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Adherence and Dosage Contributions to Parenting Program Quality

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Abstract

Objective—The 3 most frequently examined elements of treatment fidelity are adherence, dosage, and quality. The relationships between these fidelity elements are complex, and additional research is needed to provide clarity. Improving clarity may be especially relevant to parenting programs, which tend to include direct explicit instruction (DEI) elements (i.e., instruction, modeling, and practice). The adherence to and dosage of these DEI elements are frequently assumed to improve program quality; however, little information is available to determine if such adherence and dosage affect program quality. This study examines whether adherence to and dosage of DEI elements predict quality ratings for a widely disseminated, manualized parenting program.

Method—Adherence is defined as the percentage of intervention tasks completed for each DEI element. Dosage is defined as the number of minutes and seconds spent in each intervention DEI element. Treatment fidelity is assessed for 36 of 144 sessions across 10 program facilitators. A hierarchical linear regression analysis examines the contributions of adherence and dosage in the prediction of session quality ratings.

Results—The analysis indicates that adherence accounts for a significant proportion of the variance (26%), whereas dosage contributes a nonsignificant proportion of variance (11%). Adherence to skill practice was the strongest individual predictor ($\beta = .445, p < .01$).

Conclusions—Findings suggest that ensuring a high degree of adherence can contribute to quality program delivery. However, more exploration is needed to better understand the ways in which adherence and dosage of DEI elements affect program quality.

Keywords

Treatment fidelity; Parenting programs; Direct explicit instruction

Treatment fidelity refers to the extent to which an intervention or program is reliably and accurately implemented (Gable, Hendrickson, & VanAcker, 2001; Gresham, 1989). Treatment fidelity has been conceptualized multiple ways over time to address interventions at any level from the individual to the systems level (see Bosworth, Gingiss, Potthoff, & Roberts-Gray, 1999; Dusenbury, Brannigan, Falco, & Hansen, 2003; Fixsen, Blasé, Naoom, & Wallace, 2009; Jones, Clarke, & Power, 2008; Moncher & Prinz, 1991; Noell, 2008; Pereplechikova & Kazdin, 2005; Waltz, Addis, Koerner, & Jacobson, 1993). Dane and Schneider (1998) identified the five most-accepted dimensions of treatment fidelity: (a) adherence, (b) dosage (exposure), (c) quality, (d) differentiation, and (e) responsiveness. Adherence is the proportion of components delivered as prescribed by a treatment protocol (Dane & Schneider, 1998; Dobson & Singer, 2005; Sanetti, Chafouleas, Christ, & Gritter, 2009). Dosage refers to the number (i.e., how many), length (e.g., hours and minutes), or frequency (e.g., weekly) of sessions (Dane & Schneider, 1998; Power et al., 2005). Quality is determined through assessing subjective aspects of implementation and represents how well an intervention was applied (Berkel et al., 2011; Power et al., 2005). Differentiation represents the unique aspects of a program that are indicated to effect meaningful change (Power et al., 2005). Responsiveness is the degree of participant engagement in and satisfaction with a program (Power et al., 2005; Sánchez et al., 2007). Manualizing a program may limit variation in provider program delivery along these dimensions; nonetheless, implementation should be monitored for errors or variation in program delivery and in interventionists' manner of delivery to ensure consistency or assess the effect of inconsistency (Bellg et al., 2004).

It is frequently asserted that improved program delivery begins with the examination of adherence, dosage, and quality (Sanetti & Fallon, 2011) because of their assumed importance and interrelation (Power et al., 2005). Adherence and dosage are referred to as content dimensions because they are prescribed treatment elements that constitute the staple parts of an intervention, and these dimensions are typically interventionist controlled (Power et al., 2005). Quality is referred to as a process dimension because it includes discernments of service delivery procedures, which may account for interpersonal interactions (Power et al., 2005). It is often assumed that adherence is the central dimension of fidelity; however, the relationships between fidelity dimensions are likely to be more complex (Power et al., 2005), and additional research is needed to identify these relationships. Treatment fidelity monitoring strategies have focused on clinical treatment and intervention research (Bellg et

al., 2004); however, the relationship between adherence and quality and dosage and quality has limited examination within parenting programs.

Adherence, Dosage, and Quality Assessment

Adherence is best detected when intervention components are discretely defined (McLeod, Southam-Gerow, Tully, Rodríguez, & Smith, 2013). Assessments of adherence typically place the essential components of an intervention into a checklist or blended checklist and rating format (Berkel, Mauricio, Schoenfelder, & Sandler, 2011; Power et al., 2005). Adherence may be assessed through indirect methods (e.g., permanent product review or self-report), but researchers consider direct observation or video review the ideal method to assess adherence (Gresham et al., 2000; Sanetti et al., 2009). Fidelity to parenting programs is primarily assessed through adherence check lists completed by interventionist self-report or through independent observation (Eames et al., 2008; Seng, Prinz, & Sanders, 2006; Taylor, Asgary-Eden, Lee, & La Roche, 2013; Wilson, Havighurst, & Harley, 2012).

Measurements of dosage have included the number of program sessions received (Berkel et al., 2011; Sánchez et al., 2007; Zvoch, 2012), the number of weeks in treatment (Van Otterloo, van der Leij, & Veldkamp, 2006), the frequency of intervention delivery (Burke, Howard, Peterson, Peterson, & Allen, 2012; Howard, Burke, & Allen, 2013; Sanetti & Fallon, 2011), and deviation from prescribed time in sessions (Della Toffalo, 2000). Some research suggests that dosage can be a moderator of adherence related to parenting program outcomes and that adherence better predicts outcomes as dosage (i.e., number of sessions) increases (Berkel, McBride Murry, Roulston, & Brody, 2013). Nonetheless, dosage as measured by the length of continuous time (i.e., hours, minutes, and seconds) receiving treatment or treatment components has yet to be explored.

Assessing quality typically consists of gauging interventionist enthusiasm (Power et al., 2005), leadership or clinical skill (Berkel et al., 2011; Dane & Schneider, 1998), and working alliance development (McLeod et al., 2013). This assessment is often made through rating scales with items that globally assess empathy, egalitarianism, and acceptance (Schulte, Easton, & Parker, 2009). Quality is important because it may improve program outcomes. Some parenting programs incorporate quality assessments for performance feedback, comparisons of actual implementation to ideal implementation, and continuous quality monitoring (McCabe, Potash, Omohundro, & Taylor, 2012; Stern, Alaggia, Watson, & Morton, 2008). In one study, quality ratings of intervention steps implemented were associated with parent reports of improved child conduct (Hukkelberg & Ogden, 2013). Eames et al. (2009) found that positive group leader behaviors, such as encouragement, predicted improved observed and parent-reported parenting, which resulted in increased child compliance and prosocial behaviors. Furthermore, skillful interactions with clients may contribute to decreased problem behaviors and increased appropriate behaviors, as well as positive behavior generalization in youths (Cook et al., 2012). Skillful implementation of a health-related parenting program has been associated with improved health outcomes for adolescents by improving adolescent compliance with treatment regimens (Ellis, Naar-King, Cinningham, Templin, & Frey, 2007).

There is some empirical support for interrelationships among adherence, dosage, and quality, but more research is needed to determine the precise empirical relationship between these dimensions in the context of manualized interventions (Sanetti & Kratochwill, 2009), including parenting programs. Greater program adherence and dosage are assumed to contribute to implementation quality (Durlak & DuPre, 2008), although this is largely untested. Therefore, establishing the associations between adherence and dosage with quality will help to focus implementation training efforts to maximize implementation quality. For example, program developers may identify aspects of fidelity to emphasize more, less, or equally by understanding the specific contributions of adherence and dosage to quality. If it is found that adherence to specific elements results in higher quality ratings, then facilitator training should emphasize following these elements step-by-step to gain the benefits of quality implementation. It should be noted that recommendations for the amount of steps and time vary between programs. However, establishing an empirical track record may help program developers better understand continuous quality monitoring as component application and duration may indicate how a program meets quality standards (e.g., Daro, Hart, Boller, & Bradley, 2012).

The emerging information regarding the relationship between adherence and quality shows they are linked in various degrees. Adherence and quality are moderately to highly positively correlated when quality assessment is focused on how well an intervention was completed (Cook et al., 2012; Ellis et al., 2007; Hirschstein, Edstrom, Frey, Snell, & MacKenzie, 2007; Sanetti & Collier-Meek, 2014; Schulte et al., 2009). Adherence and quality are moderately and positively correlated when quality is assessed as interpersonal skillfulness, such as facilitator friendliness (Cook et al., 2012; Ellis et al., 2007; Wenz-Gross & Upshur, 2012). It is necessary for programs to monitor adherence because adherence is suggested to be a precursor to implementation quality (Dobson & Singer, 2005; Gresham, 2009). There is mounting support for the relationship between adherence and quality, but the relationship between dosage and quality remains relatively unexplored. Some research indicated no significant relationship with the number of session attended and treatment administration quality ratings (Sánchez et al., 2007), whereas others found a weak positive association when completing all sessions versus less than all sessions completed (Van Otterloo et al., 2006). These studies allow for limited inferences regarding the number of or frequency of sessions, but they do not address duration as continuous intervention time (e.g., minutes and seconds). Treating dosage as continuous time may help increase our understanding of dosage and has the advantage of providing information that could directly shape interventionists' actions within parenting program sessions. Moreover, dosage as continuous time may be particularly germane when a program specifies time criteria for parenting program elements or implies that increased time may improve the quality of intervention delivery.

Parenting Program Design Within an Efficacy Trial

Parenting programs are generally conceptualized through behavioral and cognitive-behavioral paradigms, as they are designed to provide lessons regarding targeted parenting skills. Parenting programs are consistent with the direct explicit instruction (DEI) strategy, which is meant to increase skill acquisition through instruction, modeling, and practice. Still,

no program evaluations have examined parenting programs within the DEI framework. In regard to DEI, instruction includes providing information regarding the desired behaviors related to the skill; modeling includes demonstration of the behaviors related to a skill; and practice includes providing activities to guide application of a skill's required behaviors (Kinder & Carnine, 1991; Tarver, 2001). The DEI approach is useful for teaching intervention implementation to teachers and other service providers (Sterling-Turner, Watson, Wildmon, Watkins, & Little, 2001; Ward, Johnson, & Konukman, 1998), and has been extended to parents as the targets of evidence-based parenting programs, such as Parent-Child Interaction Therapy (Eyberg, 1999). Central to this approach is completing lesson elements, pacing, and delivering material in a manner that is accessible to the learner, which is the parent in the case of parenting programs (Kinder & Carnine, 1991; Tarver, 2001). Indeed, reliably implementing the manualized steps of parent-training programs and providing an adequate quantity of time for the DEI components are assumed to improve the quality of program delivery (e.g., Burke, Schuchmann, & Barnes, 2006), although this assumption remains untested for many programs.

One program that is currently used extensively to teach parents parent-child interaction skills is Common Sense Parenting (CSP; Burke, Herron, & Barnes, 2006). CSP was built around the Father Flanagan's Boys Home (Boys Town) treatment model, and utilized DEI by stressing description of desired behaviors followed by strategic demonstration and individual rehearsal (Burke et al., 2006). Boys Town provides a continuum of services for youths who experience or are at risk for behavioral and emotional difficulties, and their parents and caregivers. The services range from inpatient psychiatric treatment to residential care to community- and school-based programs. Boys Town developed CSP using the Teaching Family Model, which posits that behavior modification within a community-based and family environment promotes learning skills related to socialization (Fixen, Phillips, & Wolf, 1973; Minkin et al., 1976). This is informed by social interaction theory, which states that reciprocal parent-child interactions develop and maintain child misbehavior (Patterson, Reid, & Dishion, 1992). Further, coercion theory is integrated into positive interaction interventions because this perspective assumes that coercive parent-child interaction cycles develop from ineffectual parent responses to escalating problem behaviors, and that competent parenting will develop reciprocal interactions leading to improved child responsiveness to the parent (Patterson, 1982; Snyder, Edwards, McGraw, Kilgore, & Holton, 1994). CSP is manualized and has multiple overlapping facets with many existing parenting programs (Barth et al., 2005; Kaminski, Valle, Filene, & Boyle, 2008). Boys Town developed CSP to extend their treatment model to parent training, which stresses describing desired behaviors followed by strategic demonstration and individual rehearsal (Burke et al., 2006), that is, DEI. For example, parents receive DEI for identifying appropriate child behaviors, such as compliance, and giving effective praise and logical consequences.

CSP is a 6-week program, in which a group of 6 to 10 parents meet with a facilitator who guides them through sequential lessons. CSP was designed for parents of children 6 to 16 years old (Burke et al., 2006) and it has been used with parents of adolescents. This use prompted a modification of CSP to an eight-session program focused on early adolescent

development, which is named *CSP Plus*. *CSP Plus* adds a beginning and ending session based on materials from the *Stepping Up To High School* (SUTHS) program. SUTHS is a curriculum designed to prepare families for a successful transition to high school and toward independent living, which was developed as a booster session for the Raising Healthy Children project (Brown, Catalano, Fleming, Haggerty, & Abbott, 2005). The added sessions included both parents and their middle-school children, and instruction was focused on the transition to high school and increased independence. Parenting programs such as CSP have reported fidelity measures to ensure that the program implementation was congruent with the manualized directions. In an investigation of CSP implementation in a randomized control trial, Oats et al. (2014) rigorously examined adherence, dosage, and quality through video-recorded sessions. It was found that structured training and supervision resulted in high levels of adherence to program steps and high-quality ratings. The researchers also monitored dosage as continuous time (in minutes and seconds; a comprehensive examination of the quality, adherence, and dosage assessments is found in Oats et al., 2014). Still, the interrelationship of adherence and dosage to quality was not examined, and analyses of these data may benefit the CSP program and its *CSP Plus* derivative by highlighting the effect of DEI procedures on program quality.

Purpose

The purpose of this study is to provide a preliminary investigation of the relationship between adherence and dosage with quality, within the context of an ongoing randomized controlled trial of the CSP parent-training program. Specifically, it examines whether the adherence to and dosage of the core components of instruction, modeling, and practice predict overall quality ratings of CSP delivery. This study used dichotomized adherence ratings and continuous minutes and seconds as dosage to predict quality ratings of program delivery. The research questions were: (a) Are quality ratings predicted by adherence to *instruction, modeling, and practice* components for CSP? and (b) Are quality ratings predicted by the dosage of *instruction, modeling, and practice* components for CSP? It was hypothesized that increased adherence and dosage of DEI components would predict increased quality ratings of the CSP program.

Method

Participants and Setting

Thirteen CSP facilitators were hired and trained, including 12 women (8 Caucasian, 3 African American, and 1 Hispanic) and one Caucasian man, 13 with experience working with adolescents, 8 with experience parenting adolescents, 3 with experience parenting only young children, and 1 with no parenting experience. Ten facilitators were in the participant pool; five facilitators conducted CSP and five conducted *CSP Plus*. One facilitator was excluded because that facilitator's sessions were cancelled because of facilitator departure from the project. Two additional hired facilitators failed to complete CSP program training and conducted no CSP sessions. The CSP facilitators had bachelor's degrees and they all received the same CSP parenting program training. The participants included 10 CSP facilitators for examining adherence and dosage. The mean number of session included for

each facilitator was 3.6 ($SD = 1.3$; range = 2 to 6) for adherence and 3.6 ($SD = 1.5$; range = 1 to 6) for dosage.

The CSP facilitators provided CSP or CSP *Plus* to targeted parents and middle school adolescents as a prevention program for at-risk families. The aim of the CSP and CSP *Plus* intervention programs was to reduce family risk factors and increase family protective factors for youth delinquency, substance-use, and risk-taking behaviors over the transition to high school. Research staff presented the study during core classes and distributed permission-to-contact forms for the students to take home to their parents. The participating schools assisted by disseminating study notices to families (e.g., emails, automated phone reminders), and mailing a copy of the permission-to-contact forms directly to families who had not responded to initial recruitment efforts. Each family included a target parent and target eighth grader, who attended one of five poor-performing middle schools in the urban Pacific Northwest. Each family was randomly assigned to one of three conditions over 2 academic years: CSP ($n = 118$), CSP *Plus* ($n = 95$), or control ($n = 108$). The control condition was assigned to receive neither the CSP nor the CSP *Plus* program, and received no treatment. The racial composition of families was 52% Caucasian, 26% African American, 4% Asian American, 4% Pacific Islander, 1% Native American, and 13% mixed or “other”; 12% reported they were Hispanic.

The facilitators delivered CSP or CSP *Plus* to 213 families over the course of 144 sessions of CSP ($n = 48$) or CSP *Plus* ($n = 96$). All sessions were videotaped; 20 CSP and 18 CSP *Plus* sessions, or 38 (26%) total sessions were randomly selected for treatment fidelity assessment after blocking by session and by each of the 10 workshop leaders. Blocking refers to random selection within the parameters of leader and session to ensure one weekly session or one CSP facilitator was not overrepresented; it may be considered a pseudorandom technique; that is, sessions were sorted by leader, then by session number, and then randomly selected from the “session x leader” blocks (Figure 1). All study procedures, including those for obtaining consent/assent, were approved by the human subjects review committees at the University, the Independent Institution, and the participating school district.

Training and Supervision

Trainers from Boys’ Town led a 3-day CSP training that provided the theoretical and practical background along with required practice for applying the CSP curriculum in order to ensure a high degree of reliability with the program manual. The first 2 days of training consisted of trainers providing instructions and the facilitators reviewing the six CSP sessions. The trainers used the third day to complete role plays, in which typical parent-related situations were presented and the facilitators took turns practicing and receiving feedback from the trainers and each other. Lastly, facilitators received general information regarding organizing and managing sessions. Eleven facilitators completed the CSP training, five of whom were randomly assigned to conduct CSP *Plus* sessions. These five facilitators received two additional 4-hour training sessions, which focused exclusively on the additional CSP *Plus* sessions. Trainers presented the 2-hour sessions and provided instructional and role play activities.

The project's intervention coordinator provided additional supervision after the initial training through three group meetings. The intervention coordinator was a certified CSP trainer; certification required training, expertise, and the completion of a 3-day trainer-of-trainers program. The meetings consisted of reviews of modeled examples, skill practice techniques, and feedback and discussions to improve general and specific program application. The intervention coordinator provided facilitators with individual supervision involving performance feedback and corrective feedback based on in-person and video observations.

Program Overview

Each CSP lesson follows the same structure: Introduction, Review, Instruction, Modeled Examples, Skill Practice, and Summary. The Instruction, Modeled Examples, and Skill Practice are emphasized as critical components, and they reflect a DEI paradigm. As outlined in the program manual, each of these three components has specified elements, time frames, and indicators of lesson delivery competence (Burke et al., 2006). Mean CSP time recommendations per session are approximately 22 minutes ($SD = 4.1$) for instruction, 16 minutes ($SD = 6.6$) for modeling, and 49 minutes ($SD = 7.4$) for skill practice (Burke et al., 2006).

Measures and Procedures

Treatment fidelity was assessed for the instruction, modeling, and skill practice components of the CSP and CSP *Plus* programs. Adherence and quality observation rating forms were developed for the original six CSP sessions based on the *CSP Trainer's Guide* (Burke et al., 2006) and for the two CSP *Plus* sessions using the SUTHS curriculum (Haggerty, Casey-Goldstein, & Barber, 2000a; Haggerty, Casey-Goldstein, & Barber, 2000b). Forms were refined through consultation with CSP and SUTHS program developers, who helped identify aspects of sessions and develop items related to essential, core intervention delivery. Quality, adherence, and dosage were assessed by two independent raters, both of whom viewed all 38 video recordings of the selected CSP and CSP *Plus* sessions. The raters were former CSP facilitators and current, certified CSP supervisors. For the analyses, half of the sessions were selected from each rater at random so that none of their session ratings overlapped. The ratings that were not selected as the analyses ratings were used as reliability ratings.

Dependent variable—The dependent, or predicted, variable in this analysis was the overall quality score for each CSP and CSP *Plus* session. Quality was assessed through a 19-item instrument using a five-point scale (1 = *Disagree*, 2 = *Slightly Disagree*, 3 = *Neither*, 4 = *Slightly Agree*, 5 = *Agree*). The items related to implementation quality (e.g., “The skill practice was introduced correctly”), and interventionist quality (e.g., “The trainer was enthusiastic”). The instrument provided an overall quality score by calculating the mean item score and was found to have high internal consistency ($\alpha = .96$). The two raters' overall quality scores for each session were strongly correlated ($r = .70, p < .001$). Inquiries regarding the full quality form may be made to the first author or first author of Oats et al. (2014), and dissemination would be at the discretion of Boys Town.

Independent variables—The independent, or predictor, variables in these analyses were adherence and dosage for each CSP and CSP *Plus* session. Adherence was assessed through a multiple-item implementation observation form, which included descriptions of the six CSP components. The number of elements included on an observation form corresponded to the number of elements for each session ($M = 28$ items; range = 18–41). Six session components rated along elements included (a) Introduction, introducing the CSP/CSP *Plus* approach used to address parenting skill development and providing an overview of subsequent session topics (first session only); (b) Review, reviewing skills taught in the previous session (after first session); (c) Instruction, instructing parents in new skills; (d) Modeling, viewing and discussing videotaped modeled examples of the new skill; (e) Skill Practice, practicing new skills using role playing exercises with performance feedback; and (f) Summary, summarizing the session. Examples of adherence items for Instruction are “States the definition of effective praise,” and, “States the three areas to consider when looking for things to praise.” Modeling items include “Uses the following script to demonstrate the example of an effective praise... [script],” and, “Shows and discusses all 6 video scenes.” Skill Practice items include “Has parents complete a second practice of effective praise using skill practice situations from the trainers’ manual” and, “Gives accurate and conceptual feedback to each parent for second practice.”

Each element was evaluated on a 3-point scale: 1 = *Yes, workshop leader fully adhered to the task*; 2 = *Partial, workshop leader partially adhered to the task*; 3 = *No, workshop leader did not adhere to the task*. If a score of 1 was recorded, the facilitator was considered to have completed the element, whereas scores of 2 or 3 indicated the element was incomplete. Adherence was calculated by dividing the number of completed elements by the total number of elements for the instruction, modeling, and skill practice components, respectively. Interrater reliability was calculated as percent agreement by dividing the number of agreements by the sum of agreements and disagreement. Kappa coefficients (κ) were calculated, as well; kappa values from 0.0 to 0.20 represent slight agreement, 0.21 to 0.40 fair agreement, 0.41 to 0.60 moderate agreement, 0.61 to 0.80 substantial agreement, and 0.81 to 1.00 almost perfect agreement (Landis & Koch, 1977). Interrater reliability for instruction was 91% ($\kappa = .44$), 94% ($\kappa = .57$) for modeling, and 84% ($\kappa = .48$) for skill practice. Interrater agreement was high between the raters, but the kappa coefficients were in the moderate range. Gwet's AC₁ (AC₁) was calculated because of the high interrater agreement and modest kappa coefficients. In such situations kappa coefficients tend to underestimate agreement because they do not account for asymmetrical, albeit similar, cell sizes (Cicchetti & Feinstein, 1990; DiEugenio & Glass, 2004). AC₁ accounts for similar, but skewed distributions (see Gwet, 2008 for a detailed comparison). AC₁ coefficients were high for instruction (.88), modeling (.91), and skill practice (.85).

Dosage was assessed through recording the actual amount of time spent on each session component in minutes and seconds. Time was recorded on a time form by the viewing rater, who wrote down the time-stamps on the video recordings. The objective nature of the time-stamp data made double-coding unnecessary for time adherence calculation (see Oats et al., 2014). CSP and CSP *Plus* delineate specific time parameters for each component; however, adherence to the time limits is not recorded as part of model adherence. Rather, time in each

component is measured independent of adherence and quality measures within the treatment fidelity monitoring procedures. In-depth information regarding adherence to and deviation from prescribed time limits in these programs is discussed in Oats et al. (2014).

Analyses

A multivariate analysis of variance (MANOVA) was conducted to determine if the CSP and CSP *Plus* programs differed in DEI adherence and dosage and program quality ratings. The MANOVA yielded significant differences between groups, $F(7, 28) = 3.58, p = .007$, Wilke's $\Lambda = .53$. The univariate tests found significant differences for dosage of modeling, $F(1, 34) = 6.02, p = .019, \eta_p^2 = .15$, and quality ratings, $F(1, 34) = 8.70, p = .006, \eta_p^2 = .20$. The CSP facilitators spent significantly more minutes in modeling than their CSP *Plus* counterparts ($M = 16\text{min } 21\text{sec}, SD = 8\text{min } 37\text{sec}; M = 10\text{min } 7\text{sec}, SD = 6\text{min } 28\text{sec}$; Cohen's $d = 0.82$). The CSP *Plus* facilitators received significantly higher quality ratings ($M = 4.38, SD = 0.33; M = 3.91, SD = 0.59$; Cohen's $d = 0.98$). Because of these results, program type (CSP or CSP *Plus*) was entered as a covariate in the regression analysis predicting quality ratings.

A hierarchical linear regression analysis was conducted in SPSS v.22 to determine the contributions of program type and adherence to and dosage of instruction, modeling, and practice components for CSP to predicted quality ratings of CSP sessions. Hierarchical linear regression is appropriate when blocks of predictor variables are dependent on other predictors (Pedhazur, 1997). For this model, program type was entered first, adherence to DEI elements was entered second, and dosage of DEI elements was entered last. In this study adherence components must be present for dosage in continuous time to be present, and this regression technique will account for the overlapping variance between these predictor blocks. Sessions were excluded list-wise and two sessions were excluded because of missing data for practice dosage, resulting in 36 total sessions included (25% of the sessions), 18 CSP and 18 CSP *Plus*.

Results

A series of diagnostic tests was conducted, and the results supported the use of hierarchical linear regression. Specifically, the scatter plots between predictor variables and the dependent variable indicated linear relationships, and the histogram of the dependent variable and the normal P-P plot of regression standardized residual values of the dependent variable indicated normality within the data. The data were noncollinear (Tolerance range = .525 to .946; VIF range = 1.06 to 1.90). The Durbin-Watson test yielded a value of $d = 1.40$, which suggests that the values are non-autocorrelated ($dL = 1.05, dU = 1.96; p < .01$; Savin & White, 1977). The data appeared homoscedastic based on the Q-Q scatter plot of the standardized predicted values by the standardized residuals.

The mean quality ratings were high ($N = 36; M = 4.1, SD = 0.53$, range = 2.7 to 4.9), as were the overall mean adherence to instruction ($M = 91\%, SD = 0.09$, range = 64 to 100%), modeling ($M = 92\%, SD = 0.16$, range = 50 to 100%), and practice components ($M = 89\%, SD = 0.15$, range = 50 to 100%). The overall mean dosage of the instruction, modeling, and practice components was 16min 45seconds ($SD = 8\text{min } 8\text{sec}$), 13min 14sec ($SD = 8\text{min }$

9sec), and 25min 38sec ($SD = 11\text{ min }42\text{sec}$), respectively. Correlations between the adherence and quality and dosage and quality measures are presented in Table 1. Program type was significantly correlated with quality ratings and dosage of modeling. Moderate and significant correlations were found between quality and adherence to modeling and skill-practice, and a moderate nonsignificant negative relationship was found with dosage of instruction ($p = .057$). Significant correlations between adherence to instructions and dosage of modeling and skill-practice were found. All other correlations between predictors were nonsignificant.

Table 2 contains overall quality as predicted by program type, as well as adherence to and dosage of DEI program components. The final model showed that predictors explained a significant amount of variance in the outcome, which indicated there must be sufficient variance to make predictions on the outcome variable (Pedhauzer, 1997). The regression analysis found the model that included program type and both adherence to and dosage of instruction, modeling, and skill-practice components significantly predicted program quality ratings (57% of the variance). Program type and Adherence to the DEI components significantly predicted quality ratings (20% and 26% of the variance, respectively); adherence to skill-practice significantly predicted increased quality ratings. Dosage of the DEI components did not significantly contribute to the variance (11%) over adherence. However, dosage of skill was positively related to quality ratings.

A post-hoc observed power analysis was conducted in GPower 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009), where $\alpha = 0.05$ and $N = 36$. There is some debate over the appropriate use of post-hoc power analyses (O'Keefe, 2007; Onwuegbuzie & Leech, 2004); however, it may be helpful through informing researchers if an increased sample size has the potential to yield different results (O'Keefe, 2007), or if null results may be replicated (Onwuegbuzie & Leech, 2004). A test of total R^2 yielded an observed power ($1 - \beta$ error probability) of 0.91. A post-hoc power analysis was conducted for the dosage block due to the nonsignificant results. A test of R^2 for the dosage block yielded an observed power of 0.45. Overall, this indicates that an increased sample size may be more likely to result in a similar amount of variance contributed by these predictors, but there is less certainty about the nonsignificance of the dosage predictors.

Discussion

This preliminary investigation examined how adherence and dosage independently affected quality of program delivery in an ongoing randomized trial of the CSP parent-training program. The findings provide an initial step forward in understanding associations between content and process dimension of treatment fidelity. As expected, adherence to the practice component was a unique predictor of quality ratings. This study confirms previous research, which found that completing practice-based intervention steps is moderately related to observers' judgment of quality (Hirschstein et al., 2007; Sanetti & Collier-Meek, 2013). Nonetheless, the failure of adherence to instruction and modeling components to predict quality was unexpected. These elements are hypothesized as fundamental to successful intervention implementation (Eyberg, 1999; Kinder & Carnine, 1991; Tarver, 2001) and have shown promising associations in previous research (Sterling-Turner et al., 2001; Ward

et al., 1998). Still, it is plausible that the context of the tightly controlled randomized efficacy trial artificially inflated the mean adherence and restricted the range of adherence for instruction and modeling, leading to a decreased range of observable effects. Further analyses under real-world implementation should be conducted.

The nonsignificant relationship between dosage of DEI components and quality ratings is consistent with other studies that found no relationship between dosage and quality (e.g., Della Toffalo, 2000; Sánchez et al., 2007). This has led some to speculate that dosage fails to show effects because psychosocial intervention dosages may be arbitrary (Della Toffalo, 2000). The duration of interventions' components needed to demonstrate a quality change is rarely established. Time guidelines may be frequently developed from speculated need, rather than dose-response analyses. In addition, it is difficult to make determinations regarding this assumption without strict observance and manipulation of dosage guidelines. The average time spent in each of the components was less than the recommended time, with deviation rates ranging from approximately 3 minutes (instruction and modeling) to approximately 24 minutes (practice). If the recommended time were followed, it may be possible to identify the effective intervals for increasing program quality as compared with recommendations. Interestingly, dosage of skill practice had a positive relationship with quality ratings, as did adherence to skill practice. One explanation may be that the raters may have associated skill practice with implementation quality, which led to rate quality higher as the presence of skill practice increased. Additionally, the low observed power coefficient indicated that a larger sample may produce different predictions of quality based on the dosage of DEI components. In sum, the results and previous research appear to indicate that information regarding the relationship between dosage and quality is limited, at best.

The current results may provide useful information regarding the relationship between adherence to and dosage of DEI components and quality. These associations may be more complex than hierarchical models of content and process dimensions indicate (Power et al., 2005). A frequent recommendation to improve intervention quality is focusing facilitator training toward technical, content aspects (Durlak & DuPre, 2008). The information gathered from this study suggests that training to adherence may be beneficial for quality, if it is concentrated on adherence to practice elements. This does not mean that nonsignificant findings for adherence and dosage of DEI components render them useless. Rather, it is conceivable that these relationships need reconceptualization to fully grasp their contributions or effects on program-delivery quality. Dosage of instruction and modeling may contribute to the effectiveness of skill practice. The current study showed moderate and significant relationships between instruction and modeling dosages and modeling and skill practice. Moreover, the restricted sample size may limit conclusions regarding the associations between adherence to instruction and modeling.

Additionally, this study investigated adherence and dosage beyond simply a list of expected steps. No known studies examined adherence and dosage organized according to the DEI model. Previous direct observation studies of adherence favored percent of completed steps of an entire intervention session (e.g., DiGennaro et al., 2005, 2007; Sanetti & Collier-Meek, 2013; Wood et al., 2007) over steps completed of DEI elements within the

interventions. Examining dosage as weeks in a program (e.g., Van Otterloo et al., 2006) or sessions attended (e.g., Sánchez et al., 2007) allows researchers to examine recipient controlled dosage; however, continuous minutes of treatment delivery allows for researchers to examine interventionist controlled dosage processes.

Still, this study was an initial investigation with corresponding limitations. The first limitation is that relatively few sessions were video recorded and coded, due to time and budget restraints. A larger number of coded sessions would allow for a wider sampling of intervention implementation practices. The low observed power for dosage serves as a reminder that outcomes in cursory studies, such as this one, may not generalize to larger samples or other programs. Future research is needed to determine the extent to which results from this study may generalize to other types of programming grounded in a DEI framework (e.g., relationship enhancement, stress reduction). Additionally, a larger number of coded sessions would allow for an investigation of the relationships between adherence, dosage, and quality, and their contribution to outcomes. Understanding these relationships may further facilitate training through focusing on implementation practices that improve client outcomes. Adherence may have an effect on parenting and child outcomes, but dosage may have a direct effect on parenting outcomes, as session time may be related to opportunities to practice parenting skills. Nonetheless, the process of sampling fidelity data should guide research and field applications of programs wherein analyzing these types of data help drive more comprehensive fidelity investigations that include more fidelity constructs and observed sessions. Further, a dose-response approach to each dimension of treatment fidelity may further the understanding of what the optimal levels are for each dimension. This could involve systematically varying or increasing time in treatment delivery to determine at what point recipients respond to the treatment and when they stop receiving benefits from a treatment.

The measures of DEI adherence in this study had high interrater agreement and moderate κ coefficients. However, interrater reliability was high when the skew of the data was accounted for with the AC₁ coefficients. It is possible that the scores from the adherence measures may vary more outside of an RCT and their reliability coefficients may align better under applied settings. There may be less rigorous monitoring in applied settings, which may lead to a less negatively skewed distribution of scores or more normally distributed scores. Relatedly, the CSP *Plus* sessions had a higher rating of quality. This may be an effect of rater bias or the limited data. Future studies may need to probe the reasons raters gave certain quality scores and include more sessions. Still, increased sample size and explorations into raters' practices cannot explain why CSP sessions had more time devoted to modeling. Regardless, the association between quality ratings and dosage of modeling was nonsignificant for the CSP ($r = .153$) and CSP *Plus* ($r = .068$) programs. Treatment fidelity research would benefit from systematically determining how differences in dosage between intervention variations affects program quality. This research could help determine the role of dosage in intervention adaptations. Additionally, future studies based on larger sample sizes are needed to explore the relationships under investigation after accounting for a larger number of potentially important covariates that have been shown to predict quality

(e.g., provider rapport and delivery style, types of skills covered, or adaptation to parent needs).

Conclusion

This study examined if adherence to and dosage of DEI elements predicted parenting program quality. Despite its limitations, it provides a framework for integrating a DEI conceptualization into treatment fidelity research. The CSP program is widely disseminated and designed to employ psychological paradigms that are implicated in parent and child behavior change and closely resemble the DEI framework. These paradigms were incorporated into the derivative program, *CSP Plus*. Therefore it is important that program facilitators implement it with appropriate quality. Adherence and dosage are linked to program delivery quality, but the interrelationships are still in need of clarification. This study provides a reference for the associations between adherence and quality and dosage and quality. It was found that skill practice adherence was the best predictor of observed program implementation. Nonetheless, the associations between the DEI elements and quality in relation to dosage should receive more exploration.

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Figure 1.
Flowchart of the session selection process for treatment fidelity with Common Sense Parenting (CSP) or CSP Plus.

Table 1

Correlations Between Quality, Program, and Adherence and Dosage

	1	2	3	4	5	6	7	8
1. Quality	1.00	.451 **	.080	.324 *	.419 **	-.268	-.081	.197
2. Program type ^a		1.00	-.038	.276	-.122	-.225	-.388 **	-.246
Adherence								
3. Instruction			1.00	.234	.075	.182	.477 **	.370 *
4. Modeling				1.00	.046	-.098	.080	.032
5. Skill-Practice					1.00	-.082	.160	.093
Dosage								
6. Instruction						1.00	.311 *	.173
7. Modeling							1.00	.514 ***
8. Skill-Practice								1.00
<i>N</i> = 36								

Note.

^a Common Sense Parenting (CSP) or CSP *Plus*.*
p .05**
p .01***
p .001.

Table 2

Overall Quality Predicted by Program Type, and Adherence and Dosage

	R^2	$F(df)$	$b (SE)$	β	$t(df)$
Constant			1.90 (.962)		1.977(28)
Program type ^a	.204**	8.70(1, 34)	.497 (.153)	.475	3.25 (28)**
Adherence ^b	.257**	4.92 (3, 31)			
Instruction			-.175 (.861)	-.030	-0.20 (28)
Modeling			.540 (.445)	.164	1.21 (28)
Skill-practice			1.54 (.442)	.445	3.48 (28)**
Dosage ^c	.106	2.27 (3, 28)			
Instruction			-.009 (.009)	-.131	-0.98 (28)
Modeling			-.007 (.011)	-.110	-0.64 (28)
Skill-practice			.016 (.007)	.358	2.42 (28)*
Total R^2	.566***	5.22 (7, 28)			
$N = 36$					

Note.

^aCommon Sense Parenting (CSP) or CSP *Plus*.^bPredictors = Percentage completed of each Instruction, Modeling, Skill-Practice component.^cPredictors = Continuous time spent in each Instruction, Modeling, Skill-Practice component.*
 $p < .05$ **
 $p < .01$ ***
 $p < .001$.