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Effects of Mindful Engagement and Attention on Reciprocal Caregiver and Client Interactions: A Behavioral Analysis of Moment-to-Moment Changes During Mindfulness Practice

Nirbhay N. Singh[1] · Giulio E. Lancioni[2] · Joshua C. Felver[3] · Rachel E. Myers[4] · Yoon-Suk Hwang[5] · Jeffrey Chan[5] · Oleg N. Medvedev[6]

Abstract

Objectives The objective of this study was to examine the effects of Mindfulness-Based Positive Behavior Support (MBPBS) training on the nature of caregiver and client reciprocal interactions at a moment-by-moment level using behavior analytic methodology. Specifically, we compared the behavior of caregivers and clients before and after MBPBS training for the caregivers in terms of caregiver-client engagement, percent of learning and leisure interactions during caregiver-client engagement, and percent of the clients' challenging behaviors and socially acceptable behaviors during learning and leisure interactions. In addition, we examined the effects of specific conditionality of attentional responses of the caregivers to the clients' challenging or socially acceptable behavior in terms of frequency, latency, duration, and quality.

Method Caregiver and client engagements were videotaped before and after MBPBS training for the caregivers. The percent of caregiver-client engagement was analyzed using partial-interval recording for overall engagement and the clients' challenging behaviors and socially acceptable behaviors during learning and leisure interactions. The effects of the caregivers' attentional responses to the clients' challenging behaviors and socially acceptable behaviors were analyzed using whole-interval recording.

Results Training caregivers in MBPBS significantly increased caregiver-client engagement during learning and leisure activities, which resulted in the clients exhibiting fewer challenging behaviors and more socially appropriate behaviors. Furthermore, an analysis of the effects of different types of caregiver attention showed differential effects on the clients' challenging behaviors and socially acceptable behaviors.

Conclusions The results indicated that behavior analytic methods can be used as an objective and reliable way of capturing the nature of changes in predefined behaviors of both caregivers and clients at a moment-by-moment level following training of the caregivers in a mindfulness-based program. Using such an analytic method may provide an effective way of objectively measuring some experiential processes involved in mindfulness training.

Keywords Mindfulness-Based Positive Behavior Support · Engagement · Attention · Reciprocal interactions · Challenging behaviors · Moment-by-moment changes

Mindful engagement is the "moment-by-moment, open hearted awareness, and nonjudgmental engagement in an activity, without expectation of specific outcomes" (Jackman, 2014, p. 244). It is evidenced, for example, when a

✉ Oleg N. Medvedev
oleg.medvedev@waikato.ac.nz

1 Medical College of Georgia, Augusta University, Augusta, GA 30912, USA

2 Department of Neuroscience and Sense Organs, University of Baril, Bari, Italy

3 Cornell University, Ithaca, USA

4 Wellstar School of Nursing, Kennesaw State University, Kennesaw, GA 30144, USA

5 The University of Queensland, Campbell Rd, St Lucia, QLD 4072, Australia

6 School of Psychology, University of Waikato, Private Bag, Hamilton 3105, New Zealand

caregiver is fully present and engaged with those in their care (e.g., client, child) in an activity that is not goal-directed, and the interaction produces wholesome changes in both the caregiver and the client. To be mindful, a caregiver needs to cultivate mindfulness, which has been defined as the "moment-to-moment, non-judgmental, non-reactive attending, and the awareness, insight, and potential liberation that can arise from that intentional cultivation" (Kabat-Zinn, 2019, p. xi). This definition of mindfulness is embodied in the two seminal mindfulness-based programs, Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990) and Mindfulness-Based Cognitive Therapy (MBCT; Segal et al., 2002), as well as in various adaptations of these programs (e.g., Mindfulness-Based Cognitive Therapy for Children [MBCT-C]; Semple & Lee, 2011).

The effects of mindfulness-based programs (MBPs) have been, and continue to be, evaluated across a broad and increasingly diverse range of health issues in both clinical and healthy populations (Baminiwatta & Solangaarachchi, 2021; Zhang et al., 2021). These include, but are not limited to, such diverse areas as substance use disorders, eating behaviors, tobacco smoking, chronic illnesses, education, and the gamut of psychiatric conditions in children, adolescents, and adults (Krägeloh et al., 2019; Schuman-Olivier et al., 2020; Schutt & Felver, 2021; Singh & Singh Joy, 2021). The effects of the MBPs have typically been measured in terms of changes in specific variables as reported by self-assessments of the participants using psychometrically validated rating scales. While rating scales have their limitations (e.g., Grossman, 2011; Sauer et al., 2013), they do indicate replicable positive findings across intervention studies in terms of changes in specific target variables, such as depression and anxiety (Prieto-Fidalgo et al., 2022).

The use of other MBPs has focused on observed effects in interpersonal contexts, based on the theoretical notion of behavioral spillover (Dolan & Galizzi, 2015; Strain et al., 1976) or cascading (Fowler & Christakis, 2010) effects from individuals who have been trained to embody mindfulness in their interpersonal interactions. This notion is derived from the Buddhist philosophy of dependent origination (Sanskrit: *pratityasamutpada*, Pali: *paticca-samuppada*) or conditioned co-arising, which holds that everything that exists is dependent on something else. That is, when the mind rests in non-duality, there is no self and other, and thus changes in one (i.e., self) will conditionally effect changes in the other (i.e., other). In the present context, this can be conceptualized as the effects of training caregivers in a MBP will spillover or cascade onto those in their care. For example, Singh, Lancioni, Karazsia, and Myers (2016) taught group home caregiving staff the Mindfulness-Based Positive Behavior Support (MBPBS) program and measured programmatic effects on both the staff and the individuals with developmental disabilities in their care. Post-intervention results showed that staff interventions (e.g.,

physical restraints for aggressive behavior) decreased, and the individuals with developmental disabilities evidenced increased number of learning objectives mastered and increased participation in socially integrated activities. Similar findings regarding the reduction of physical restraints for aggressive behavior following caregiver staff training were reported by Brooker et al. (2014) based on the use of a different MBP.

The findings on the effects of MBPBS in interpersonal contexts have been replicated across other caretaker populations, including parents (Singh et al., 2021), teachers (Singh et al., 2013), and community-based group home staff (e.g., Singh et al., 2020). The outcome measures have been based on direct observation of events and behaviors of both the caregivers who were trained in MBPBS, and those in their care who were not trained in mindfulness practice. The changes in their behavior were recorded at the molar level, such as use of physical and pharmacological restraints, physical and verbal aggression, and caregiver and peer injury. The data were collected independently of those trained in MBPBS (i.e., no subjective rating scale data were utilized), and inter-rater reliability of the observational data were established (Barlow et al., 2009). In general, these data supported the notion that the Buddhist teachings on dependent origination can be operationalized and measured in clinical settings and that such findings can be replicated across different contexts. What remains unclear is the exact nature of the changes that occur in these interpersonal contexts at a molecular level, i.e., at a moment-by-moment level. Behavioral observation methodology as used in the field of applied behavior analysis (Kahng et al., 2011) may provide a solution in terms of descriptive methods to quantify these moment-by-moment behavior-environment relations (McComas et al., 2009).

The aim of the present study was to better understand the effects of MBPBS training on caregiver-client reciprocal interactions on a moment-by-moment basis. Specifically, we compared the behavior of caregivers and clients before and after MBPBS training. Outcomes of interest included caregiver-client engagement, percent of learning and leisure interactions during caregiver-client engagement, and percent of client challenging behaviors and socially acceptable behavior during learning and leisure interactions. In addition, we recorded caregiver responses to clients' challenging and socially acceptable behavior in terms of frequency, latency (i.e., time taken by a caregiver to respond to client behavior), duration (i.e., time spent in providing attention), and quality (i.e., descriptive nature of caregiver feedback).

Method

Participants

Thirty caregivers (i.e., direct care professionals) from four group homes in the Southern United States, who worked during the morning and afternoon shifts, served as the target

caregiver participants. All 30 caregivers were experienced care staff having worked in developmental disabilities services for 11 to 27 years (mean = 19 years). These caregivers did not have previous experience in meditation or mindfulness practices. Each of the four group homes housed four resident clients with mild to moderate intellectual impairments. None of the individuals had any physical impairments, but eight had co-occurring mental illness (i.e., intermittent explosive disorder [$n = 2$], psychosis [$n = 4$], and depression [$n = 2$]). As noted in Table 1, eight individuals were on psychotropic medications for their co-occurring mental illness. There was no change in the dosage of their medications and no additional medications were prescribed during the data collection period. All of them exhibited some level of behavioral challenges, including intermittent verbal and physical aggression toward caregivers and peers. These behavioral challenges were low intensity events that could escalate to high intensity depending on how the caregivers responded to the behaviors. The clients did not have previous experience in meditation or mindfulness practices. Sociodemographic characteristics of the caregivers and the clients are presented in Table 1.

Procedure

Experimental Design We used a quasi-experimental research design, generally known as one-group pretest-posttest design (Thyer, 2012). This design provides a reasonable method for assessing the effects of mindfulness-based training on caregiver-client interactions under two conditions, pre- and post-training of the caregivers.

Pre-training During the 3 weeks immediately prior to the training in MBPBS, the caregivers were instructed to continue performing their daily tasks as they had done previously and not to change anything regarding their interactions with the clients. No new interventions or behavioral contingencies were introduced or implemented during this period.

MBPBS Training The 7-day MBPBS protocol (Singh et al., 2016, b) was the active intervention provided to the caregivers. Training was presented in three parts. Part I was a 1-day (8 hr) training on basic meditations, followed by 4 weeks of personal practice of these meditations. Part II was a 5-day (40 hr) intensive training on the mindfulness and positive behavior support (PBS) components of the program, followed by 4 weeks of caregiver implementation practice of embodying mindfulness and employing principles of PBS during interpersonal interactions with clients. Part III was a 1-day (8 hr) review of the caregivers' meditation practices, implementation of the MBPBS program, discussion of three ethical precepts (Table 2), and feedback on the training program. Thus, the MBPBS training period lasted 9 weeks total: 4 weeks of personal practice (which included the 1-day initial training), 1 week of intensive training, and 4 weeks of implementation practice (which included the final 1-day training). Table 2 presents the MBPBS program and a brief outline of each day's training.

During the 4 weeks of implementation practice following the 5-day intensive training, support for the caregivers was provided as needed in real-time via text message. Real-time texts using WhatsApp enabled immediate assistance matched to the training needs of the caregivers when they

Table 1 Characteristics of the participants

Demographic variables	Caregivers ($n = 30$)	Clients ($n = 16$)
Number of females	19	8
Race		
White	14	9
Black	12	7
Asian	4	0
Educational level		
College	2	0
One year college	7	0
Some college	5	0
High school	16	10
Elementary school	0	6
Mean age in years (range)	41 (23–54)	24 (19–31)
Mean number of years in current group home (range)	7 (2–13)	5 (3–12)
Intellectual impairments		
Mild	0	10
Moderate	0	6
Number prescribed psychotropic medication	0	8
Number with behavioral challenges	0	16

Table 2 Outline of the MBPBS program

Part I	
Day 1 training	Samatha meditation
	Kinhin meditation
	Vipassanā meditation
	Five hindrances—sensory desire, ill will, sloth and torpor, restlessness and remorse, and doubt
Personal practice (4 weeks)	Caregivers practice meditations, keep daily logs of their practice, and reflect on their practices by writing in personal journal
Part II	
Day 2 training (1st day of 5-day intensive training)	Review of meditation practice
	Introduction to the Four Immeasurables (*Brahmavihara*: *metta*—lovingkindness; *karuna*—compassion; *mudita*—empathetic joy; *upekkha*—equanimity)
	Equanimity meditation
	Beginner's mind
	Guiding principles of PBS
Day 3 training	Review of Day 2 instructions and practices
	Further instructions on the Four Immeasurables
	Equanimity meditation
	Lovingkindness meditation
	Being in the present moment
	Goals for the PBS support team
Day 4 training	Review of Days 2 and 3 instructions and practices
	Further instructions on the Four Immeasurables
	Equanimity meditation
	Lovingkindness meditation
	Compassion meditation
	The three poisons—attachment, anger, and ignorance
	Information gathering for PBS plans, functional behavior assessment, and developing function-based hypotheses for target behaviors
Day 5 training	Review of Days 2 to 4 instructions and practices
	Further instructions on the Four Immeasurables
	Equanimity meditation
	Lovingkindness meditation
	Compassion meditation
	Joy meditation
	Attachment and anger—shenpa and compassionate abiding meditations
	Designing and implementing PBS plans
Day 6 training	Review of Days 2 to 5 instructions and practices
	Review and practice Samatha, Kinhin and Vipassanā meditations
	Review of the Four Immeasurables
	Practice equanimity, lovingkindness, compassion and joy meditations
	Attachment and anger—meditation on the soles of the feet
	Braiding of mindfulness and PBS practices
	Review of the MBPBS training program
Implementation practice (4 weeks)	Caregivers implement MBPBS by (1) embodying mindfulness cultivated during trainings and practice with their interpersonal interactions with clients, and (2) applying principles of PBS in their interactions with clients

most needed or wanted such assistance. This real-time tele-health support enabled an MBPBS trainer to skillfully assist the caregivers when using the MBPBS program with the clients. We used the Just-In-Time Adaptive Interventions (JITAIs; Nahum-Shani et al., 2017) methodology which enabled us to dynamically respond to the training needs of the caregivers by providing the right type and amount of support at the right time via telehealth technology. None of

Table 2 (continued)

Part III	
Day 7 training	Review of the meditation instructions and practices (daily logs)
	Review and practice Samatha, Kinhin, and Vipassanā meditations
	Review of the Four Immeasurables
	Practice equanimity, lovingkindness, compassion, and joy meditations
	Emotion regulation and anger—meditation on the soles of the feet
	Instructions for practicing three ethical precepts—refrain from (a) harming living beings, (b) taking that which is not given, and (c) incorrect speech
	Mindfulness and PBS practice
	Review of the 7-day MBPBS training program

All training days were 8 hr in duration

the caregivers had training in or previously used JITAIs as a resource when dealing with clients with behavioral challenges. The caregivers requested an average of 3 hr of JITAI assistance during the 4-week period.

Post-training The caregivers implemented the MBPBS program for 10 weeks following the termination of the 7-day training, thus making this a 19-week study. No other new interventions were introduced or implemented during the 10-week post-training implementation period. In addition, no changes were reported regarding the prescription of psychotropic medications or the participants' general medical regimen.

MBPBS Trainers The primary trainer had a life-long practice of meditation and was well versed in mindfulness-based training for caregivers, parents, teachers, and clients. In addition, the trainer was a behavior analyst at the BCBA-D level with extensive experience in developing and implementing PBS plans. A second trainer provided independent fidelity ratings of the MBPBS training by the primary trainer. The second trainer had 14 years of personal practice in mindfulness meditation and 9 years practice in training support staff in mental health. In addition, the second trainer was a doctoral-level licensed clinical psychologist and a behavior analyst at the BCBA-D level.

Fidelity of MBPBS Training The second MBPBS trainer independently observed the 7-day training provided by the primary trainer and rated fidelity of teaching on the following variables: (1) adherence (i.e., extent to which the core training components of the MBPBS program were taught); (2) dosage (i.e., the number of training sessions delivered); (3) quality (i.e., extent to which the trainer delivered the program components and content as intended); and (4) responsiveness (i.e., extent to which the trainer was responsive and skillfully engaged with the participating caregivers [Dane & Schneider, 1998]). The overall fidelity ratings were (1) 100%

for adherence; (2) 100% for dosage; (3) 95% (mean; range = 92 to 100%) for quality; and (4) 96% (mean; range = 93 to 100%) for responsiveness.

Measures

Two categories of caregivers' behavior were coded: (1) *mindful engagement* of caregivers with clients during learning or leisure activities, and (2) *caregiver attention* to clients' challenging or socially appropriate behavior. Furthermore, caregiver attention was measured in terms of latency, duration, and quality of attention. Two categories of clients' behavior were coded: (1) client's participation in *learning activities* or *leisure activities*, and (2) client exhibiting *challenging behavior* or *socially appropriate behavior*. Learning activities consisted of tasks that required the caregiver to teach identified skills, such as those in a client's annual Individual Support Plan (ISP), and included task demands by the caregiver during the activity. Leisure activities included physical or mental activities that were free from task demands, enjoyable, and fun for the clients.

Caregiver Data

Mindful engagement was characterized as the caregiver providing sustained attention to the client, with clear awareness, curiosity, and acceptance of present events and experiences. It included the caregiver demonstrating an ability to disengage from automatic, habitual reactions to the client's behavior.

Caregiver attention was defined as the caregiver providing positive or negative verbal feedback following a client's challenging or socially acceptable behavior. Caregiver attention was further measured in terms of latency, duration, and quality of attention.

Latency of attention was recorded in terms of the number of seconds it took the caregiver to give feedback following a client's challenging behavior or socially acceptable behavior.

Duration of attention was recorded in terms of the number of seconds caregiver feedback lasted following a client's challenging behavior or socially acceptable behavior, which could include verbal responses and physical contact.

Quality of attention was defined with mutually exclusive sub-categories of positive-high, positive-low, or negative attention. *Positive-high attention* was defined as enthusiastic specific praise (e.g., "Great job in putting your dishes in the dishwasher!"); frequent eye contact (i.e., head or eyes oriented toward the client or activity); or gentle physical touch. *Positive-low attention* was defined as generic non-specific praise (e.g., "Great job!") or infrequent eye contact (i.e., head or eyes oriented toward anything other than the client). *Negative attention* was defined as verbal reprimand, no eye contact, something was removed that the client liked, or non-gentle physical touch.

Client Data

Challenging behaviors included behaviors that are not acceptable or expected in a social environment (e.g., verbal or physical aggression, self-injury, property destruction, and disruptive interactions). Challenging behaviors are often used by clients to access various contingent reinforcers (e.g., caregiver attention, desired items), or to escape from or avoid task demands (e.g., learning activities, chores). These behaviors pose a challenge for caregivers because they are socially inappropriate and difficult to replace with socially acceptable behaviors that serve an equivalent function for the client.

Socially acceptable behaviors included actions that are generally deemed to be appropriate and contextually relevant when clients interact with caregivers and peers. The interactions produce positive rather than negative consequences. Examples of socially acceptable behaviors include pleasant eye contact, positive changes in facial expressions or body movements, appropriate hand gestures for emphasis, and interactions that are not physically or verbally disruptive.

It is de rigueur in behavioral intervention studies to undertake a functional analysis of challenging behaviors as the basis for deriving the most appropriate treatment for the target behavior. In mindfulness-based interventions, MBPs are based on other considerations, such as putative mechanisms that may be involved in producing general changes in a person's state or trait mindfulness, which may lead to downstream behavioral changes. Functional assessment was included to assess whether singular or mixed motivations for the clients' behaviors may impact outcomes or if positive outcomes of mindfulness-based interventions are limited by the clients' current motivation for engaging in challenging behaviors.

Data Collection

Each caregiver was videotaped once daily for 10 days, for a minimum of 15 min, with the 4 clients in the caregiver's group home, during the pre- and post-training periods. The pre-training data collection period was the 3 weeks preceding the MBPBS training. The post-training data collection period was during the last 2 weeks of the 10 weeks of the planned implementation of the MBPBS program. The videotaping was scheduled during times when the caregivers were required to be engaged with the clients as prescribed in the client's ISP. These periods were chosen as they were presumed to offer maximum opportunities for routine naturalistic staff-client engagement without having to contrive artificial situations for the purposes of data collection. In addition, the caregivers were accustomed to being with the clients during these periods by policy and practice of the group homes.

For each client, a simple randomization was used to select 10 videotaped sessions of caregiver-client interactions during both pre- and post-training periods, providing 10 sessions per client for data coding during the pre-training period and 10 sessions per client during the post-training period.

Mindful Engagement The last 10 min of each videotaped recording were coded using a partial interval recording procedure (Barlow et al., 2009). Each 10-min session was divided into 60, 10-s intervals, and the occurrence of each target behavior at any time within an interval was recorded. The data were coded as follows:

1. In the initial analysis, each 10-s interval was coded as either the caregiver was (a) engaged or (b) not engaged with the client. No further coding was undertaken of the intervals in which the caregiver was not engaged with the client. The focus of the study was to elucidate patterns of interactions, and there were no interactional patterns to code when a caregiver was not engaged with a client.
2. Taking only those intervals that a caregiver was engaged with a client, each interval was coded as either the caregiver was engaged in a (a) learning or (b) leisure activity with the client.
3. Taking only those intervals in which a caregiver was engaged in either learning or leisure activities, all intervals were coded as either the client engaged in a (a) challenging behavior or (b) socially acceptable behavior.

The coded data were averaged across sessions for each caregiver to yield the average percent of intervals of the following: (a) caregiver-client engagement during pre- and

post-training; (b) caregiver-client engagement in learning or leisure activities during pre- and post-training; and (c) caregiver-client engagement in learning or leisure activities that were followed by client challenging behaviors or client socially acceptable behavior during pre- and post-training.

Attention The last 10 min of each videotaped recording was also coded using a continuous recording procedure during the whole session instead of the partial interval recording procedure used for mindful engagement above (Barlow et al., 2009). That is, the number of times the client's target behaviors (i.e., challenging or socially acceptable behaviors) occurred and the corresponding caregiver's attention to those behaviors were recorded throughout each session. The data were coded stepwise as follows:

1. The number of client challenging behaviors or socially acceptable behaviors in each session was recorded.
2. Whether the caregiver attended to each challenging behavior or socially acceptable behavior in each session was recorded. Given that only mindful engagement intervals were coded, there were no instances of the caregiver not attending to either the challenging behavior or socially acceptable behavior.
3. Each attentional response of the caregiver to the clients' challenging or socially acceptable behavior was coded for (a) latency (i.e., time taken by caregiver to respond to client behavior), (b) duration (i.e., time spent in providing attention), and (c) quality (i.e., positive-high, positive-low, or negative attention).

The coded data were averaged across sessions to yield the following: (a) number of client challenging or socially acceptable behaviors; (b) number of caregiver attentional responses following occurrence of each client challenging or socially acceptable behaviors; (c) length of time it took for the caregiver to respond to the client's challenging or socially acceptable behavior; (d) length of time the caregiver provided attention; and (e) number of positive-high, positive-low, and negative quality of caregiver attention responses. These data were coded and analyzed at pre- and post-training.

Interrater Agreement Interrater agreement data for coding the videotaped recordings of caregiver-client interactions were obtained across two independent raters for at least 20% of the caregiver-client videotaped sessions. The independent raters were practicing behavior analysts at the BCBA-level and had extensive experience in coding in vivo observations and from videotaped recordings. The two raters were trained in the coding until they obtained an average of 95% agreement (range = 92–100%). For each caregiver-client dyad, one observer was designated as the primary rater and the

other as the secondary rater. Each rater was the primary rater for 15 caregiver-client dyads (i.e., 50% of the dyads). Primary and secondary raters viewed and coded the videotaped recordings independently at different times based on written definitions of the dependent variables. An agreement was defined as the two raters recording the same variable occurring in the same interval. Interrater agreement between the two raters was calculated by dividing the number of agreements by the total number of intervals rated and multiplying it by 100 to obtain a percentage. The overall mean interrater agreement was 94% (range = 86 to 100%) for mindful engagement and 91% (range = 79 to 97%) for attention.

Functional Assessment of Client Challenging Behaviors Caregivers with the most knowledge of the participating clients completed a functional behavioral assessment using the Questions About Behavioral Function (QABF) questionnaire (Paclawskyj et al., 2000). The QABF provides an indirect assessment of the environmental conditions hypothesized as the purported functions of the clients' verbal and physical aggression. The functions measured by the QABF include attention (e.g., *engages in the behavior to get attention*), escape (e.g., *engages in the behavior when he/she does not want to do something*), non-social (e.g., *engages in the behavior as a form of self-stimulation*), physical (e.g., *engages in the behavior because he/she is in pain*), and tangible (e.g., *engages in the behavior to get access to items such as preferred toys, food, or beverages*).

Data Analyses

To address potential concerns related to the assumption of normality due to our small sample size, we adopted a Bayesian analytical approach. Our data were analyzed using R version 4.1 (R Core Team, 2021) and Bayesian paired *t*-tests were chosen, acknowledging the nature of our pre-post data and the robustness of this technique in handling small sample sizes (Morey & Rouder, 2018). The Bayesian model does not strictly rely on the normality assumption and provides a full probability distribution for the difference in engagement percentages, allowing for a more nuanced and complete understanding of the uncertainty around the estimate (Kruschke, 2015). We estimated effect sizes of Bayesian *t*-tests using δ (delta) values interpreted as follows: δ-value around 0.20 signifies a small effect size, around 0.50—a medium effect size, and above 0.80, represents a large effect size (Cohen, 1988). A Cauchy prior of 0.707 was chosen to ensure a well-defined prior while allowing for a wide range of values for the standard deviation of the difference of means. The Cauchy prior is centered at zero and has a scale parameter of 0.707, which is a default, non-informative prior that is symmetric and has fat tails. It is used to make the test less dependent on prior knowledge or assumptions

(Rouder et al., 2009). Results are reported in terms of probabilities and credible intervals, and the posterior probability of the difference of pre- and post-means being greater than zero was used to determine statistical significance. We also reported descriptive statistics including mean and standard deviation, and minimum and maximum values. As is standard in behavior analysis, a visual analysis based on mean data was used to analyze quality of attention.

Results

The results of this study are summarized in Table 3, including descriptive statistics, and are illustrated in Figs. 1 and 2, showing the statistical comparisons based on posterior distributions. Figure 3 presents the data for quality of caregiver attentional responses to clients' challenging and socially appropriate behaviors. The following sections describe the results for each outcome variable and highlight the effect sizes.

Percent of Intervals Engaged Following training in MBPBS, caregivers engaged with clients on average three times more when compared to pre-MBPBS training assessment. Figure 1A shows posterior distributions of differences between pre- and post-MBPBS training including 95% CI, which do not include zero, indicating a statistically significant increase in caregivers' engagement with clients with a large effect size ($\delta = -8.38$). Note that a negative difference in effect size indicates an increase after training while a positive difference indicates a decrease because all tests were conducted with the reference to the baseline.

Percent of Intervals of Learning or Leisure Activities During Engaged Intervals Caregivers' engagement with the client in learning activities increased on average by six times post-MBPBS training when compared to a relatively low post-training increase in engagement in leisure activities (Table 3). Specifically, a large effect size was observed for the engagement in learning activities as can be seen in Fig. 1B, ($\delta = -4.55$), while engagement in leisure activities was of a moderate effect size (Fig. 1C, $\delta = -0.55$).

Percent of Intervals of Learning or Leisure Activities That Were Followed by Challenging Behaviors There was a strong significant decrease in client challenging behaviors with a large effect size following engagement in learning activities ($\delta = 3.46$) and leisure ($\delta = 1.49$) activities at post-MBPBS training compared to the baseline (Table 3). This decrease is demonstrated statistically for client challenging behaviors following learning activities (Fig. 1D) and following leisure activities (Fig. 1E) with 95% CI over the cut-off zero point.

Table 3 Descriptive statistics for outcome variables before and after mindfulness training

Outcome variables	Mean	SD	Min	Max
The overall caregiver engagement with client				
Before training (%)	24.70	6.48	10	38
After training (%)	82.03	7.17	67	95
Caregiver engagement with client during learning activities				
Before training (%)	9.53	4.96	2	20
After training (%)	59.83	10.62	35	77
Caregiver engagement with client during leisure activities				
Before training (%)	17.83	4.79	5	30
After training	22.80	5.71	11	36
Client challenging behavior followed learning engagement				
Before training (%)	46.97	11.84	20	67
After training (%)	4.90	2.81	0	11
Client challenging behavior followed leisure engagement				
Before training (%)	7.30	4.65	0	15
After training (%)	0.00	0.00	0	0
Client challenging behavior				
Before training (*n*)	14.17	4.66	3	23
After training (*n*)	3.37	1.43	0	6
Caregiver attention to client challenging behavior				
Before training (*n*)	5.40	3.12	0	12
After training (*n*)	0.43	0.57	0	2
Latency of caregiver attention to client challenging behavior				
Before training (s)	3.00	1.78	0	7
After training (s)	0.40	0.50	0	1
Duration of caregiver attention to client challenging behavior				
Before training (s)	49.30	16.97	0	75
After training (s)	0.40	0.50	0	1
Client socially acceptable behavior				
Before training (*n*)	16.00	3.97	11	29
After training (*n*)	20.63	4.33	14	33
Caregiver attention to client socially acceptable behavior				
Before training (*n*)	3.77	2.13	0	8
After training (*n*)	17.60	2.97	14	25
Latency of caregiver attention to client socially acceptable behavior				
Before training (s)	6.20	3.49	0	15
After training (s)	2.40	0.97	1	4
Duration of caregiver attention to client socially acceptable behavior				
Before training (s)	1.57	1.22	0	7
After training (s)	67.80	8.05	53	82

Clients' Challenging Behaviors and Caregivers' Latency and Duration of Attending to Such Behaviors The number of client challenging behaviors observed significantly decreased following mindfulness training of caregivers with a large effect size ($\delta = 3.14$) as shown in Fig. 1F, and caregivers' attention to such behaviors significantly decreased (Fig. 1G, $\delta = 1.59$). At the same time, latency of caregiver attention to client challenging behaviors decreased significantly ($\delta =$

1.60) as illustrated in Fig. 1H, and the duration of such attention significantly decreased ($\delta = 2.84$) as well (Fig. 2A).

Clients' Socially Acceptable Behaviors and Caregivers' Latency and Duration of Attending to Such Behaviors A significant increase of client socially acceptable behaviors was also evident after mindfulness training of caregivers ($\delta = -2.82$) as shown statistically on Fig. 2B. Caregivers' attention (Fig. 2C, $\delta = -4.46$) to appropriate clients' behaviors and duration of the attention (Fig. 2E, $\delta = -8.30$) significantly increased with the overall large effect size. Latency (Fig. 2D, $\delta = 1.04$) to client behavior decreased.

Quality of Attention As shown in Fig. 3, the mean number of caregiver attentional responses directed at challenging client behaviors was totally negative and decreased from 5.4 prior to caregiver training in MBPBS to 0.43 following training in MBPBS. Similarly, the mean number of caregiver attentional responses directed at socially acceptable client behaviors increased from 0 to 14.53 for positive-high-quality attention, decreased marginally from 3.77 to 3.07 for positive-low-quality attention, and remained at 0 for negative quality attention post-MBPBS training.

Functional Assessment for Challenging Behaviors Of the 16 clients, 7 had attention, 4 had escape, and 5 had tangible as the primary motivation for their verbal and physical aggression. In all cases, the functions were not singular, and each client had different secondary motivations for their challenging behaviors as well.
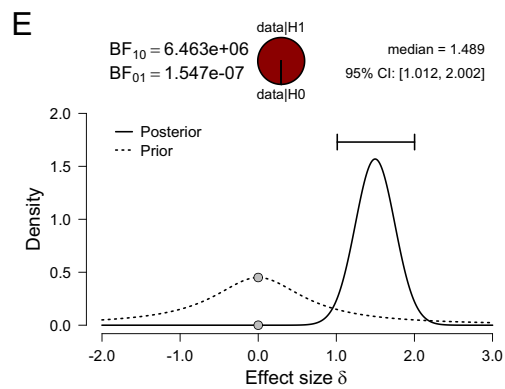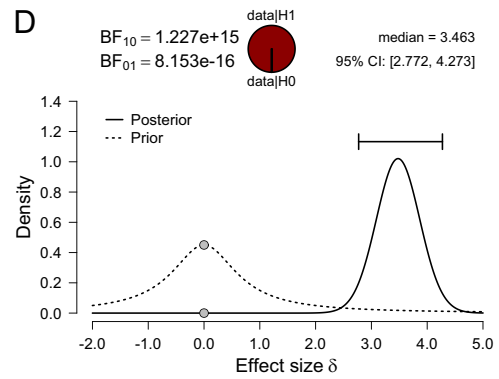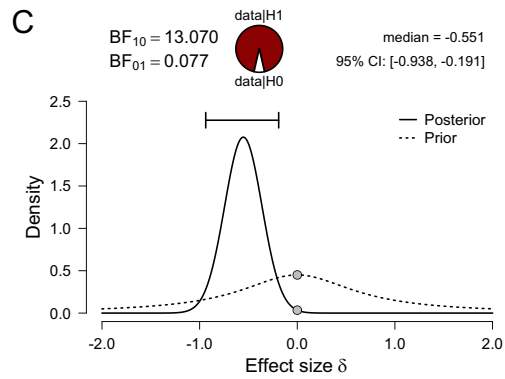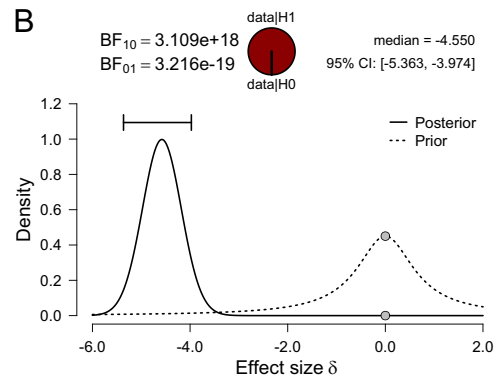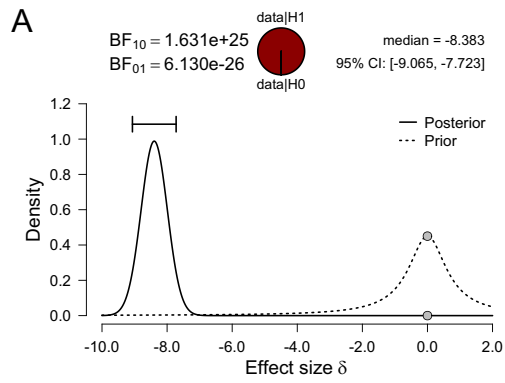
Discussion

This study aimed to provide a micro-analysis of the behavioral effects of mindful engagement on reciprocal caregiver and client interactions. The study was based on behavioral observations of caregivers and their clients prior to and following training of the caregivers in MBPBS, a second-generation mindfulness-based program (Van Gordon et al., 2015) that is informed by and grounded in Buddhist teachings and general principles of positive behavior support (Carr et al., 1999, 2002; Carr & Horner, 2007). Behavioral observations showed that, on average, caregivers were positively engaged with clients significantly more during post-MBPBS training when compared to pre-MBPBS training. Their engagement increased six-fold during learning activities, with minimal increase during leisure activities. The clients' challenging behavior was significantly reduced during both learning and leisure activities. The caregivers reduced their negative attention to the clients' challenging behavior, significantly decreased the latency of attention,

and significantly increased the duration and quality of their attention to the clients' socially appropriate behaviors following training in MBPBS.

Before training in MBPBS, the caregivers responded only with negative attention to the clients' challenging behaviors and with only minimal low-positive attention to the clients' socially appropriate behaviors. This kind of caregiver-client engagement typically leads to increased challenging behaviors and decreased socially acceptable behaviors in the clients. One of the key reasons for this outcome is that attention, regardless of whether it is positive or negative, can be reinforcing to the client (Fisher et al., 1996; Kodak et al., 2007). Because less attention is paid to socially acceptable behavior, it is not reinforced often enough, and thus does not increase. Only when caregivers were taught mindfulness within the MBPBS program, the nature of the caregiver-client interaction changed. The caregivers responded mindfully to the clients' behaviors, now with enhanced positive attention (mostly high) to socially acceptable behaviors and with minimal negative attention to challenging behaviors. This led to significant increases in the clients' rate of socially acceptable behaviors and almost ceasing of challenging behaviors. Similarly, the latency, duration, and quality of attention affected the rate of the clients' challenging and socially acceptable behaviors. This finding is aligned with results from behavior analytic studies that have shown how latency, duration, and quality of attention may affect an individual's challenging behaviors (Gardner et al., 2009). Overall, our findings demonstrated that the clients' behaviors dependently arose in response to caregivers' behaviors, and changed contingently when specific training in mindfulness was provided to the caregivers.

Both mindfulness and PBS components of the MBPBS program could have changed the nature of the caregivers' attention to the clients' challenging and socially appropriate behavior following the caregivers' training in MBPBS. However, from the lens of mindfulness, it can be theorized that the focused attention meditation taught in the MBPBS program could have heightened the sensitivity of the caregivers in terms of how to differentially focus their attention on the clients' challenging and socially acceptable behaviors. In addition, the awareness that arose from cultivating attention during meditation may have further sensitized the nature of their attention. That is, when attention to a target behavior is immediate, of substantial duration, and of high quality, the probability of the behavior recurring is increased regardless of whether the behavior is challenging or socially acceptable. Conversely, when attention to a target behavior is immediate but of short duration and low in quality, this would lead to a much lower probability of recurrence, and thus may lead to its reduction and possible extinction. Furthermore, the content of the MBPBS training program may have increased caregivers' ability to be more kind, compassionate, and

A
$BF_{10} = 1.631e+25$
$BF_{01} = 6.130e-26$
data|H1
data|H0
median = -8.383
95% CI: [-9.065, -7.723]

B
$BF_{10} = 3.109e+18$
$BF_{01} = 3.216e-19$
data|H1
data|H0
median = -4.550
95% CI: [-5.363, -3.974]

C
$BF_{10} = 13.070$
$BF_{01} = 0.077$
data|H1
data|H0
median = -0.551
95% CI: [-0.938, -0.191]

D
$BF_{10} = 1.227e+15$
$BF_{01} = 8.153e-16$
data|H1
data|H0
median = 3.463
95% CI: [2.772, 4.273]

E
$BF_{10} = 6.463e+06$
$BF_{01} = 1.547e-07$
data|H1
data|H0
median = 1.489
95% CI: [1.012, 2.002]

F
$BF_{10} = 1.442e+14$
$BF_{01} = 6.935e-15$
data|H1
data|H0
median = 3.137
95% CI: [2.592, 3.754]

G
$BF_{10} = 1.904e+07$
$BF_{01} = 5.253e-08$
data|H1
data|H0
median = 1.594
95% CI: [1.186, 2.126]

H
$BF_{10} = 1.904e+07$
$BF_{01} = 5.253e-08$
data|H1
data|H0
median = 1.600
95% CI: [1.075, 2.227]

◀**Fig. 1** Bayesian inferential plots of caregiver engagement and client behaviors comparing outcomes before and after training in MBPBS. *Note.* Panel **A** Overall caregiver engagement. Panel **B** Caregiver engagement in learning activities. Panel **C** Caregiver engagement in leisure activities. Panel **D** Client challenging behaviors in response to learning activities. Panel **E** Client challenging behaviors in response to leisure activities. Panel **F** Client challenging behaviors. Panel **G** Caregiver attention to client challenging behaviors. Panel **H** Latency of caregiver attention to client challenging behaviors

empathic in the quality of their interactions. For example, their enhanced ability to pay attention to moment-to-moment interactions may have increased their awareness of arising anger or irritation within themselves. This would have sensitized them to opportunities for altering their responses to the clients' challenging behaviors. These are issues that can be investigated further using behavior analytic methodologies.

In terms of theory, our findings can be explained in two different but related ways, i.e., within the Buddhist doctrine of dependent arising or within the PBS model of behavior analysis. This study was based on the understanding that when caregivers are taught MBPBS, their interactions with their clients will change and that these interactions in turn will produce positive changes in the behaviors of the clients. This formulation can be interpreted in terms of the Buddhist doctrine of dependent arising and the principle of specific conditionality. It is presented in the Saṃyukta Nikāya (12:21) as: *This being, that exists; with the arising of this, that arises. This not being, that does not exist; with the ceasing of this, that ceases* (Anālayo, 2021). That is, when there is a specific positive change in the caregivers' behaviors, the clients' socially adaptive behaviors increase, and their challenging behaviors cease.

The Buddhist doctrine of dependent arising is reflected in PBS philosophy as: ". . . it is change in the behavior of support providers that will result in change in the behavior of the person being supported" (O'Neill et al., 2015, p. 76). Early behavioral research on coercive family systems (Patterson, 1982), such as mother-child interactions, showed that the effects are bi-directional (Wahler & Dumas, 1986), and the behavior of the family affects the behavior of the child as much as the child's behavior affects family systems (Schopler & Mesibov, 1984). Similar to our findings, Carr et al. (1991) reported that adults engaged in less teaching activities with children who engaged in challenging behaviors under task demand conditions and let the children spend more time in leisure activities, essentially to avoid dealing with their increased challenging behaviors. Thus, these children successfully engaged in escape behavior to avoid learning tasks via caregiver use of negative reinforcement. In the present study, these escape and avoidance behaviors were essentially neutralized following training in MBPBS when the caregivers began to interact with the clients mindfully by attending more to their socially acceptable behaviors and attending minimally to their challenging behaviors. The

attention they provided to the clients was positive, immediate, longer in duration, and higher in quality as a result of their training in MBPBS. Behavioral research suggests that specific dimensions of socially mediated consequences, such as latency, duration, and quality of caregiver attention, can alter the clients' behavior by reducing caregiver's use of negative reinforcement (e.g., Gardner et al., 2009). That is, when the caregivers change the nature of their behavioral interactions, the clients come under the stimulus control of the new contingencies.

In the present study, functional assessment suggested mixed motivations that gave rise to the clients' challenging behaviors. The current finding that positive changes occurred in the clients due to mindfulness-based training of caregivers, regardless of the assessed motivations for specific client behaviors, is in line with findings from previous studies that showed similar outcomes (e.g., Felver et al., 2014, 2017; Shah et al., 2022; Singh et al., 2017, 2019; Wilson et al., 2015). There have been various speculations regarding the reasons why MBPs may override the behavioral functions of challenging behaviors (e.g., Singh et al., 2019). It may be a result of decoupling of the reinforcement contingencies that originally strengthened these motivations from the unfolding of current behavior with enhanced awareness of the new contingencies, thus resulting in reduced emotional and behavioral reactivity. Caretakers may have undermined the functional relation between their internal unpleasant states and habitual patterns of reaction during personal meditation practice (e.g., responding to aversive experience with intentional mindful attention rather than habitual reactions). This process of eroding the functional relation of unpleasant internal states with habitual reactions could be considered a form of desensitization (Wolpe, 1973) of caretakers with themselves. This desensitization of intrapersonal experience during meditation may in turn have generalized to desensitization of interpersonal interactions with clients, potentially affording opportunities for more skillful responding to aversive interactional patterns, and/or opportunities for modeling mindful prosocial behavior clients naturalistically adopted via observation.

The significance of the present study is not in the demonstration of the effectiveness of MBPBS training in changing the behavior of the caregivers, which in turn changes the behavior of their clients. This has been amply demonstrated in previous studies with caregivers (Singh et al., 2020), parents (Singh et al., 2021), and teachers (Singh et al., 2013). What the present study does is to show exactly what kinds of caregiver and client behaviors change on a moment-by-moment basis in terms of caregiver-client engagement and the caregivers' frequency, latency, duration, and quality of attention. When the behaviors of both caregivers and clients are observed and analyzed through partial-interval recording, it utilizes a method that is sensitive enough to detect changes in the target behaviors as a function of training. This leads to the
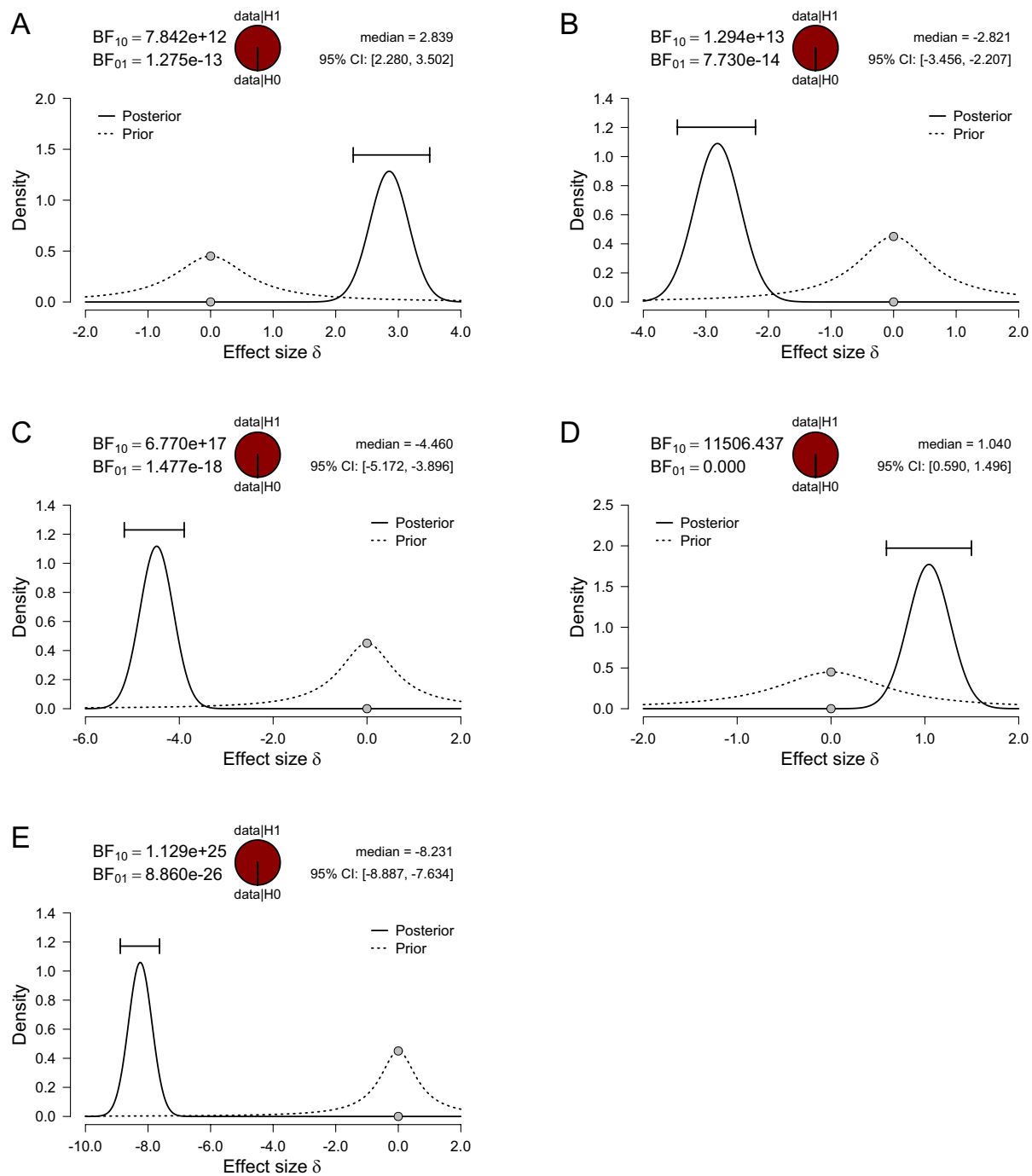
Fig. 2 Bayesian inferential plots of caregiver attention comparing outcomes before and after training in MBPBS. *Note.* Panel **A** Duration of caregiver attention to client challenging behaviors. Panel **B** Client socially acceptable behaviors. Panel **C** Caregiver attention to client socially acceptable behaviors. Panel **D** Latency of caregiver attention to client socially acceptable behaviors. Panel **E** Duration of caregiver attention to client socially acceptable behaviors

consideration that researchers and clinicians using MBPs may be able to operationalize the Buddhist doctrine of dependent arising within the framework of applied behavior analysis. The specific conditionality inherent in dependent arising and ceasing may be analogous to the behavioral concepts of setting events and motivating operations.

Limitations and Future Research

This study is not without limitations. This study clearly substantiates the behavioral spillover or cascading effects of caregiver training in MBPBS on their clients, and it also shows that the clients' behaviors in turn affect the behavior of the
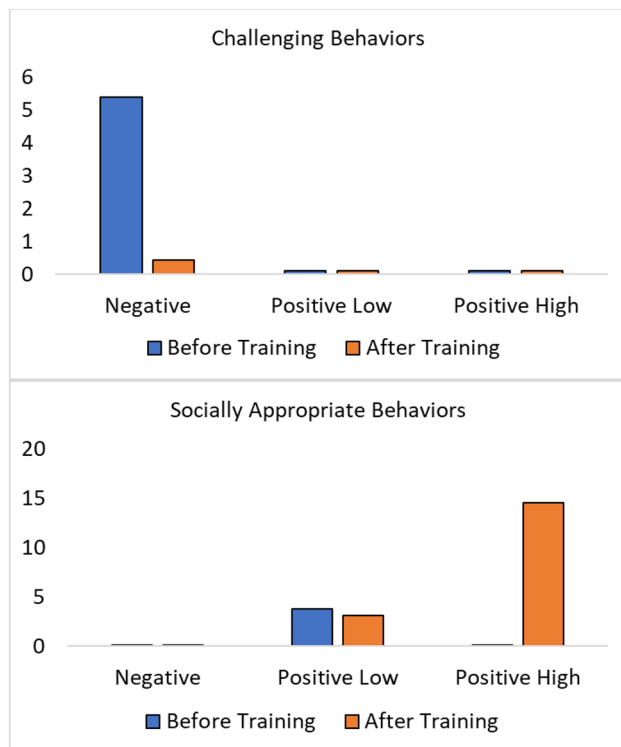
Fig. 3 Quality of caregivers' attentional responses before and after training in MBPBS

caregivers. Indeed, a limitation of this study is that it does not take into account how the behavior of these caregivers and clients may have also affected others within their daily social network (i.e., other caregivers and clients in the group homes) and how their behaviors in turn may have affected the behavior of those we analyzed. The reciprocal influence of others in the group home needs to be analyzed to truly understand how the arising of socially acceptable behaviors and cessation or reduction of challenging behaviors changes the nature or valence of the behaviors of each caregiver and client in the social network. A related limitation is that this study did not take into account other nonspecific variables that may have influenced caregiver behavior (e.g., level, nature, and amount of prior training in behavior management strategies; the personal characteristics of the caregiver such as friendliness, warmth, compassion, and genuine interest in the welfare of the client; therapeutic alliance) and the manner in which the clients' behaviors affected the caregivers' rate and quality of treatment delivery. Future research could use behavior analytic methods to dissect the nature of the contingencies that operate prior to and post-MBP training.

Outcomes in most MBPs are based on the use of self- and other-reported measures of the target dependent variables (e.g., changes in state or trait mindfulness, symptoms of specific diseases and disorders). However, self-report measures are not robust reliable measures. For example, rating scales are subjective measures affected by unaccounted environmental, cultural, and personal variables, with the key issue being the correspondence between what one says, what one does, and what one says they do. Typically, self-ratings by caregivers are informative of what they say they do, but what they *say they do* and what they *actually do* during caregiving are often entirely different. Behavioral observations provide an alternative reliable means of assessing what they do independent of what caregivers say they do. In contrast to self-ratings which can be done regularly and cheaply, behavioral observations and the resulting data reduction, interrater reliability checks, and data analyses are time-consuming, intrusive, and labor-intensive. This may be a limitation for research with large sample sizes and in clinical practice in non-behavioral clinical settings. However, behavioral research using internally valid research designs with small sample sizes has demonstrated that behavioral observations are feasible and practical, and behavioral observations are routinely used by behavior analysts in clinical practice. Future research could focus on using such methods to assess the impact of MBPs on behavior change in caregivers and their clients.

Given the findings in the present study that moment-by-moment changes in caregivers' behavior can be independently observed by others, future research could assess if the caregivers are mindful of these changes in their own behavior. For example, is there self-awareness of not only the changes that are occurring in their own behavior but also what is changing. A related issue is whether the changes the caregivers observed in client behaviors provided them with further insight and consequent enhancement of their awareness and mindfulness practice. Would such incremental changes in caregivers' behavior lead to positive changes in the social ecology of group homes? This is a question that may be empirically answered in future behavioral mindfulness research.

Declarations

Ethics Statement All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compatible ethical standards.

Informed Consent Informed consent was obtained from all caregivers and individual clients (if they were able to understand and give informed consent) or their legal guardians.

Conflict of Interest NNS is the developer of the Mindfulness-Based Positive Behavior Support (MBPBS) program. The rest of the authors declare no competing interests.

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