,3].
- **Anticonvulsants such as lamotrigine and carbamazepine** are associated with elevated thresholds and lower remission rates in large-scale studies [4].
- Few studies have evaluated how these medications affect **seizure metrics and treatment response across the ECT course**, especially when combined.
- *Our aim is to explores how concomitant benzodiazepine or anticonvulsant use correlates with seizure characteristics and clinical outcomes during ECT*

Methods

- **Participants:** 220 patients were recruited to an observational ECT cohort spanning 2014–2024 across UBC Hospital.
- **Measures:** Demographic and clinical characteristics were recorded from clinical records.
- **Procedure:** Patients underwent a course of ECT. Stratified trajectory plots were used to visualize changes grouped by relevant clinical subcategories over the course of treatment.
- **Analysis:** Data were analyzed using R version 4.3.0 (2023-04-21). Visualization and model-based plotting were performed using the ggplot2 and ggeffects packages.

Results

- **Charge requirements were highest** in patients on both benzodiazepines and anticonvulsants, showing steeper trajectories over time—suggesting elevated seizure thresholds.
- **Patients on anticonvulsants alone** underwent the most treatments (mean = 14.7 vs. 13.1 in unmedicated), indicating a possible delay in treatment response.
- **Severity and global improvement** were visually similar across groups, though improvement appeared slightly smaller in the anticonvulsant medication groups.
- **Males required higher ECT charges** than females, while diagnosis (mood vs. psychotic) was not associated with charge differences.
- **Seizure durations were shorter** in the benzodiazepine and anticonvulsant group, aligning with known pharmacologic effects and suggesting reduced seizure adequacy.
- **CARS composite scores were lower** in anticonvulsant and combined-medication groups, with all groups showing the lowest scores at treatment 1—consistent with subthreshold titration.

Discussion

- **Patients on benzodiazepines required more treatments**, suggesting delayed response or higher seizure thresholds.
- **Higher charge trajectories and shorter seizures** in medicated groups may indicate reduced ECT efficiency. **Future Work: should examine equivalent doses**, as effects were most pronounced in the combined-medication group.
- **Limitations:** Observational data only; no dose info or causal conclusions can be drawn.

References

1. Voineskos D, Daskalakis ZJ, Blumberger DM. Management of medications during electroconvulsive therapy. *CNS Drugs*. 2017;31(6):465–476.
2. Sienaert P, Peuskens J. Safety of ECT in patients receiving anticonvulsants. *The Journal of ECT*. 2007;23(1):55–58.
3. Verwijk E, Comijs HC, Kok RM, Spaans HP, Stek ML. The effect of concomitant benzodiazepine use on the effectiveness of electroconvulsive therapy in depressed older adults. *The Journal of ECT*. 2012;28(2):110–113.
4. Nordenskjöld A, von Knorring L, Engström I. Predictors of seizure threshold in major depressive disorder: Results from the Swedish National Quality Register for ECT. *The Journal of ECT*. 2024;40(1):30–38.

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Benzodiazepine and anticonvulsant use—particularly in combination—is associated with higher ECT charge requirements and less favorable clinical trajectories, suggesting a correlation between anticonvulsant medications and treatment outcomes.

Table 1.

	Mood Disorders (n = 129)	Schizophrenia Spectrum Disorders (n = 91)	All (N = 220)
Age (Years) * **	50.6 (16.1)	41.4 (13.4)	46.8 (15.7)
**Sex ** **			
Male	49 (38.0%)	53 (58.2%)	102 (46.4%)
Female	80 (62.0%)	38 (41.8%)	118 (53.6%)
Weight (kg) * **	72.8 (17.7)	82.0 (21.3)	76.7 (19.8)
Height (cm)	169.3 (11.1)	170.3 (9.9)	169.7 (10.6)
**BMI ** **	25.4 (5.2)	28.4 (7.0)	26.7 (6.2)
Antidepressants ***	117 (90.7%)	46 (50.5%)	163 (74.1%)
Antipsychotics **	117 (90.7%)	90 (98.9%)	207 (94.1%)
**Anticonvulsive Medications ** **			
Only BZD	37 (28.7%)	20 (22.0%)	57 (25.9%)
Only AC	19 (14.7%)	16 (17.6%)	35 (15.9%)
BZD and AC	33 (25.6%)	9 (9.9%)	42 (19.1%)
# of Treatments * **	11.0 (5.6)	17.2 (10.1)	13.6 (8.3)
Motor Duration (s)	33.4 (20.0)	42.0 (28.3)	36.9 (23.9)
Seizure Duration (s)	54.8 (37.9)	57.5 (39.5)	55.9 (38.5)
Charge (mC)	80.9 (65.5)	88.7 (69.7)	84.1 (67.2)
CARS Composite Scores	14.1 (2.7)	13.5 (3.3)	13.9 (3.0)
Severity Scores			
Pre-Severity Scores	5.8 (0.9)	6.1 (0.8)	5.9 (0.9)
Post-Severity Scores ***	4.0 (1.5)	5.0 (1.3)	4.4 (1.5)
Global Improvement Post-ECT * **	2.2 (1.0)	2.9 (1.1)	2.5 (1.1)

Table 1. Mean (SD) and Count (Percentage (%)). All medication are scheduled Medications. Antipsychotics and antidepressant categories show patients who used each of these medication types at least once. Benzodiazepine (BZD), Anticonvulsant (AC), both (BZD and AC), and neither (BZD and AC) are mutually exclusive categories. Motor and Seizure Duration, Charge and CARS Composite Scores are from treatment 1 only. Severity scores graded: 1-Normal (not ill), 2-Borderline mentally ill, 3-Mildly ill, 4-Moderately ill, 5-Markedly ill, 6-Severely ill, 7-Among most ill. Global Improvement Scores graded: 1-Very much improved, 2-Much improved, 3-Minimally improved, 4- No change, 5-Minimally worse, 6-Much worse, 7-Very much worse. Wilcoxon rank sum test; Pearson's Chi-squared test with simulated p-value (based on 2000 replicates); Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates); * p-value 0.05, ** p-value 0.01, *** p-value 0.001

Figure 1.

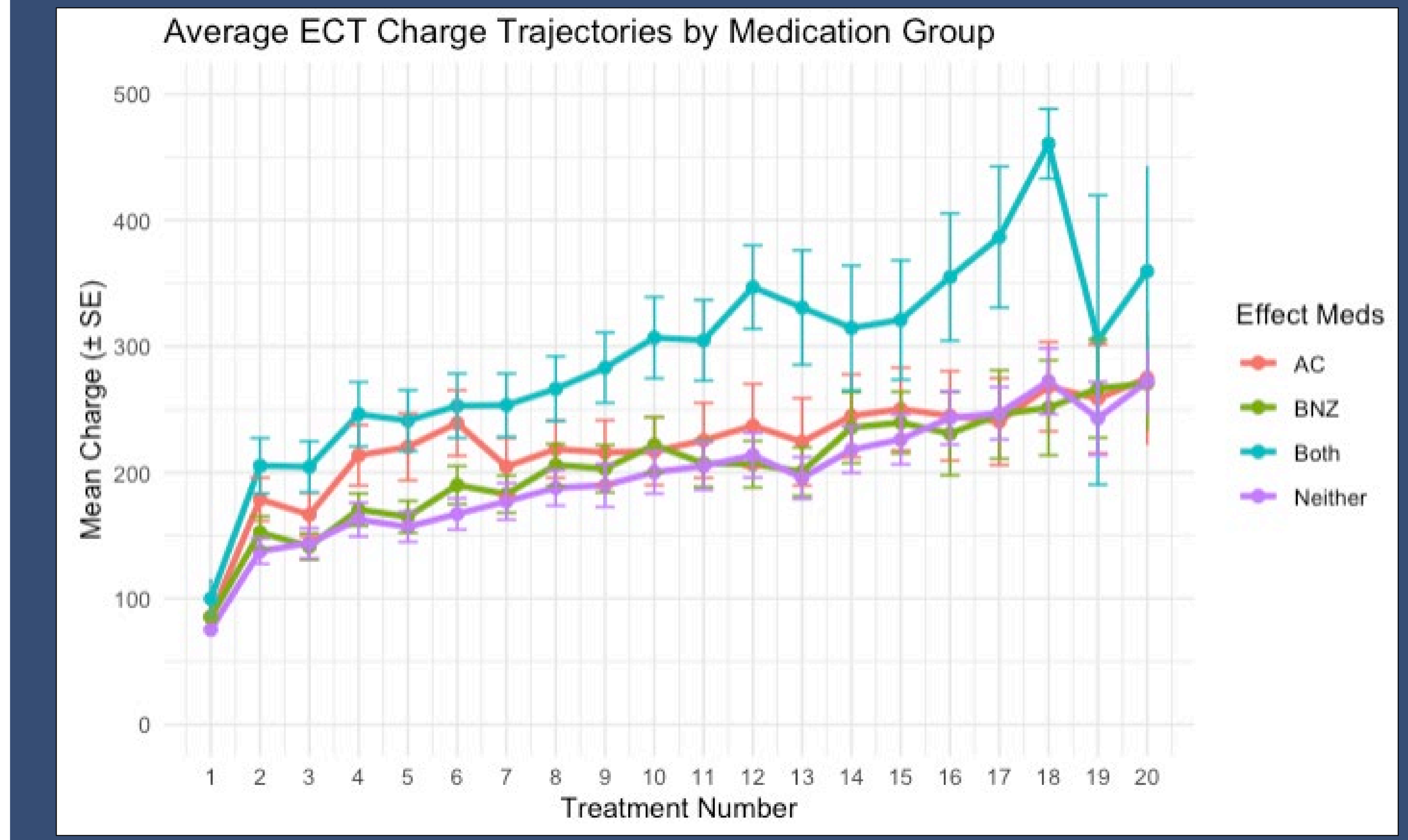

Figure 1. Loess trajectory plot of the average charge at each treatment. Patients with missing values were removed.

Table 2.

Medication Category	Mean Number of Treatments
AC	14.7
BNZ	13.8
Both	13.2
Neither	13.1

Table 2. Table of the average number of ECT treatments required by each patient based on anticonvulsant medication usage.

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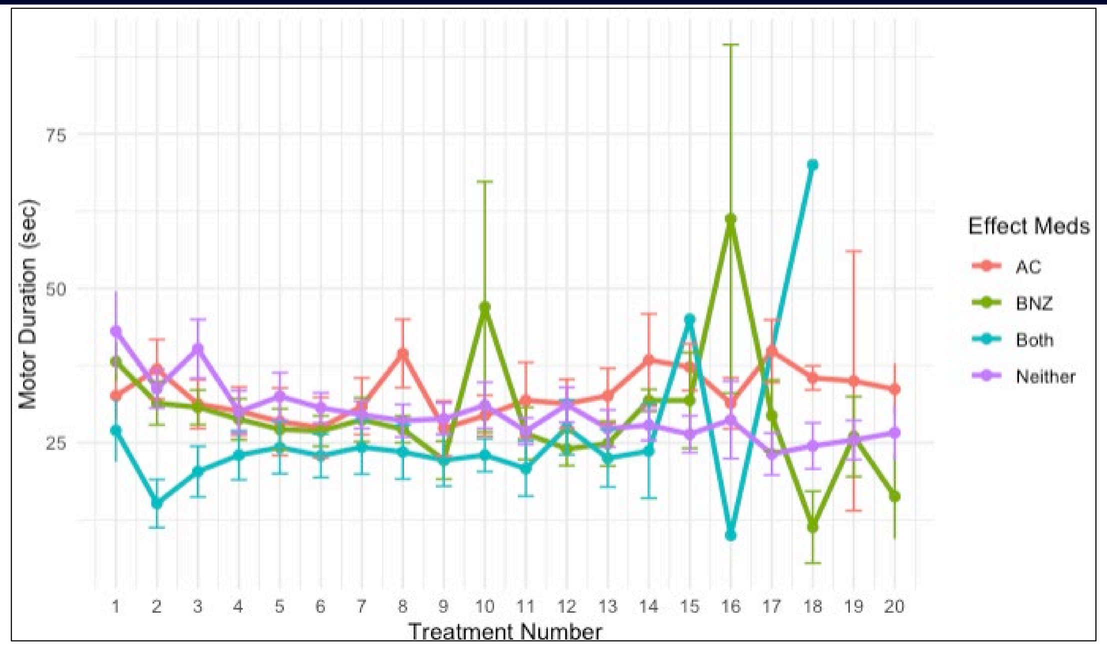

Figure 2. Motor Duration By Medication Trajectory
Motor duration trajectory with mean's and error bars for each level

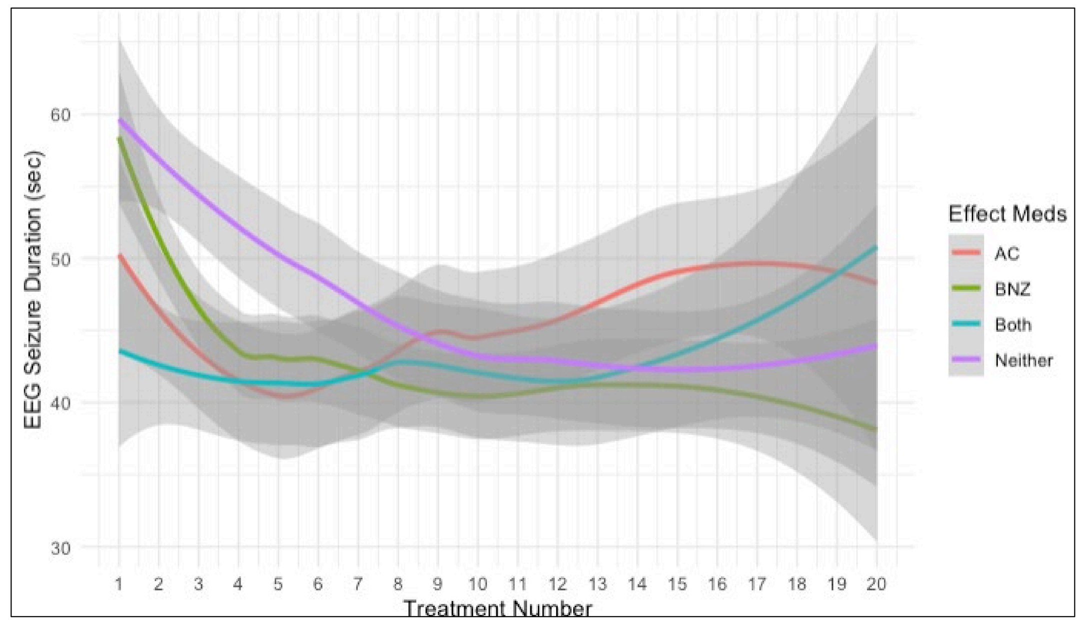

Figure 3. Seizure Duration By Medication Trajectory
Loess trajectory plot of the summation of all ECT CARS Scores

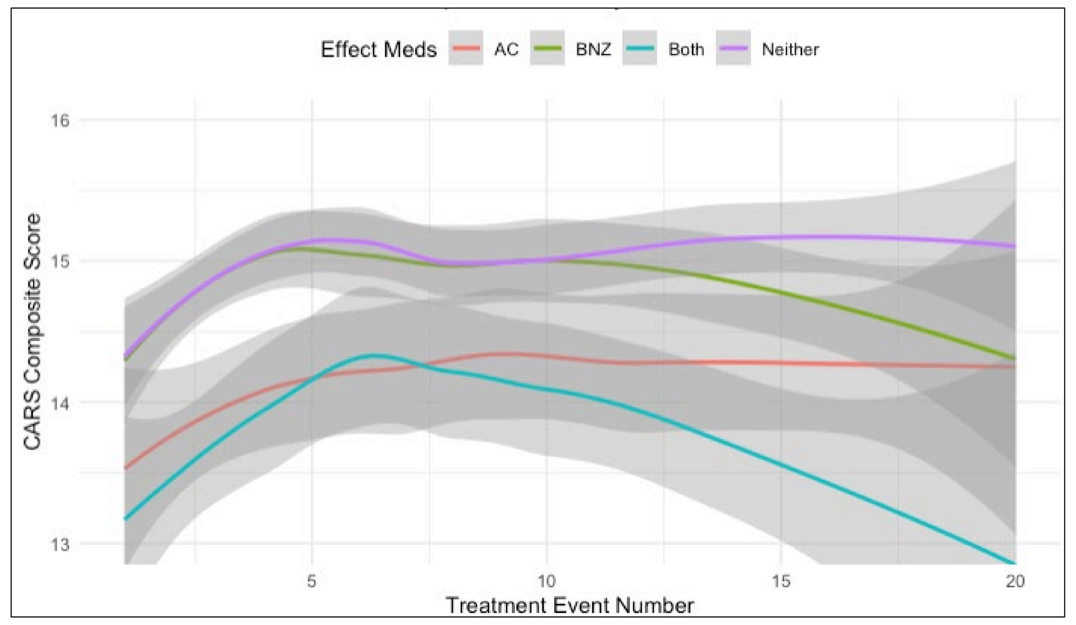

Figure 4. CARS Composite Scores By Medication Trajectory
Loess trajectory plot

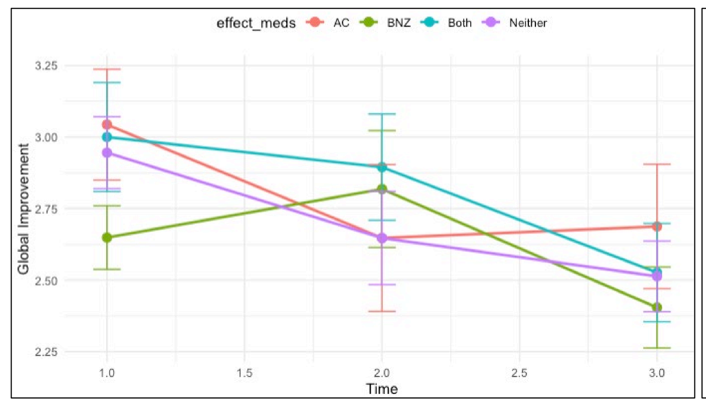

Figure 5. Global Improvement Scores By Medication.
Global Improvement graded: 1-Very much improved, 2-Much improved, 3-Minimally improved, 4- No change, 5-Minimally worse, 6-Much worse, 7-Very much worse.

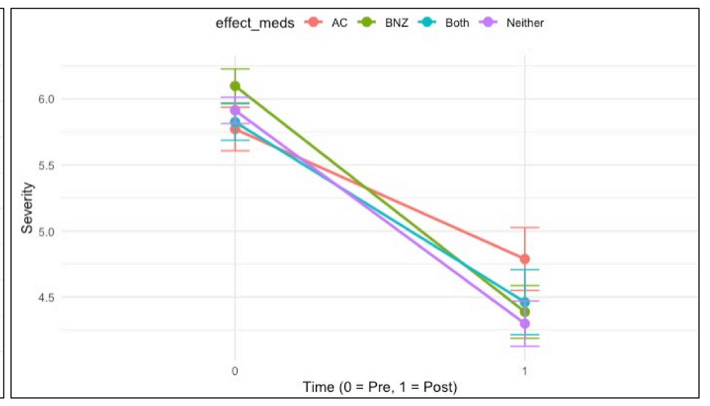

Figure 6. Severity Scores By Medication.
Severity scores graded: 1-Normal (not ill), 2-Borderline mentally ill, 3-Mildly ill, 4-Moderately ill, 5-Markedly ill, 6-Severely ill, 7-Among most ill.

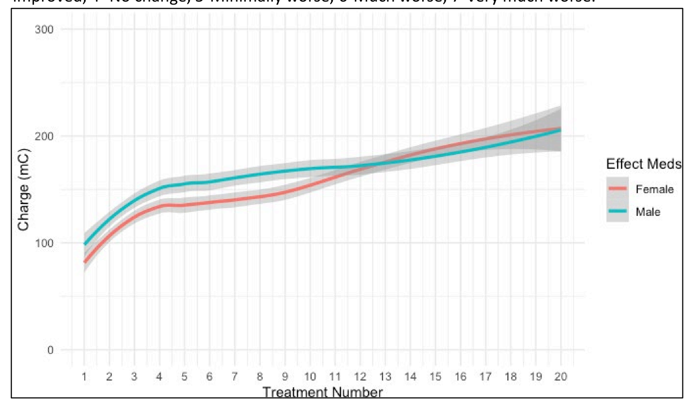

Figure 7. Charge by Sex Trajectory.

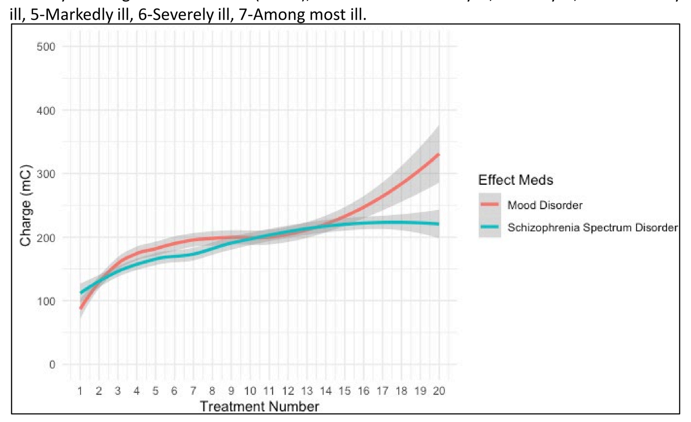

Figure 8. Charge by Diagnosis Trajectory.