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The Efficacy of Technology-Enhanced Behavioral Parent Training for Families With Low Income: Do Parent-Centered Profiles Moderate Treatment Outcomes?

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Behavior disorders (BDs) in children are common and have long-term impacts. Financially disadvantaged families are at a greater risk of having a child with an early-onset BD but have more difficulty engaging in and therefore benefiting from behavior parent training (BPT). Building upon the potential of technology-enhanced (TE) treatment approaches in addressing barriers to treatment engagement and effectiveness, TE to one BPT program, Helping the Noncompliant Child (HNC), were tested in a randomized controlled trial (RCT) with 101 families with low income. The current study aimed to examine for whom TE-HNC versus standard HNC is optimal at posttreatment by exploring how pretreatment, parent-centered profiles may moderate parenting and child outcomes at posttreatment. Latent profile analyses yielded four distinct parent-centered profiles. The profile membership differentially predicted treatment outcomes by group for positive and negative parenting, as well as child behavior intensity, but not child problem behavior. The heterogeneity of responses to standard relative to TE treatment models among underserved families may provide clues regarding the future personalization of BPT toward improved treatment efficacy.

Keywords: behavioral parent training; personalization; latent profile analysis; low income; technology enhancement

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The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research, supporting data are not available.

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BEHAVIOR DISORDERS (BDs) are among the most common reasons children get referred to mental health services (Ghandour et al., 2019; Larson et al., 2011). Often characterized by externalizing, overt behaviors that are aggressive, destructive, hostile, or defiant, early-onset (3–8 years old) BDs can increase children's vulnerability to negative life

consequences across psychological, social, and occupational domains, such as antisocial behavior, substance dependence, and academic underachievement (Owens & Hinshaw, 2016; Piquero et al., 2016). Therefore, identifying and treating early-onset BDs, especially in at-risk families, is a public health imperative (e.g., Cohen & Piquero, 2009; Loeber et al., 2005; Sitnick et al., 2015). Previous literature on family economic stress theory (Conger & Conger, 2008) linked economic hardship with heightened stress, suggesting an increased likelihood for parents from low-income households to engage in coercive parenting, potentially increasing the risk of early-onset BDs (Jones et al., 2014).

Grounded in several theories, such as social learning theory and attachment theory, behavioral parent training (BPT) has demonstrated efficacy among children with BDs across socioeconomic status (e.g., Comer et al., 2013; Eyberg et al., 2008; Leijten et al., 2020). BPT targets the coercive cycle of parent–child interaction implicated in the etiology and maintenance of early-onset BDs by teaching parents skills such as differential attention (e.g., sustaining positive attention to desired behaviors and ignoring unwanted behaviors) and employing clear and consistent limits and consequences (e.g., clear instructions and time-out sequence), subsequently decreasing children's problem behavior (Axelrod & Santagata, 2021; Leijten et al., 2013). Combining results from between-subjects, within-subjects, and single-subject designs, a meta-analysis conducted by Maughan (2005) investigated the efficacy of BPT and found that the effect size for BPT on children's behavior problems was robust. Not only does BPT have efficacy in previous treatment outcome research but qualitative and quantitative studies link its individual components to significant improvements in child problem behavior (Bausback, 2021). Yet, a quarter to a third of families still fail to benefit from BPT, which is important to consider.

Similar to many prevention and intervention programs (Jones et al., 2016), recent systematic reviews found a lower likelihood for financially disadvantaged families to successfully engage in, and therefore benefit from, BPT compared to relatively higher-income families. This might be due to the same stressors that may have increased the risk for early-onset BDs and compromised parenting (e.g., less consistent session attendance, lower coping capacity, less homework practice; Chacko et al., 2016; Dedousis-Wallace et al., 2021). Recent literature has found digital tools to have promise for increasing mental health services engagement for families with low income (e.g., Aguilera & Muench, 2012; Jones et al., 2010; Kazdin & Blase, 2011), and in turn improving BPT outcomes (Jones, 2014; Jones et al., 2013; Ralston et al., 2019). As one example, a technology-enhanced (TE) version of one evidence-based BPT program, Helping the Noncompliant Child (HNC; McMahon & Forehand, 2003), increased family efficiency with treatment (i.e., fewer weeks to complete the program) and improved some aspects of engagement (e.g., homework completion) at posttreatment. Although variably defined, "technology enhanced" is used here to refer to an augmentation to standard HNC, specifically an interactive system that allowed therapists to monitor and tailor parent activity on their smartphone application via a web portal. While TE-HNC families also maintained gains in parenting and child outcomes at follow-up more than HNC families, gains in parenting and child outcomes were not seen immediately posttreatment (Jones et al., 2021; Parent et al., 2021), leading us to ask, Do family characteristics moderate *for whom* the TE-HNC or HNC program is optimal at posttreatment?

Considering moderators when using RCTs to test treatment efficacy has become increasingly critical given the call for greater attention to "precision medicine"—namely, the ability to tailor treatments to specific populations and individuals (White House Fact Sheet, 2015; Williams, 2022). Consistent with such calls, research to date has explored parent factors using single-variable moderation analyses and found how these factors may impact BPT outcomes (Lundahl et al., 2006). For instance, Haine-Schlagel et al. (2019) reported that parental daily stress may moderate treatment outcomes of TE treatment since a higher level of stress may impede parents' ability to keep up with the treatment routine, making features beyond in-person BPT (e.g., receiving daily surveys of skills practice) seem burdensome. However, less research has explored if and how *multiple* parent factors *collectively* impact treatment outcomes of standard versus TE BPT *within* low-income families, which is critical if we are to move beyond single-factor moderation studies to better capture the multidimensionality of each family. Toward this goal, the current study simultaneously considers multiple theory-driven variables to identify holistic parent-centered profiles and explores if and how those parent-centered profiles moderate parenting and child treatment outcomes. Building upon existing literature (Dale et al., 2021) that has effectively employed a family-centered approach to identify pretreatment profiles

predicting changes in parenting behavior following BPT, the current study uses latent variables to identify statistically distinct profiles among low-income families. We explore the intersection of four pretreatment parental factors that may shape families' responses to TE treatment simultaneously as moderators based on a combination of theory and data: depressive symptoms, everyday stress, co-caregiver relationship, and dispositional mindfulness.

First, parental depressive symptoms may impact treatment outcomes of a TE BPT. Low motivation, which commonly occurs with depressive symptomatology, may compromise parents' willingness to use at-home TEs that require additional participation beyond in-person sessions (Haine-Schlagel et al., 2019). Alternatively, active coaching in TEs may relieve depressive symptoms by providing active support and subsequently allow parents to improve parenting practices (Leijten et al., 2020). Second, parental stress may also impede parents' ability to maintain engagement in TEs since features such as receiving daily surveys of skills practice beyond attending in-person BPT might be considered burdensome by parents with a higher stress level. However, the scenario-based learning opportunities provided by skills videos used in TE programs may help stressed parents gain parenting skills more successfully, given their limited time and energy (Irvine et al., 2015). In addition to parental depressive symptoms and stress, a TE intervention may boost BPT treatment responses when there is a supportive co-caregiver relationship. Technology may allow two supportive and communicative caregivers to gain greater familiarity with program skills simultaneously (i.e., watching skills videos together), which could encourage both caregivers' use of TEs and parenting skills. Consistent skill use between caregivers is linked to greater improvements in child behavior (McMahon & Forehand, 2003).

Finally, parents' dispositional mindfulness was considered. Higher levels of parent mindfulness predict greater use of mindful parenting strategies, which could improve co-caregiving relationship quality and benefit from features that afford opportunities for coparent involvement and coordination at home (Parent et al., 2016, 2021; Parent and DiMarzio, 2021). Furthermore, parents with higher mindfulness can more accurately notice their children's behaviors and use BPT skills accordingly. This may mean technology features like feedback videos are particularly useful for personalized feedback and maximizing parents' practice at home (Cain et al., 2024; Portharse et al., 2021). In contrast to traditional deficit-centered approaches that have often characterized previous research on low-income populations (Elliott, 2020; Sano et al., 2021), the current study explores both risk and protective factors *within* communities with economic challenges to understand the families more thoroughly.

Although the current study is exploratory and did not propose specific hypotheses regarding the number of profiles, all four domains were expected to serve as useful indicators for identifying latent profiles (Spurk et al., 2020). For example, based on family systems theory (Conger & Conger, 2008), one profile may emerge characterized by high levels of dispositional mindfulness, since mindfulness has been shown to potentially affect the functioning of the family through its impact on subsystems (Cummings et al., 2000; Parent et al., 2016). Building upon these profiles, subsequent analyses examine whether profiles moderate parenting and child treatment outcomes.

Material and Methods

STUDY DESIGN

This study represents secondary analyses of a prior investigation comparing TE-HNC to HNC (Jones et al., 2021; Parent et al., 2021). Participants included 101 English-speaking parents from low-income households (<250% of the Federal Poverty Guidelines), and their children (3–8 years old) with clinically significant disruptive behaviors (Eyberg Child Behavior Inventory Problem scale >15 or Intensity scale >131; Eyberg & Pincus, 1999). Families were excluded if the (a) child had a developmental and/or physical impairment that would preclude the use of BPT without significant modifications (e.g., unable to hear parents or physically unable to do time-out); (b) parent had a current mood, psychotic, and/or substance use disorder (e.g., depressive symptoms in the severe range and diagnosis); and/or (c) family has a pending or prior substantiated child abuse/neglect case. Families were recruited via advertisements distributed at nonprofit organizations, local schools, agencies serving low-income families, and word of mouth. Our sample was relatively racially and ethnically diverse (see Table 1). Families completed a phone screen and baseline assessment at a community-based clinic to confirm eligibility and provide consent for their family's participation, and were compensated $50 per assessment. Families were randomly assigned to HNC or TE-HNC (see Figure 1). All families that completed the treatment were included in the current analysis, regardless of their compliance with all features of the TEs. The current project analyses focus on

Table 1
Sample Demographics

	Total sample *M* (*SD*) or %	HNC (*n* = 54) *M* (*SD*) or %	TE-HNC (*n* = 47) *M* (*SD*) or %
Child			
Age	4.19 (1.19)	4.28 (1.17)	4.13 (1.19)
Gender (% male)	54.90%	57.41%	53.19%
Parent			
Age	31.66 (6.72)	32.50 (6.12)	31.34 (5.88)
Gender (% female)	97.06%	98.15%	97.87%
Race			
White	68.30%	62.96%	74.47%
Black	21.80%	27.78%	14.89%
Native American	1.00%	0%	2.13%
Multiracial	7.90%	7.41%	8.51%
Marital status			
Single or separated	38.24%	40.74%	36.17%
Married or living together	61.76%	59.26%	63.83%
Family size	3.87 (1.06)	3.90 (0.97)	3.83 (1.15)

Note. HNC = Helping the Noncompliant Child; TE-HNC = Technology-Enhanced Helping the Noncompliant Child; *M* = mean; *SD* = standard deviation.

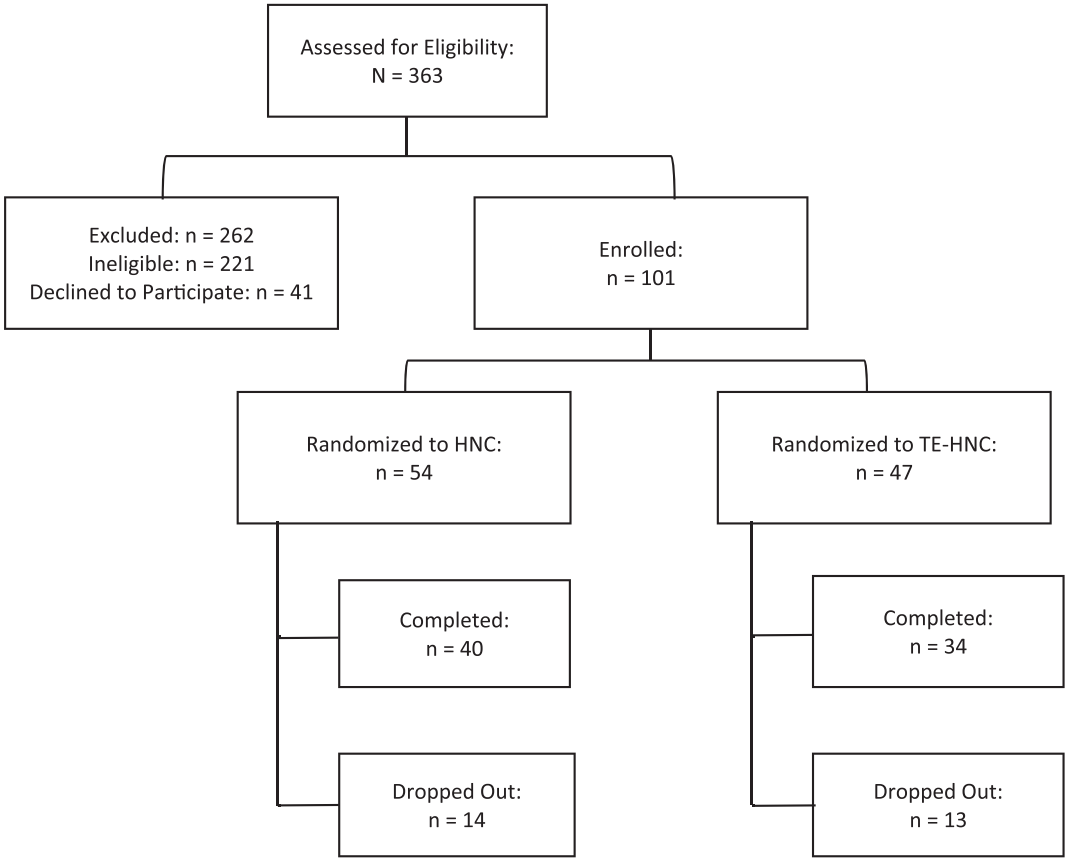

FIGURE 1 CONSORT diagram describing participant flow in RCT. *Note*. RCT = randomized controlled trial; HNC = Helping the Noncompliant Child; TE-HNC = Technology-Enhanced Helping the Noncompliant Child

the pretreatment and posttreatment assessments. The Institutional Review Board approved all study procedures.

INTERVENTION

All families received HNC, which consists of weekly in-person sessions and a brief midweek telephone check-in regarding skill practice and progress. HNC is a therapist-delivered, criteria-based BPT intervention for children with BD (McMahon & Forehand, 2003), meaning therapists conduct weekly observation and coding of skills used to determine progression through skills and program completion. Consisting of two phases, HNC targets differential attention (e.g., increasing positive attention, ignoring inappropriate behavior) during the first phase and progresses to compliance training (e.g., utilizing time-outs). When parents progress to Phase II (i.e., compliance training), they continue to practice Phase I skills to maintain skill proficiency.

Families in the TE-HNC group received the standard HNC protocol (McMahon & Forehand, 2003) augmented with a Health Insurance Portability and Accountability Act (HIPAA)-compliant, interactive system that includes a mobile app for parents and a web portal for clinicians. The mobile application consists of daily surveys of skills practice, weekly video-recorded home practice, daily text reminders for skill practice and appointments, midweek video calls with the family to problem solve obstacles, and a skills video series to model new skills. The web portal allows clinicians to monitor caregiver activity on the mobile application (i.e., reading through parents' survey responses and watching parents' recorded practices), and to tailor the focus and pace of treatment based on parent practice and progress. Overall, TE-HNC aims to increase family connection to the treatment, support skill use at home, and increase parent mastery of skills in session and at home (Jones et al., 2014, 2020; Parent et al., 2021). If families were randomized to TE-HNC, they completed an additional consent regarding technology safety and security. A therapist guide was created for each session and paired with a corresponding coding sheet, which allowed content coding to assess fidelity. Master's-level therapists treated families in both the HNC group and the TE-HNC group. The average fidelity rating of therapists was 98%.

MEASURES

Parental Stress

Parents reported on their experiences of stress using the Everyday Stressors Index (ESI; Hall et al., 1985), an instrument that consists of 20 items assessing the extent to which various stressors bother each parent from 1 (*not at all*) to 4 (*bothered a great deal*). The total score is the sum of all responses (range = 20–80), with higher scores indicating more stress ranging from 20 to 80. The measure has adequate reliability and validity data (α = .85).

Parental Depressive Symptoms

Parents completed the Beck Depression Inventory–II (BDI-II; Beck et al., 1961), a 21-item survey assessing depressive symptoms during the past 2 weeks. Each item describes a particular symptom of depression and consists of four statements reflecting symptom severity (0 = *the least severe*, 3 = *the most severe*). The total score is the sum of all responses (range = 0–63): 0–13 represents "minimal" depression, 14–19 represents "mild" depression, 20–28 represents "moderate" depression, and 29–63 represents "severe" depression. The BDI-II has been validated with several populations (α = .85).

Co-Caregiver Relationship

Parents completed the Parent Convergence Scale (PCS), an 11-item questionnaire designed to assess the relationship between participating parents and their co-caregivers (i.e., second most important person who cares for the child) pretreatment. Derived from the Communication and Support subscales of the Quality of Coparenting Scales (QCS; Ahrons, 1981), the PCS assesses three areas: communication (six items), support (two items), and conflict (three items), each ranging from 1 (*never*) to 4 (*often*). These three areas were summed independently and used as three separate subscales in the current study, with higher scores indicating higher levels of communication, support, and conflict with the co-caregiver, respectively (α = .81–.89).

Mindfulness and Self-Awareness

Parents completed the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003), a 15-item self-report questionnaire measuring parents' dispositional mindfulness. Parents are asked to indicate how frequently they have the experience described in each of the 15 statements on a 6-point Likert-type response scale ranging from 1 (*almost always*) to 6 (*almost never*). Higher scores indicate higher levels of mindfulness. The MAAS has demonstrated convergent and discriminant validity and good internal consistency (α = .80–.90; Brown & Ryan, 2003; MacKillop & Anderson, 2007), including in the current study (ω = 0.87).

Parenting

Parents completed the Alabama Parenting Questionnaire (APQ; Shelton et al., 1996), a 19-item questionnaire measuring parenting characteristics that have previously been associated with behavior disorders of children. Originally, the APQ consisted of 42 items with a three-factor solution including positive parenting, negative/inconsistent parenting, and punitive parenting. In the current study, we selected to use only the Positive Parenting subscale (α = .64) and the negative/inconsistent parenting subscale (α = .79).

Child Behavior Problems

Parents completed the Eyberg Child Behavior Inventory (ECBI; Eyberg & Robinson, 1983), a 36-item parent-report inventory that assesses the occurrence of common problem behaviors in children ages 2–16 years. The ECBI includes two subscales: the Intensity scale and the Problem scale (Eyberg & Pincus, 1999): (a) the Intensity scale assesses the frequency of 36 commonly seen disruptive behaviors in children (1 = *never*, 7 = *always*), and all responses are summed to acquire a raw score (range = 36–252); (b) the Problem scale measures whether parents view those behaviors as a problem (1 = *yes*, 0 = *no*), and the number of items endorsed is added together to yield the total score (range = 0–36). The ECBI has been proven to be sensitive to BPT interventions (Nixon et al., 2003; Webster-Stratton & Hammond, 1997) and has demonstrated good internal consistency in the current study for the Intensity scale (α = .84) and the Problem scale (α = .91).

DATA ANALYSIS PLAN

A latent profile analysis (LPA) was used in this study to develop subgroups of individuals according to similar baseline parent factors and examine how these constellations may impact treatment outcomes between two treatment modalities. LPA is often used to elucidate homogeneity within groups and heterogeneity between groups by identifying observations that share similar indicator means and variances to cluster (Marsh et al., 2009; Roesch et al., 2010). To determine the optimal number of profiles, multiple fit values and content decision criteria were viewed, including entropy, the Lo–Mendell–Rubin adjusted likelihood ratio test (LMR-LRT), the bootstrap likelihood ratio test (BLRT), the Bayesian information criterion (BIC), sample-size adjusted Bayesian information criterion (SABIC), Akaike information criterion (AIC), and the size of each profile. Specifically, the LMR-LRT and BLRT test specific comparisons between the model of interest and a model with one fewer class. The AIC and BIC aid in determining model fit, with lower values on each index indicating better relative fit. Further, entropy determines the accuracy of classifying individuals into the profiles identified in each model, with values closer to 1 indicating more certainty in group division. Last, each profile should have $n > 10$ for the final solution. Given our aim of exploring the use of parent-centered treatment profiles as a moderator, parents randomized in two treatment groups (HNC vs. TE-HNC) were combined to conservatively account for any possible treatment group difference when determining profiles, since no significant group differences were found in preliminary analyses (Parent et al., 2021). Profile indicators were parental depressive symptoms, parental stress, co-caregiver relationship, and mindfulness.

Four moderation analyses were used to examine *for whom* TE-BPT versus standard BPT improved parenting practices and reduced child problem behaviors in low-income families. We minimized the error variance by controlling for parent's and child's pretreatment symptoms and all profile membership predictors significantly linked with treatment outcomes. No systematic bias needed to be addressed in interpreting any significant interactions since our moderator measure, the parent-centered profiles, was completed preceding the random assignment to treatment conditions.

Results

LPAs were conducted using Mplus version 8.4 (Muthén & Muthén, 2017) to determine the optimal number of clusters of families with similar parental factor profiles. A covariate (i.e., marital status) was entered into the LPA models, which ranged from two to five profiles and were run with a minimum of 200 random starts. Fit indices for the profiles are presented in Table 2. All models demonstrated entropy above 0.90. The AIC and BIC supported the model with four profiles, the most, while the LMR-LRT suggested that the three-profile solution fit the data best ($p < .05$). However, since the smallest profile of the three-profile solution contains less than 5% of the total sample, this solution did not meet the predetermined requirement of having $n > 10$ for each profile for the final solution. Overall, a four-profile solution was selected upon consideration of a combination of all criteria, including statistical information measures, entropy, and parsimony as well as interpretability of the profiles (Nylund et al., 2007)—named Profile One, Two, Three, and Four for ease of presentation.

Table 2
Latent Profiles Indices

	2-Profile	3-Profile	4-Profile	5-Profile
Entropy	0.907	0.963	0.905	0.913
Log likelihood	-1629.303	-1577.476	-1536.027	-1557.236
Free parameters	25	38	51	64
AIC	3308.607	3230.952	3174.054	3242.472
BIC	3373.736	3329.948	3306.918	3409.203
SABIC	3294.78	3209.935	3145.847	3207.074
VLMR-LRT (*p*)	0.1817	0.0129	0.2041	0.4981
Adjusted LMR-LRT	0.1856	0.0138	0.2091	0.4981
BLRT *p*		<.001	<.001	<.001
Class 1n	84	5	13	0
Class 2n	16	83	10	60
Class 3n		12	14	24
Class 4n			63	11
Class 5n				5

Note. AIC = Akaike information criterion; BIC = Bayesian information criteria; SABIC = sample-size adjusted Bayesian information criteria; VLMR-LRT = Vuong–Lo–Mendell–Rubin likelihood ratio test; BLRT = bootstrapped likelihood ratio test.

Profile characteristics and differences for pre-treatment factors are shown in Figure 2. Profile One (n = 13) was defined by the lowest level of parental convergence and the lowest level of parental depressive symptoms as compared to the other profiles. Regarding convergence, parents in this profile reported the highest conflict with their co-caregivers (e.g., having different ideas about how to raise the child; becoming angry when discussing how to raise the child) as well as the lowest support and communication with co-caregivers. In contrast, Profile Four was defined by the highest level of parental convergence, including the lowest conflict, the highest support, and the highest communication with their co-caregivers compared to other profiles. This is also the largest profile (n = 63) among the four profiles. Profile Two (n = 10) was characterized by the highest level of parent-reported dispositional mindfulness, while Profile Three (n = 14) emerged with parents reporting the most elevated scores of both daily stress and depressive symptoms.

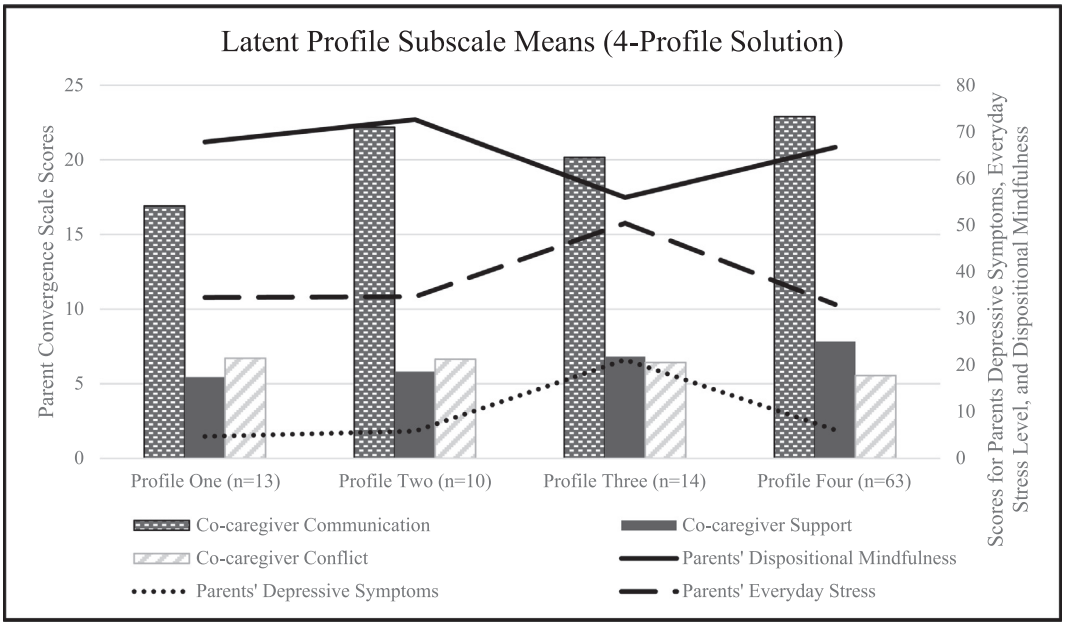

FIGURE 2 Four-solution latent profile composition by subscale means.

Following profile enumeration, family demographic (i.e., parent gender, age, family income, household size, parent marital status) indicators potentially associated with treatment outcomes were explored as simultaneous predictors of parent-centered profile membership. A multinomial logistic regression via Vermunt's three-step approach was employed for predictor analyses, with the largest group, the supported profile, serving as the reference group for comparisons. Among selected family demographic predictors, parent marital status was the only statistically significant predictor of parent-centered profile membership ($p < .05$) and was included as a covariate in the moderation analyses to account for any potential confounding effects on treatment outcomes. Upon selecting the four-profile solution as the optimal choice, a series of four moderation analyses were conducted to examine which profile benefits more from TE BPT compared to standard BPT. The automatic Bolck–Croon–Hagenaars (BCH; Bolck et al., 1998) approach in MPlus was selected, which used Wald tests to examine the mean scores of continuous distal outcomes (i.e., parenting and child treatment outcomes) between different categories (i.e., two treatment conditions) across latent profiles (i.e., four family profiles).

Families in all profiles demonstrated clinically significant improvement at posttreatment (see Table 3). However, controlling for baseline parenting practices at pretreatment and parents' marital status, statistically different posttreatment parenting outcomes were found between treatment conditions moderated by parent-centered profiles (see Table 4). The Wald tests revealed at least one parent-centered profile was significantly different from the others in their associations between treatment conditions and positive parenting practices, $\chi^2(3) = 18.74$, $p < .001$, and negative parenting practices, $\chi^2(3) = 21.32$, $p < .001$). Follow-up pairwise comparisons showed that across these profiles, treatment conditions predict that parenting practices significantly differ at posttreatment (see Figure 3). For positive parenting practice, parents in Profile One and Four presented significantly different patterns between treatment conditions compared to Profile Two and Three ($p < .05$). For negative parenting practices, Profile One reported significantly different patterns from other profiles ($p < .05$), and Profile Two reported a more magnified difference between the two treatment conditions ($p < .01$).

The associations between treatment conditions and outcomes within each profile were examined next (see Table 4). For families in Profile One, statistically significant associations were found between treatment conditions and positive parenting (b = –5.17, $SE = 0.90$, $p < .001$) and between treatment conditions and negative parenting (b = 3.84, $SE = 1.19$, $p < .001$), indicating that parents randomized to HNC endorsed significantly more positive parenting and significantly less negative parenting practices than parents randomized to TE-HNC at posttreatment. Within Profile Two, a statistically significant association was found between treatment conditions and negative parenting practices, though in the opposite direction from Profile One (b = –4.94, $SE = 1.16$, $p < .001$)—that is, parents in Profile Two randomized to TE-HNC endorsed significantly less negative parenting practices than parents randomized to HNC at posttreatment. No other statistically significant associations between treatment conditions and parenting outcomes were observed in other profiles.

Additionally, parent report of children's problem behavior at posttreatment while controlling for baseline parent-reported child problem behavior and parents' marital status were examined. The Wald tests revealed at least one of the four parent-centered profiles was significantly different from the others in the association between parent-reported child behavior intensity scores and treatment conditions across four parent-centered profiles at posttreatment (see Table 5), $\chi^2(3) = 9.47$, $p < .05$. Alternatively, no statistically significant association was observed for parent-reported child problems scores across four profiles, $\chi^2(3) = 3.86$, $p = .28$). Follow-up pairwise comparison tests in child behavior intensity comparisons showed parents in Profiles One and Four presented significantly different associations between treatment conditions and outcomes compared to Profiles Two and Three ($p < .05$). Parents randomized to HNC reported lower child behavior intensity scores than parents randomized to TE-HNC in Profiles One and Four, while parents randomized to TE-HNC reported lower child behavior intensity scores than parents randomized to HNC in Profiles Two and Three at posttreatment (see Figure 4). These results showed that treatment conditions predict parent report of child outcomes significantly differ across four profiles.

Additionally, the associations between treatment conditions and parent-report child behavior intensity scores at posttreatment were examined within each profile and summarized in Table 5. There were statistically significant associations between ECBI Intensity scores and treatment conditions in Profile Two (b = –25.63, $SE = 7.03$, $p < .001$) and Three (b = –23.15, $SE = 8.16$, $p < .05$),

Table 3
Comparison of Mean Pre- and Posttreatment Outcomes Scores and Standard Deviations Across Profiles

	Pretreatment scores means (standard deviation)				Posttreatment scores means (standard deviation)			
	ECBI–Intensity	ECBI–Problem	APQ–Positive	APQ–Negative	ECBI–Intensity	ECBI–Problem	APQ–Positive	APQ–Negative
Profile One	135 (23.13)	20 (6.65)	48.67 (6.20)	18.43 (3.43)	95 (15.82)	11 (5.24)	48.63 (3.72)	14.13 (2.21)
Profile Two	155 (22.79)	23 (4.28)	54.96 (2.9)	17.11 (4.04)	106 (16.01)	12 (4.06)	55.73 (3.50)	12.70 (2.86)
Profile Three	161 (23.82)	25 (4.98)	48.86 (5.25)	18.14 (3.68)	120 (22.21)	17 (4.96)	51.38(3.71)	12.75 (1.79)
Profile Four	155 (30.00)	23 (6.21)	49.31 (5.64)	16.96 (3.90)	110 (22.72)	13 (6.95)	50.93 (4.99)	13.09 (3.45)
HNC	155.43 (27.61)	23.52 (6.41)	49.41 (5.49)	17.72 (4.08)	111.13 (21.49)	13.66 (5.88)	51.87 (4.42)	13.24 (3.20)
TE-HNC	150.80 (29.40)	22.5 (5.67)	50.04 (5.82)	16.84 (3.51)	104.5 (22.06)	12.12 (7.03)	51.71 (5.22)	12.97 (3.02)

Note. ECBI = Eyberg Child Behavior Inventory; APQ = Alabama Parenting Questionnaire; HNC = Helping the Noncompliant Child; TE-HNC = Technology-Enhanced Helping the Noncompliant Child. On the ECBI, scores greater than 131 on the Intensity scale and greater than 15 on the Problem scale are indicative of difficulties in the clinical range.

Table 4
Associations Between Parent Outcomes and Treatment Conditions Within Each Profile

	Profile One				Profile Two				Profile Three				Profile Four				
APQ–Negative Parenting	b	*SE*	est/*SE*	*p* value	b	*SE*	est/*SE*	*p* value	b	*SE*	est/*SE*	*p* value	b	*SE*	est/*SE*	*p* value	Wald test (*p* value)
Condition	3.84	1.19	3.24	.00	-4.94	1.16	-4.28	.00	0.09	1.37	0.06	.95	-0.10	1.01	-0.10	.92	
Pre-APQNEG	0.21	0.21	1.02	.31	0.26	0.14	1.95	.05	-0.05	0.34	-0.15	.88	0.44	0.17	2.61	.01	
Marital status	-0.17	0.71	-0.24	.81	6.95	6.36	1.09	.27	4.47	2.71	1.65	.10	0.69	1.21	0.57	.57	
																	.00
APQ–Positive Parenting																	
Condition	-5.17	0.90	-5.74	.00	8.79	23.23	38.00	.71	3.44	1.91	1.80	.07	-1.94	1.17	-1.65	.10	
Pre-APQPOS	0.25	0.15	1.74	.08	-3.69	18.52	-0.20	.84	0.38	0.22	1.76	.08	0.61	0.08	7.62	.00	
Marital status	-1.71	2.53	-0.67	.50	-36.11	34.64	-0.27	.79	-5.86	2.01	-2.91	.00	0.49	1.43	0.34	.73	
																	.00

Note. Est = estimated; *SE* = standard error; APQNEG = Alabama Parenting Questionnaire—Negative; APQPOS = Alabama Parenting Questionnaire—Positive.

suggesting that in these profiles parents randomized to TE-HNC reported significantly lower Intensity scores regarding their children's problem behavior than parents randomized to HNC. No regression coefficients were significantly different from zero in other profiles.

Discussion

This study used a person-centered approach to explore the construct of parent-centered latent profiles characterized by parental stress, parental depressive symptoms, parental dispositional mindfulness, and co-caregiver relationship and whether those moderated posttreatment parent-reported parenting and child treatment outcomes between HNC and TE-HNC. Findings suggested that there are four distinct profiles. Moreover, parenting practices and child problem behavior intensity, but not parents' perception of how much the behaviors were a problem, varied depending on the combination of treatment condition and profile. Our identification of Profile Two is consistent with literature demonstrating that highly mindful parents are unique in their ability to listen and pay attention to their children with less distraction, which enables them to perceive their child's experiences accurately and respond with more targeted parenting skills (Potharst, 2021). For parents in Profile Four, supportive co-caregiver relationships may play a critical role in treatment responses by increasing caregivers' involvement and consistency in skill use, promoting greater improvements in child behavior (McMahon & Forehand, 2003; McRae et al., 2021). Profile Three aligned with previous treatment studies that identify parents with higher stress as a distinct group, as they often face challenges in engaging with in-person mental health appointments (McKay et al., 2001). However, Profile One differed from previous studies linking low caregiver convergence with higher depressive symptoms (Barry et al., 2019; Harasemiw et al., 2019), highlighting the value of LPA in clarifying the variability among low-income families.

While parents in Profiles Three and Four reported similar parenting practices at posttreatment regardless of treatment condition, parenting outcomes varied in Profiles One and Two. In Profile Two, the parents randomized to TE-HNC reported better parenting outcomes than parents randomized to HNC. Given that mindfulness can help parents pay full attention and stay present with their children (Duncan et al., 2009), these parents may be more aware of their skill use in responding to their children and, therefore, can perhaps use the skill videos intentionally to refine specific parenting skills. Additionally, parents with higher dispositional mindfulness are believed to be less judgmental (e.g., Dumas, 2005) and may be more receptive to the clinicians' personalized feedback regarding reducing negative parenting and improving parenting outcomes with technology enhancements, such as using a video-recording feature to record the daily home practice.

In contrast, in Profile One, parents receiving HNC reported better parenting outcomes than those receiving TE-HNC. It is possible that the lower levels of agreement between caregivers in Profile One influenced how much parents could fully engage with and benefit from the mobile

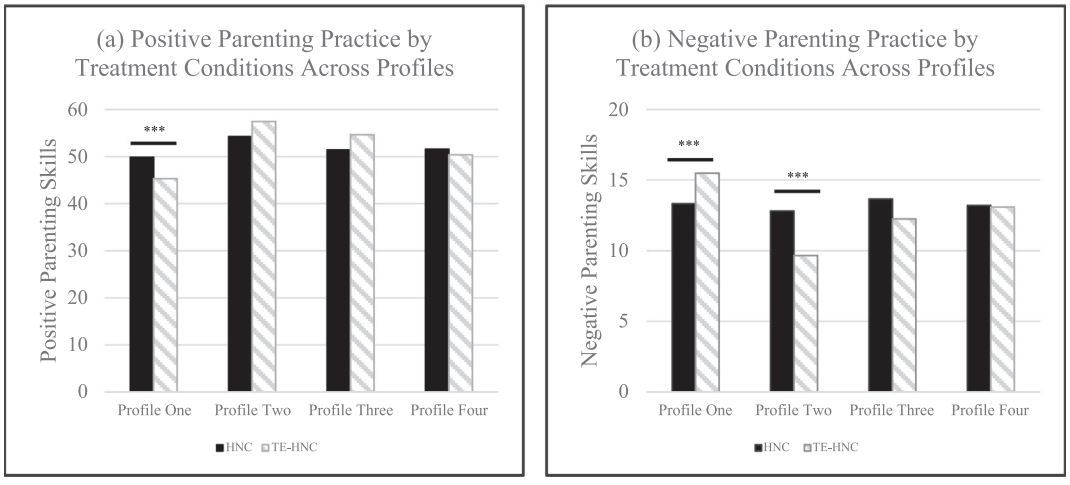

FIGURE 3 Parent outcomes by treatment conditions across four profiles. *Note.* HNC = Helping the Noncompliant Child; TE-HNC = Technology-Enhanced Helping the Noncompliant Child. *$p < .05$, **$p < .0$, ***$p < .001$.

Table 4
Associations Between Parent Outcomes and Treatment Conditions Within Each Profile

	Profile One				Profile Two				Profile Three				Profile Four				
APQ–Negative Parenting	b	*SE*	est/*SE*	*p* value	b	*SE*	est/*SE*	*p* value	b	*SE*	est/*SE*	*p* value	b	*SE*	est/*SE*	*p* value	Wald test (*p* value)
Condition	3.84	1.19	3.24	.00	-4.94	1.16	-4.28	.00	0.09	1.37	0.06	.95	-0.10	1.01	-0.10	.92	
Pre-APQNEG	0.21	0.21	1.02	.31	0.26	0.14	1.95	.05	-0.05	0.34	-0.15	.88	0.44	0.17	2.61	.01	
Marital status	-0.17	0.71	-0.24	.81	6.95	6.36	1.09	.27	4.47	2.71	1.65	.10	0.69	1.21	0.57	.57	
																	.00
APQ–Positive Parenting																	
Condition	-5.17	0.90	-5.74	.00	8.79	23.23	38.00	.71	3.44	1.91	1.80	.07	-1.94	1.17	-1.65	.10	
Pre-APQPOS	0.25	0.15	1.74	.08	-3.69	18.52	-0.20	.84	0.38	0.22	1.76	.08	0.61	0.08	7.62	.00	
Marital status	-1.71	2.53	-0.67	.50	-36.11	34.64	-0.27	.79	-5.86	2.01	-2.91	.00	0.49	1.43	0.34	.73	
																	.00

Note. Est = estimated; *SE* = standard error; APQNEG = Alabama Parenting Questionnaire—Negative; APQPOS = Alabama Parenting Questionnaire—Positive.

app. Also, the fact that the parents in Profile One are the ones bringing the child to treatment may suggest that these parents have more child care responsibilities and less energy to meaningfully engage with the app (Bécotte et al., 2022; Cowan et al., 2011). Additionally, parents in this profile may be less motivated to share resources like the TE-HNC video series with their co-caregiver, decreasing the likelihood that parents could feel supported in the treatment process and that the broader family system can affect change in child behavior outside of session.

For the intensity of children's behaviors, the patterns observed in Profiles Two and Four were similar to those for parenting outcomes, perhaps because BPT operates through parenting practices to effect change in child behavior. In Profile Three, parents in the TE-HNC group reported a greater decrease in child behavior intensity than in the HNC group. Given that parents in this profile also indicated relatively high co-caregiver support, it is possible that TE-HNC created an additional avenue for co-caregivers to aid the primary caregiver, leading to a more pronounced decrease in child problem behavior intensity immediately posttreatment. In Profile One, no significant differences were noted between caregivers using HNC and TE-HNC in child behavior intensity, possibly because parents in this profile found both modalities comparably effective, achieving similar reductions posttreatment regardless of the group.

The observed parenting outcomes did not extend to parents' perceptions of their child's behavior as problematic, as no moderation effects were detected. This could be due to the binary nature of ECBI Problem scores (i.e., yes, no), which may show slower changes than the continuous spectrum of ECBI Intensity (DeGarmo et al., 2004; Parent et al., 2021).

The current study aims to move beyond traditional single-factor moderation studies by exploring the interplay of multiple variables, illustrating that the effectiveness of a treatment modality may vary based on the unique combination of characteristics within each family. Additionally, considering the time and financial burdens associated with mental health interventions in the United States, this study begins to address the critical question of for whom these interventions may be the most appropriate, aligning with precision medicine principles. Notably, while prior work suggests that the implementation costs of HNC and TE-HNC are similar (e.g., the average cost to master a skill was $82 in TE-HNC and $80 in HNC; Jones et al., 2014, 2021), technology enhancements may not be necessary or even desired for

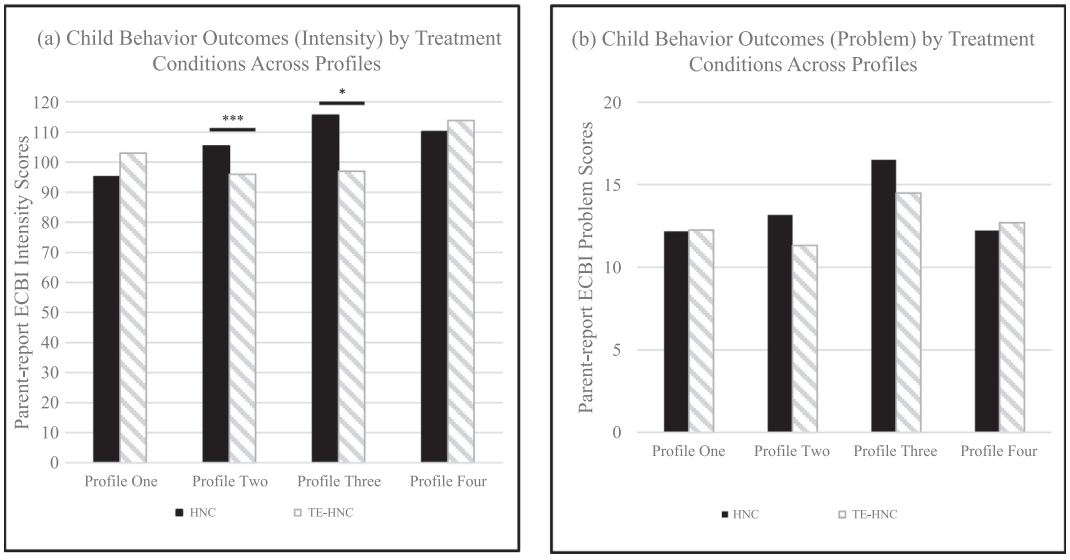

FIGURE 4 Child treatment outcomes by treatment conditions across four profiles. *Note.* HNC = Helping the Noncompliant Child; TE-HNC = Technology-Enhanced Helping the Noncompliant Child. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

all families. Furthermore, to ensure that any additional burden is justified by substantial clinical benefits, it is crucial to conduct more rigorous research to carefully evaluate the cost-effectiveness of person-centered assessments before recommending additional steps in the assessment process, which can increase time and costs for clinicians.

The results of this study must be interpreted in the context of its limitations. First, the study relied on parent report of both moderators and outcomes. Future work will benefit from replicating the findings with objective ratings to decrease the likelihood of common method variance. Second, parents were excluded if they met diagnostic criteria for depression *and* scored in the severe range on the BDI at baseline, potentially limiting the generalizability of the findings to parents with more clinically elevated symptoms. Third, even though several previous studies have successfully applied LPA to yield family profiles with similarly small sample sizes (Bernard et al., 2018; Dale et al., 2021), patterns should be replicated with larger samples to increase confidence in the results.

Despite the limitations, this study has several strengths. One key strength is the focus on families with low income that are more likely to have a child with early-onset BD and likely to have more challenges engaging in BPT. As discussed in earlier work, TE-HNC improved some aspects of engagement (e.g., homework, midweek call) but did not prevent dropout. Indeed, the dropout rates for both the HNC and TE-HNC groups align with broader literature, which estimates that about a quarter (26%) of families start but eventually drop out of BPT services (see Chacko et al., 2016, for a review) highlighting the importance of ongoing work with this underserved group. Moreover, the current work considers multiple moderators simultaneously for treatment outcomes. This person-centered approach broadens the historical focus that often relies on a deficit-focused perspective as we explore the variability within families with low income. In addition, given the nature of this small sample size and the unequal variances, our use of a BCH three-step approach is another notable strength since it exhibits the most robust and stable performance when used to yield unbiased estimation for small sample sizes in comparison with other approaches (e.g., ML_E, ML_U, LTB) in the literature (Shin et al., 2019). Finally, although the sample is too small to examine meaningful patterns about race and ethnicity, the families included in this study were relatively diverse, increasing the likelihood of generalizing the findings to families with low income more broadly.

Conclusions

Through examination of differential treatment outcomes of standard and technology-enhanced HNC across four profiles, our results highlight the diverse presentations of underserved families and how this diversity may shape their responsiveness to technology enhancements. As innovations in digital mental health interventions proliferate,

prior research has suggested the promise of TE-BPT approaches for early-onset BDs. Our study extends this research by demonstrating that technology-enhanced interventions may be a more optimal fit for some families than others posttreatment.

Although the findings from this study are preliminary and premature for clinical practice recommendations due to the small sample size and the exploratory nature, our findings highlight promising areas for future research that may eventually lead to direct clinical applications. With further evaluation, this line of person-centered research holds the potential for capturing the multidimensionality of families in clinical practice, paving the way for more personalized assessment and intervention. Future research could tailor treatments to specific family profiles and evaluate whether these tailored approaches lead to improved outcomes. Since previous work found that TE-HNC allowed families to maintain gains better than HNC at follow-up overall (Parent et al., 2021), future research should explore *if* and *for whom* digital approaches moderate treatment maintenance at follow-ups, to understand the sustained impact of technology-enhanced interventions that support long-term behavior change. Overall, recognizing the differences among families with low income may provide possible explanations for families' inconsistent posttreatment responses to standard BPT and offer the potential to personalize treatment further to improve outcomes.

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