Tracking Emotional Adaptation in Real Time: Decentering Dynamics During Ketamine-Assisted MBCT

Wenfei Yu[1], Arushi Badola[1], Melanie Bozzay, PhD[1], Anne-Marie Duchemin, MD[1,2], Subhdeep Virk, MD[1,2], Anthony King, PhD[1]

[1]Department of Psychiatry and Behavioral Health, The Ohio State University, [2]Harding Hospital, The Ohio State University Wexner Medical Center

Background

- **Treatment-resistant depression affects about 44% of patients who have tried at least two consecutive antidepressant therapies.**
- **Ketamine is a NMDA receptor antagonist that offers rapid antidepressant effects and enhance cognitive flexibility ; however, its benefits are often short-lived.**
- **One of Mindfulness-Based Cognitive Therapy (MBCT)'s primary goals is to enhance meta-cognitive awareness. A specific form of this, decentering, is the ability to step back and observe one's thoughts and emotions as passing mental events rather than facts, reducing automatic identification and reactivity.**
- **Increase in decentering could improve emotion regulation and affective well-being.**
- **Ecological Momentary Assessment (EMA) captures real-time emotional and cognitive states multiple times per day in natural settings, offering a temporal view of within-person dynamics.**
- **The current focus studies within-person fluctuations in decentering track same-day changes in regulation, affect, and distress—and whether these links strengthen from pre-MBCT to the peri-infusion and late-MBCT phases.**

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Methods

- **Study Design: an 8-week Mindfulness-Based Cognitive Therapy (MBCT) program, with participants attending weekly 2-hour virtual group sessions and completing daily home mindfulness practices. An IV ketamine infusion (0.5 mg/kg) was administered between weeks 2 and 3, followed by three "booster" mindfulness sessions.**
- **EMA schedule: Participants completed 3 one-week EMA bursts across MBCT. Burst 1: the week before MBCT. Burst 2: a 7-day window centered on the ketamine session (typically ~3 days pre- and ~4 days post-infusion; some Cohort 3 participants were 4 pre/3 post). Burst 3: the final week of MBCT.**
- **EMA data collection: Each day included one morning survey (around wake time) plus four daytime prompts (main battery). Passive phone-sensor data were collected throughout.**
- **Analysis: Linear mixed-effects models (LMM) were used to examine whether within-person daily changes in decentering predict each outcome, while controlling for each participant's mean decentering for each burst. Models had random intercepts and decentering slopes by participant, and fixed effects for phase (Pre-MBCT, Pre-Infusion, Post-Infusion, Post-MBCT) plus decentering × phase interactions.**

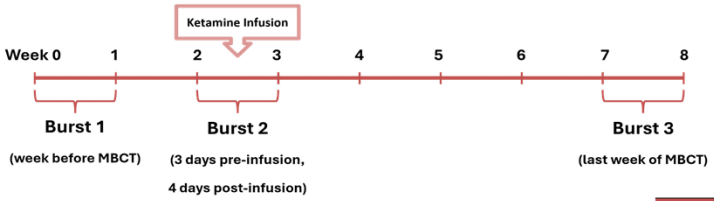

Figure 1. EMA timeline set-up
This figure illustrates when EMA bursts happen across study timeline.

Table 1. EMA data collection structure
This table contains overview of EMA measures collected across three daily components: passive phone-sensor data, a once-daily morning battery, and a four-times-daily main battery.

Passive Phone-Sensor Data Collection	Main Battery (4 x daily)	Morning Battery (1 x daily)
Physical Activity & Mobility	Positive/Negative Affect	Sleep Quality
Social & Communication Behavior	Distress	Discrimination
Digital Behavior & Screen Use	Positive/Negative Emotion Regulation	Daily Functioning
Environmental Context	Rumination	Alcohol Consumption
	Decentering	Mindfulness Practice
	Social/Loneliness	Pain
	Resilience	Hope/Meaning
		Suicidal Ideation
		Fear of the Unknown

Results

- **Linear mixed-effects models tested how daily decentering (within-person) and average decentering (between-person) related to emotion regulation (ER), affect, and distress across treatment phases.**
- **Within-person (daily) pattern:**
  - **Positive affect rises on days with higher decentering (β = 0.44, p = .002).**
  - **Negative affect falls on days with higher decentering (β = –0.37, p = .036), and shows associations post-MBCT.**
  - **Positive ER shows stronger associations after infusion (β = 0.83, p < .001).**
  - **Negative ER shows strong associations post-MBCT (β = –0.78, p = .008).**
  - **Distress shows trend associations post-MBCT (β = -0.53, p = .1)**
- **Between-person effects:**
  - **Higher average decentering was linked to better daily functioning across all outcomes**

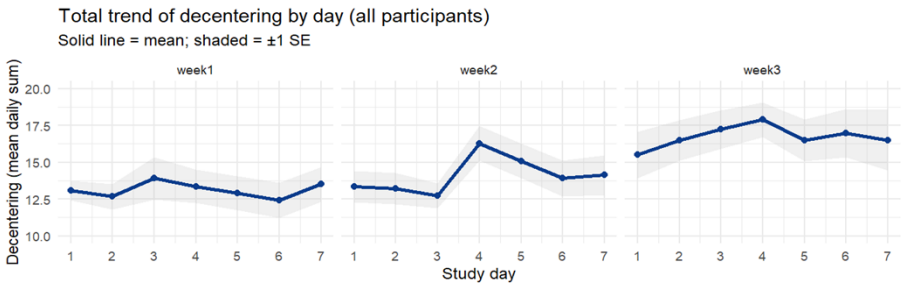

Figure 2. Average decentering scores across study bursts.
Participants' daily decentering scores increased from the pre-treatment week (Burst 1) to the post-infusion (Burst 2) and post-MBCT (Burst 3) phases, indicating substantiate increase after ketamine-infusion and progressive gains throughout course of MBCT. Error bars represent ±1 SE.

Associations Between Decentering and Daily Emotional Outcomes

Outcome	Within-subject Decentering	Between-subjects Decentering	Decentering x Post-Infusion	Decentering x Post-MBCT
Positive Emotion Regulation	-0.18 (0.14)	+0.25 (0.07)***	+0.83 (0.21)***	+0.36 (0.36)
Negative Emotion Regulation	-0.15 (0.09)	-0.11 (0.05) *	+0.05 (0.14)	-0.61 (0.23) **
Positive Affect	+0.44 (0.14) **	+0.17 (0.08) *	+0.22 (0.22)	+0.40 (0.28)
Negative Affect	-0.37 (0.18) *	-0.26 (0.09) **	-0.06 (0.26)	-0.78 (0.35) *
Distress	-0.26 (0.16)	-0.26 (0.08) **	-0.27 (0.24)	-0.53 (0.32) †

•*Note.* Within-subject decentering = person-centered by burst; Between-subjects = burst mean. † p < .10, * p < .05, ** p < .01, *** p < .001.

Table 2. Associations Between Decentering and Daily Emotional Outcomes
Within- and between-person decentering were modeled as predictors of daily emotion regulation, affect, and distress across MBCT phases. Values reflect unstandardized coefficients (β) with standard errors in parentheses

Discussion

- **Momentary decentering tracked via EMA was linked to better emotion regulation and positive affect, and lower distress, consistent with MBCT's model. Participants with higher average decentering across bursts showed more favorable affect/distress profiles overall.**
- **Future directions are to examine whether mindfulness practice frequency predicts decentering and emotional outcomes, and integrate additional EMA measures (e.g., self-compassion, rumination) to capture broader change processes.**