Research on Child and Adolescent Psychopathology (2023) 51:165–175
https://doi.org/10.1007/s10802-022-00979-1

The Effects of Young Children's Callous-Unemotional Traits on Behaviorally Observed Outcomes in Standard and Technology-Enhanced Behavioral Parent Training

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Accepted: 14 September 2022 / Published online: 8 November 2022

Abstract

Behavioral Parent Training (BPT) remains the current standard of care for early onset behavior disorders (BD); however, problem behaviors characterized by relatively high callous unemotional (CU) traits are linked to poorer treatment outcomes, highlighting the need for novel interventions. This study examined the relation of baseline child CU traits to changes in observed parent and child (3 to 8 years old) behavior in 101 families with low-income randomized to either a standard (*Helping the Noncompliant Child*, HNC) or technology-enhanced BPT program (TE-HNC). Assessments occurred at baseline, post-intervention, and at a three-month follow-up. Treatment group moderated the relation between CU traits and observed parenting behaviors and child compliance. Specifically, higher levels of child CU traits at baseline predicted lower levels of positive parenting at post-intervention and follow-up, and lower levels of child compliance at follow-up but *only* in the standard program (HNC). This is the first intervention study to behaviorally assess the differential impact of CU traits in standard, relative to technology-enhanced, BPT and suggests the promise of a technology-enhanced treatment model.

Keywords Callous unemotional traits · Behavioral parent training · Technology · Low-income families · Child behavior disorders

Introduction

Early-onset behavior disorders (BDs; e.g., oppositional defiant disorder, conduct disorder, attention-deficit/hyperactivity disorder) affect an estimated 113 million youth (Polanczyk et al., 2015) and are a leading cause of child mental health referrals worldwide (Merikangas et al., 2009). Importantly, early-onset BDs also increase children's risk for a number of other problems, including (but not limited to) substance use, delinquency and antisocial behavior, academic underachievement, and employment instability (e.g., Piquero et al., 2016). Therefore, early identification and treatment of BDs is critical (Cohen & Piquero, 2009), especially in at-risk populations, such as lower income families (see Debovic et al., 2011; Jones et al., 2013; Lundahl et al., 2006, for reviews). Behavioral Parent Training (BPT) is the recommended and most used treatment for young children with early-onset BDs (Chorpita et al., 2011; Kaminski & Claussen, 2017) as it has resulted in improvements in both parent and child behavior (Forehand et al., 2013; Lundahl et al., 2006). However, similar to other interventions, BPT post-treatment effect sizes vary and wane after treatment

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ends (Lundahl et al., 2006), likely due to a number of factors, including characteristics of the child.

One characteristic of the child that has received attention is callous-unemotional (CU) traits (e.g., low empathy and guilt; lack of sociality; shallow emotions; insensitivity to punishment) (for a review see Frick, 2022). Consideration of CU traits is important for several reasons, including informing models for severe conduct problems, classifying children, and developing or tailoring interventions that are effective when CU traits are elevated (Frick et al., 2014). For example, the presence of these traits at baseline can lead to poorer BPT outcomes among pre-adolescent children (e.g., Elizur et al., 2017; Hawes & Dadds 2005; Hogstrom et al., 2013). However, the effects of CU traits on treatment outcomes appear to vary depending on the intervention approach. For example, researchers have found that an adapted version of *Parent-Child Interaction Therapy* (PCIT; Eyberg & Funderburk, 2011), which entailed an extended number of treatment sessions designed specifically for children with CU traits, was more effective with child conduct problems than standard PCIT at a 3-month follow-up (Donohue et al., 2021; Fleming et al., 2022). While promising, additional sessions may further challenge family engagement in BPT, which already has relatively low levels of engagement and high levels of drop-out like many of our child-focused evidence-based interventions (Anton & Jones, 2017; Jones et al., 2020). Alternatively, Fleming and colleagues (2020) kept PCIT content the same but varied the delivery vehicle (standard in-person vs. web-based services) and found the effects of CU traits were more detrimental for some parent and clinician-reported child behavior indicators (e.g., intensity of problem behaviors, global functioning) for internet-delivered BPT. Drawing across prior work, we do not yet know whether technology can serve as a delivery vehicle to offer a more tailored and engaging treatment model to families of children with higher CU traits without dramatically increasing the number of treatment sessions.

In addition, the literature on the relationship of CU to BPT outcome is limited by the method of assessment (Waller et al., 2013). Although behavioral assessment has long been viewed as the gold standard for assessing parent-child interactions (e.g., Hawes & Dadds 2006), this method has only occasionally been used in studies focusing on CU and BPT (Fleming et al., 2017; Hyde et al., 2013; Kimonis et al., 2019). Instead, parents have typically reported on all measures. This is important because when parents report on both their children's CU traits *and* the outcome of BPT (e.g., parent report measures of child behavior, standardized interviews), shared method variance is apparent and risks inflating the relationship (Waller et al., 2013) as well as potential biases in parent report compared to observations (Parent et al., 2014).

Beyond the scarcity of studies using behavioral observations as BPT outcomes, the research to date remains largely preliminary. For example, Kimonis et al. (2019) conducted a pilot open trial, Fleming et al. (2017) reported a single case study, and Hyde et al. (2021) used a non-standardized measure of CU traits. In addition, Fleming et al. (2017) and Hyde et al. (2021) both limited measurement to parent behavior change, and alternatively Kimonis et al. (2019) assessed only child behavior change. While these formative studies offer critical first steps and important clues regarding the links between CU and BPT, subsequent advances in this line of research will more likely occur with studies using comparison groups, behavioral observation, and the assessment of *both* parent and child behavior.

The current study is a secondary analysis which builds on the recent Parent et al. (in press) report where a technology-enhanced version of one evidence-based BPT program, *Helping the Noncompliant Child* (McMahon & Forehand, 2003), was found to be more effective than the standard program for parenting skills at post-treatment and child compliance at follow-up. Critically, the Technology-Enhanced HNC (TE-HNC; Jones et al., 2014; 2021) gains in parenting and child behavior were achieved in less time (i.e., fewer sessions or weeks to complete treatment), suggesting a more cost-effective treatment model for BDs in general. Specifically, in the current analysis, CU traits of the participating children were assessed at baseline and the impact of these traits on *behaviorally observed* parent and child outcomes of BPT was assessed in the two groups (HNC and TE-HNC). Of importance, we assessed whether CU had a similar impact in each of the two treatment conditions. That is, did CU traits predict similar treatment outcomes across the standard and enhanced programs, or did families of children with greater CU traits benefit more from a technology-enhanced intervention model?

We offer two hypotheses. First, we hypothesized that TE-HNC would be *less* impacted negatively by CU on parent and child observation measures than in the standard program (HNC). This hypothesis is based on the supposition that technological enhancements have the potential to facilitate therapist monitoring of, corrective feedback on, and reinforcement of skill practice and progress in the home, which may be especially useful for parents of children with more severe problem behavior including that complicated by CU traits. Second, based on proposed BPT mechanisms (Forehand et al., 2014), we hypothesized that this differential impact would be seen first in parent behavior and subsequently in child behavior (i.e., at follow-up).

We chose positive parenting (praise & attend statements) as the parent outcome, since research suggests that increasing these parental skills is important in decreasing difficult behavior (e.g., noncompliance, antisocial behavior) in

Table 1 *Demographics by group at baseline*

	Total Sample ($N=101$)	HNC ($n=54$)	TE-HNC ($n=47$)
	M (SD)	M (SD)	M (SD)
Child			
Age (years)	4.19 (1.19)	4.28 (1.17)	4.13 (1.19)
Gender (% male)	54.9%	57.41%	53.19%
Race %			
White	62.75%	57.41%	70.21%
Black/African American	20.59%	25.93%	14.89%
American Indian/Alaskan Native	0.98%	0.00%	2.13%
Multiracial	14.71%	14.81%	12.77%
Not Reported	0.97%	1.85%	0.00%
Hispanic/Latinx	13.73%	14.81%	12.77%
Parent			
Age (years)	31.66 (6.72)	32.50 (6.12)	31.34 (5.88)
Gender (% female)	97.06%	98.15%	97.87%
Race %			
White	68.63%	62.96%	74.47%
Black/African American	21.57%	27.78%	14.89%
American Indian/Alaskan Native	0.98%	0.00%	2.13%
Multiracial	7.84%	7.41%	8.51%
Not Reported	0.98%	1.85%	0.00%
Hispanic/Latinx	7.84%	7.41%	6.38%
Marital Status			
Single	24.51%	27.78%	21.28%
Married/living together	61.76%	59.26%	63.83%
Divorced/separated	13.73%	12.96%	14.80%
Employed in Any Capacity	46.08%	50.00%	40.43%

children with high CU traits (see Bixby et al., 2017; Clark & Frick 2018; Bjornebekk & Thogersen, 2022). Furthermore, in their reviews, both Hawes et al., (2014) and Bjornebekk and Thorgensen (2022) recommended focusing on this parental behavior to address child CU traits. In regard to a child observational outcome, we focused on compliance as this behavior has been identified as a keystone behavior of young oppositional children (see McMahon & Forehand 2003).

Methods

Participants

This study includes secondary analyses of data from 101 families who participated in a randomized control trial comparing a standard BPT program, *Helping the Noncompliant Child* (HNC; McMahon & Forehand 2003), and Technology-Enhanced HNC (TE-HNC; Jones et al., 2014; 2021; Parent et al., 2022). Most (97.08%) caregivers identified as female, more than half (61.76%) were married or living together with a partner, and the majority identified as White (68.3%) or Black/African American (21.8%) with other parents identifying as multiple races (7.84%) or American Indian/Alaskan Native (1%). Further, 6.9% of caregivers identified as Hispanic/Latinx. Approximately half (54.9%) of the participating children were boys. Parents identified child race as White (64.0%), Black/African American (21.0%), American Indian/Alaskan Native (1%), or more than one race (14.0%). Approximately twice as many children (13.73%) as parents (7.84%) were Hispanic/Latinx, reflecting the racial and ethnic diversity between and within participating families (see Table 1).

Families were included if family income was < 250% of the federal poverty line, which was chosen based on state guidelines for subsidized services (e.g., Medicaid, CHIP) and health insurance in order to connect with families least likely to receive evidence based BPT. We focus on lower income families as there is some evidence CU traits are associated with lower SES (e.g., Frick et al., 2003). Children had to evidence clinically significant problem behaviors (*Eyberg Child Behavior Inventory Problem* > 15 or *Intensity* > 131; Eyberg & Pincus 1999), but they could not have a significant developmental and/or physical impairment that required adaptations to standard HNC (e.g., unable to respond to parenting skills, do Time-Out). Families were also excluded if caregivers had a *current* mood, psychotic, and/or substance use disorder or a pending and/or prior substantiated child abuse/neglect case. Participants were recruited via advertisements and flyers distributed at nonprofit organizations, local schools, agencies serving low-income families, and word-of-mouth (see Khavjou et al., 2018; Khavjou et al., 2020).

Procedure

Families completed a phone screen and baseline assessment at a community-based clinic to confirm eligibility and provide consent for their family's participation. Eligible families were then randomized to either HNC or TE-HNC. Families were compensated $50 per assessment for completing the baseline, post-, and 3-month follow-up assessments in this report. TE-HNC families received an additional $100 phone return bonus at the 3-month assessment. All procedures were approved by the university's institutional review board.

Intervention

All families received HNC, which is a therapist-delivered, criteria-based (i.e., therapists conduct weekly observation and coding of skills used to determine treatment progression and program completion) BPT intervention validated for young (3 to 8 years old) children with BDs. HNC includes weekly face-to-face therapy sessions with each parent and child, as well as a brief midweek phone check-in to assess, problem solve, and reinforce caregiver use of new skills. HNC consists of two phases: Differential Attention (e.g., increasing positive attention, ignoring inappropriate behavior) and Compliance Training (e.g., utilizing time outs). When parents progress to Phase II (i.e., Compliance Training), they continue to practice Phase I skills (Differential Attention) to maintain skill proficiency (see McMahon & Forehand 2003, for more detail).

Families randomized to TE-HNC received the standard HNC program, as well as enhancements via a HIPAA-compliant technical system, which allowed clinicians (via a web portal) to monitor and reinforce caregiver progress (via native iOS application, Tantrum Tamers ©). The prototype was originally developed by an interdisciplinary team consisting of researchers with expertise in BPT programs for underserved families, an advisory panel of five clinicians who practiced at least one BPT program (20% men; 20% racial and/or ethnic minority), an industry partner with experience developing health-related software apps, and health economists with expertise in health care evaluation, efficiency, and effectiveness (Jones et al., 2013). Building upon the functionality and content tested in that pilot study, the Tantrum Tamers mobile app included: a skills video series to model concepts and skills; surveys with automated feedback to assess and coach parent skill use and attitudes, video recording of parent skill use at home for therapist review and coaching; a midweek video call to problem solve and reinforce skill practice and progress; reminders regarding weekly sessions, mid-week calls, and skills practice; and a weekly checklist. The goal of these components, coupled with the corresponding therapist web portal, was to allow for greater tailoring of BPT psychoeducation, skills, and feedback.

Therapist Training and Fidelity

Master's-level therapists treated families in both groups. Training included reviewing treatment manuals and establishing reliability with the HNC coding system, as well as role-plays, session observations and discussions, weekly observations, and supervision and feedback by two licensed clinical psychologists. Approximately a quarter of sessions (24%) were coded by one Master's-level coder to ensure treatment fidelity (97% fidelity); 72% of those were double coded (90% reliability between coders). In addition, 35% of sessions were coded for therapist competence by at least one doctoral-level coder and of those 22% were coded by a second doctoral-level coder, yielding an average competence rating of 97%.

Measures

Demographics. Caregivers reported their and their child's demographic information at baseline, including, age, race/ethnicity, marital status, education level, and income.

Inventory of Callous Unemotional Traits. The Inventory of Callous Unemotional Traits (Frick & Ray, 2015; Ray & Frick, 2020) was administered to the participating parent at baseline. The ICU-Parent Preschool or the ICU-Parent version was used depending on the age of the child. This measure consists of 24 items that provide an assessment of the child's callous and unemotional traits. As recommended, after reverse scoring some items, a total score is calculated by summing all items to capture an overarching CU dimension (Ray & Frick, 2020). The ICU-Parent Preschool ("Seems motivated to do his/her best in structured activities") and ICU-Parent ("Is concerned about schoolwork") versions differ on one item but otherwise have the same total number of items. It has been recommended to sum across all items and treat the resulting total score as the variable of interest regardless of the version used (Frick, person communication, March 11, 2022). For follow-up analyses to characterize the sample, we used a score of > 23 to represented clinically significant CU traits (Kimonis et al., 2014). The omega coefficient for reliability was 0.88, 95% CI [0.827, 0.949].

Observed parenting and child compliance. Parent-child observations were conducted at all waves. Coders received approximately 50 h of training in the Behavioral Observation Coding System (McMahon & Forehand, 2003) and reached at least 80% agreement on one or more of the coded behaviors with expert coders on a series of training videos. Half of the videos from the intervention study were double-coded for fidelity. When two coders failed to reach 80% agreement, they jointly coded the observation to resolve discrepancies. This two-step process was viewed as providing the most accurate picture of each of the coded behaviors in the parent-child interaction. Behaviors are reported at a rate per minute during a 5-minute observation period for positive parenting skills to account for slight variability in interaction length.

Two parent behaviors were recorded in the context of a free play situation (Differential Attention or Child's Game;

see McMahon & Forehand 2003) in which a parent was instructed to play whatever game their child chose from the toys provided. The child was allowed to determine the nature and rules of the interaction. **Attends** was defined as positive attention in which the parent provides an ongoing verbal description of what the child is doing, and **Rewards** was defined as positive attention that is provided following the child's appropriate behavior. These two behaviors were combined for a single average score and called "Do Skills." Child **Compliance**, the focus of the second phase of the program, was assessed in the context of the parent issuing directions to the child (Compliance Training or Parent's Game; see McMahon & Forehand 2003). The parent was told to engage the child in activities whose rules and nature are determined by the parent. Compliance was measured as the percentage of all clear instructions to which the child complied within 5 s after an instruction was issued.

Data Analytic Plan

Prior to conducting analyses, the pattern of missingness was examined to determine if data were missing at random. For primary analyses, full information maximum likelihood (FIML) estimation techniques were used for inclusion of all available data based on intent-to-treat guidelines. Multiple group path analysis was used to test primary hypotheses and was conducted with Mplus 8.3 software (Muthen & Muthen, 2017). To account for non-normal data, maximum likelihood estimation with robust standard errors (MLR) was used. The following fit statistics were employed to evaluate model fit: chi-square, $\chi 2$: $p > .05$ excellent, comparative fit index (CFI; > 0.90 acceptable, > 0.95 excellent), root mean square error of approximation (RMSEA; < 0.08 acceptable, < 0.05 excellent), and the standardized root mean square residual (SRMR; < 0.08 acceptable, < 0.05 excellent) (Hu & Bentler, 1999).

Multi-group models were run to test if baseline child CU traits *differentially* impacted treatment efficacy across treatment groups: one model using outcomes at post-treatment and one using outcomes at the three-month follow-up. Each model included observed baseline parenting skills (i.e., "Do Skills"), observed baseline child compliance, and parent reported baseline child CU traits for the two assessment waves. As noted, covariates for all outcomes include the baseline scores on both outcome variables. Covariances between all variables at baseline and between outcomes were estimated. The primary predictor and focus of the current paper was baseline CU traits. The moderating impact of treatment group was examined using multiple-group models. Specifically, models were first run allowing for the effect of CU on outcomes to vary across groups. To allow for model fit evaluation, the covariance between CU and each outcome at baseline was constrained to be equal across groups. Next, a constrained model was tested that fixed the effect of CU on each outcome to be equal across treatment groups. We then compared the two models; deteriorated model fit in the constrained model, as indexed by Δ scaled Satorra-Bentler χ^2 and ΔCFI, indicated that the impact of CU traits on outcomes differed by treatment group.

Results

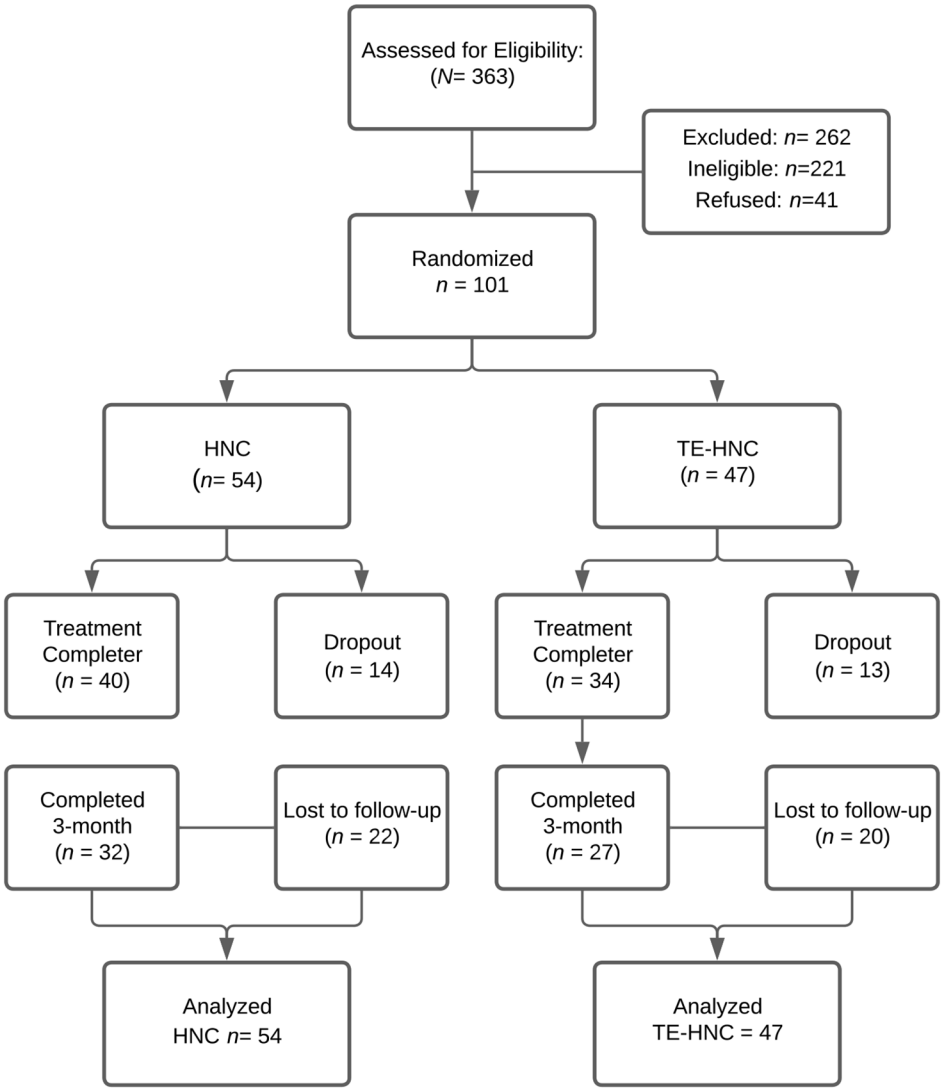
No significant condition differences were observed across demographics at baseline (see Table 1). In addition, the number of treatment sessions did not differ across treatments (HNC = 10.03; TE-HNC = 9.55). Retention rates were similar across groups at follow-up (see the CONSORT diagram, Fig. 1). Patterns of missingness did not significantly differ by the following: treatment condition; child age, sex, race/ethnicity; caregiver age, ethnicity/race; nor family economic stress, all $ps > 0.05$. Further, random patterns of missingness, along with a non-significant Little's missing completely at random (MCAR) test, χ^2 (239) = 267.64, $p > .05$, suggest that the mechanism of missingness was MCAR and support the use of multiple imputation and FIML for primary analyses.

Results of multiple-group models where parameters were allowed to vary across treatment groups are depicted in Table 2. Model fit for all models was excellent. At post-treatment, constraining the effect of CU on outcomes to be equal across treatment groups resulted in deteriorated model fit, $\Delta\chi 2$ (2) = 6.57, p < .05, ΔCFI = 0.75, supporting the moderating influence of treatment condition. Specifically, higher levels of baseline child CU traits predicted *lower* levels of observed "Do Skills" (Attends + Rewards) at post-treatment for HNC but had no impact on outcomes in the TE-HNC group. Child CU traits had no impact on observed compliance at post-treatment regardless of treatment group.

At the 3-month follow-up, constraining the effect of CU on outcomes to be equal across groups resulted in deteriorated model fit, $\Delta\chi 2$ (2) = 17.39, $p < .01$, ΔCFI = 0.57, supporting the moderating effect of treatment condition. Specifically, higher levels of baseline child CU traits predicted *lower* levels of observed "Do Skills" *and* compliance in the HNC group. In contrast, in the TE-HNC group, higher levels of child CU traits had no impact on parental "Do Skills" and predicted *higher* levels of observed child compliance included, suggesting that results.

To graphically present a summary of the findings, we used a cut-off score of 24 based on previous research on school-aged youth (Kimonis et al., 2014). We plotted mean scores across assessments separately for high (24+) and low (< 24) CU in the HNC intervention and in the TE-HNC

Fig. 1 *CONSORT Diagram*



intervention. The results are presented in Fig. 2. High, relative to low, levels of child CU traits had a *negative* impact on parental positive parenting "Do Skills" (post & follow-up) and child compliance (follow-up) in the HNC intervention but *not* in the TE-HNC intervention. As a sensitivity analysis, child externalizing behavior problem severity at baseline (via parental report) was included as a covariate in models. The results remained unchanged with the inclusion of externalizing problem severity included suggesting that results are unique to child CU traits.

We conducted additional sensitivity analyses by including child age as a covariate for models at post-treatment and 3-month follow-up. For the post-treatment model, the inclusion of child age reduced the significance of the effect of CU on observed positive parenting at post-treatment to $p = .08$ in the HNC group; however, child age was unrelated to observed parenting outcomes, and the strength of the CU effect size was similar across models. For 3-month outcome models, the results remained unchanged with the inclusion of child age. Finally, we conducted another additional sensitivity analysis by including child sex as a covariate. The inclusion of child gender had no effect on the results at either timepoint. Overall, we found that child age and sex had limited to no impact on the interpretation of results in the current study.

Discussion

Children with higher CU traits often have poorer treatment outcomes in standard BPT programs, highlighting the need for novel approaches to foster parenting skills to improve child compliance. Study results suggest that a technology-enhanced BPT approach has the potential to buffer the

Table 2 *Model coefficient by group*

	HNC			TE-HNC		
	β	95% CI	*p*	β	95% CI	*p*
Post Treatment Model - c^2 (2) = 1.801, p = .406, RMSEA = 0.000, CFI = 1.0, SRMR = 0.034						
DV: Attends + Rewards Post						
Attends + Rewards Baseline	0.22	0.03, 0.42	0.024	0.37	− 0.10, 0.83	0.119
Compliance Baseline	0.13	− 0.18, 0.44	0.410	0.32	0.11, 0.52	0.002
CU Baseline	− 0.48	− 0.86, − 0.10	0.013	0.13	− 0.16, 0.43	0.377
DV: Compliance Post						
Attends + Rewards Baseline	− 0.17	− 0.48, 0.13	0.268	0.25	− 0.20, 0.69	0.277
Compliance Baseline	0.00	− 0.37, 0.38	0.988	0.24	− 0.03, 0.51	0.077
CU Baseline	− 0.13	− 0.52, 0.27	0.530	0.17	− 0.13, 0.46	0.268
3-Month Model - c^2 (2) = 1.610, p = .447, RMSEA = 0.000, CFI = 1.0, SRMR = 0.033						
DV: Attends + Rewards 3 m						
Attends + Rewards Baseline	0.26	0.01, 0.52	0.047	0.59	0.21, 0.97	0.002
Compliance Baseline	0.40	0.13, 0.66	0.003	0.13	− 0.13, 0.38	0.341
CU Baseline	− 0.42	− 0.63, − 0.21	0.000	− 0.07	− 0.37, 0.23	0.650
DV: Compliance 3 m						
Attends + Rewards Baseline	− 0.25	− 0.51, 0.02	0.066	− 0.03	− 0.68, 0.63	0.936
Compliance Baseline	0.31	0.01, 0.61	0.043	0.14	− 0.22, 0.51	0.438
CU Baseline	− 0.50	− 0.72, − 0.28	0.000	0.36	0.05, 0.66	0.021

Note: covariances between all variables at baseline and the dependent variable (DV) wave are modeled but are not depicted. Covariances between CU and baseline variables are set to be equal across groups

detrimental effects of pre-treatment CU traits initially on behaviorally observed positive parenting skills at post-treatment, which was maintained at follow-up, and emerging at follow-up for behaviorally observed child compliance.

TE-HNC proved to be effective at buffering the negative impact of baseline CU traits on treatment outcome compared to standard HNC. HNC has a long history of demonstrated effectiveness (see Forehand & McMahon 1981; McMahon & Forehand, 2003); however, the influence of child CU traits has not been considered in earlier investigations of HNC. The present results suggest that the efficacy of the standard program may be susceptible to children's CU traits but that technology-enhancements allow therapists to monitor caregiver activity, as well as tailor the focus and pace of treatment based on parent practice and progress, thereby buffering against the detrimental effect of those traits. The findings are consistent with prior work highlighting that tailoring based on such things as the child's unique presentation (i.e., higher CU traits) and delivery format (i.e., in person vs. remote) improve treatment benefits for the families of children with relatively higher CU traits (Fleming et al., 2020, 2022; also see Waller et al., 2013; Wilkinson et al., 2016 for reviews). Importantly, TE-HNC was not developed to explicitlytarget CU traits or the unique characteristics of families of children with relatively higher CU traits. That said, the technology-enhanced approach may allow clinicians to overcome some of the issues with remote service delivery seen in earlier work (e.g., absence of a controlled treatment setting to provide coaching of parents with difficult child behavior; Fleming et al., 2020). Further, it allows therapists to track individual family's use of and effectiveness with the new skills outside of session and in the context of the families' daily lives. In turn, technology-enhanced BPT approaches like TE-HNC may offer models for better supporting parents of children with higher CU traits (e.g., coaching, modeling, feedback) and in turn increase the generalizability of the skills from sessions to the home without necessarily adding more sessions. Consistent with this potential reason, prior work suggests that TE-HNC parents who use the technology more consistently between sessions achieve a greater treatment response (Anton et al., 2016). Critically, given the growing emphasis on scalable and sustainable intervention models, such gains have been achieved without compromising parent satisfaction or therapeutic alliance in the short term (Anton & Jones, 2019; Jones et al., 2021).

Findings suggest the importance of collecting follow-up data when examining child CU traits. While these traits were associated with deficits in parenting skills at post treatment in the standard HNC program, their negative impact on child compliance in the HNC group did not emerge until the 3-month follow-up. These findings are theoretically congruent with the model underlying BPT; that is, one would expect CU traits to impact parenting skills initially and subsequently to impact child behavior. Further and of great importance, the enhanced program (TE-HNC) prevented the negative relationship of CU traits and behavioral outcomes of BPT from emerging.

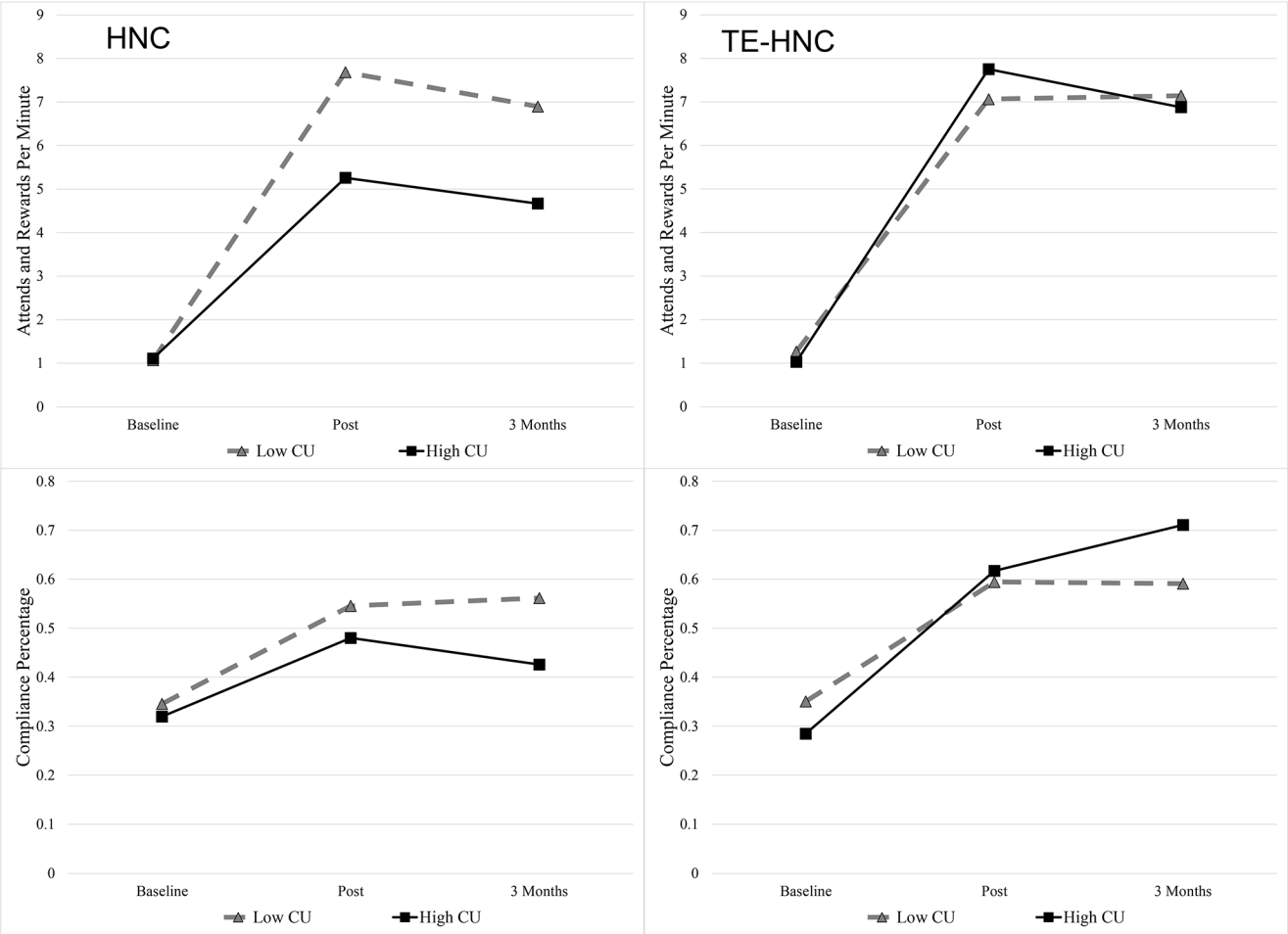


Fig. 2 *Mean outcome scores plotted separately by treatment group for high vs. low CU status*

Left panels are mean plots for the HNC group and right panels are for the TE-HNC group. CU = Callous-Unemotional Traits score. High CU is > 23 on the Inventory of Callous Unemotional Traits.

One unexpected finding did emerge; namely, in the TE-HNC program, *higher* levels of baseline CU traits were associated with *larger* increases in child compliance at the 3-month follow-up. Following our discussion regarding how technology-enhanced delivery models can help with personalizing and tailoring program information and skills (Waller et al., 2013; Wilkinson et al., 2016), this finding suggests that TE-HNC may be particularly effective with children high in CU traits. While this finding needs to be replicated, it is promising for these more difficult-to-treat children, especially since higher CU scores were associated with *lower* child compliance in the standard program.

There were several limitations of the current study. First, behavioral observations were brief and conducted only in the clinic. Longer observations conducted in the home would provide more information about the parent-child interaction (See Gridley et al., 2019, for a review of observational measures of parent-child interactions and their limitations). Second, we coded therapist fidelity in the weekly sessions, but we did not code therapist fidelity outside of session as it related to use of the TE-HNC web-portal and information (e.g., surveys, videos) from the parents' mobile app. Indeed, therapist user analytics could be one way to do this in a fairly efficient and cost-effective way in future studies. Third, if a family does not have a mobile phone, the technology used in the current study may not be feasible for frontline clinical and community settings or their clients who are low income (due to cost and availability of phones and service plans). However, families with low income most likely do have access to a smartphone as consumer industry statistics suggest that rates of ownership in this group are similar to that of the general population (e.g., Anderson Lewis et al., 2018; Pew Research Center, 2021; Vangeepuram et al., 2018). For instance, in the current study, 94% of the participating families had a mobile phone when they entered the project. A fourth potential limitation is that we did not examine maternal CU traits, which research indicates may be important to consider when examining the stability of children's CU

traits (Cavanagh et al., in press). Fourth, this study reported only post-treatment and 3-month follow-up outcomes; however, given that BPT effects have been shown to wane with time, longer term follow-up assessments are warranted. Fifth, CU traits were only assessed from the perspective of the parent. Diagnostic interviews, as well as ratings by other individuals who interact with the child (e.g., teachers), will be an important next step in research on this topic.

The current study also had a number of strengths. First, short-term follow-up data, similar to that reported in other recent CU/BPT studies (Fleming et al., 2022), were collected and reported. These data are important to determine if treatment effects on child behavior persist and whether post-treatment changes in parent behavior are associated with child behavior longer term. Second, a standardized measure of CU traits (ICU), as well as behavioral observation of parent and child behaviors, were used. Third, our sample consisting of low-income families is a notable strength, since families with low income are overrepresented in statistics on early onset BDs and low-income also appears to be associated with increased risk for CU traits as well (Dekovic et al., 2011; Frick et al., 2003). It is particularly critical to focus on these families at this stage of research because families with low-income are less likely to have access to, engage in, and in turn have the opportunity to benefit from BPT compared to relatively more affluent families.

In summary, CU traits at baseline negatively impact trajectories of change in standard behavioral parent training; however, with technological enhancements, the detrimental impact of CU traits can be reduced. Moreover, TE-HNC did not require additional sessions to address child CU traits, like other standardized programs. For example, multiple sessions have recently been added to a standardized program, PCIT, in order to address CU traits (e.g., Donohue et al., 2021; Fleming et al., 2022). It is clear from the current study as well as work from prior investigators that children's CU traits can be addressed in multiple ways. As such, it is critical that we not only identify children with high CU traits but provide clinicians with alternative ways to address these traits when implementing BPT moving forward.

Acknowledgements This study was funded by the National Institute of Mental Health (NIMH) R01MH100377 (Clinical Trials. gov Identifier: NCT02191956). Other support was provided by NIMH R21MH113887 (ClinicalTrials.gov Identifier: NCT03597789), and the National Institute of Child Health and Human Development (F31HD106768 & L40HD103048). The authors are grateful to the families, assessors, and therapists who participated in this project for their time and valuable contributions.

Compliance with Ethical Standards

Conflict of Interest The authors have declared that they have no competing or potential conflicts of interest.

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