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# Predictors of Treatment Integrity in an Adherence Intervention Delivered by Multidisciplinary Healthcare Providers

Adrianne N. Alpern
*University of Miami*, a.alpern@umiami.edu

UNIVERSITY OF MIAMI


PREDICTORS OF TREATMENT INTEGRITY IN AN ADHERENCE
INTERVENTION DELIVERED BY MULTIDISCIPLINARY HEALTHCARE
PROVIDERS


By

Adrianne N. Alpern


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Approved:


_____                    _____
Alexandra L. Quittner, Ph.D.                Rebecca J. Bulotsky Shearer, Ph.D.
Professor of Psychology                     Associate Professor of Psychology


_____                    _____
Kristin M. Lindahl, Ph.D.                   Neena M. Malik, Ph.D.
Professor of Psychology                     Psychology Training Director
                                            Department of Pediatrics


_____                    _____
Amanda Jensen-Doss, Ph.D.                   Dean of the Graduate School
Associate Professor of Psychology

ALPERN, ADRIANNE N.                          (Ph.D., Psychology)

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<u>Multidisciplinary Healthcare Providers</u>

Adherence to medical regimens is a national public health concern across chronic health conditions (Balkrishnan, 2005), with problem-solving (PS) interventions demonstrating the greatest empirical support (Kahana, Drotar & Frazier, 2008). Prior research indicates adolescents with cystic fibrosis (CF) perform 50% or less of their treatments (Eakin et al., 2011; Modi et al., 2006; Quittner et al., 2014; Chest), resulting in serious health consequences (Briesacher et al., 2011). To address this critical problem, effective interventions need to be conducted in medical centers where patients receive regular care (Quittner, Alpern, & Blackwell, 2013). This will require efforts to train healthcare providers, who have variable levels of expertise in delivering behavioral interventions. This study measured multidisciplinary providers' fidelity and competence in a behavioral adherence intervention, and examined key predictors of gains in providers' implementation over time. Although fidelity and competence following one-time training was poor, supervision and practice both predicted improvements in implementation over time. Further, accounting for patient receptivity provided a clearer picture of implementation. Although findings suggest that one-time training is insufficient, providers from various disciplines can deliver this intervention faithfully and skillfully if ongoing supervision is provided. Disseminating evidence-based interventions

into specialty medical clinics has the potential to improve more patients' adherence, health, and quality of life.

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**Chapter 1: Introduction**

Adherence to medical regimens is a major public health problem that directly affects the health outcomes of children and adults with chronic health conditions. Across illness groups, patients perform less than 50% of their prescribed treatments (Dunbar-Jacob et al., 2001; La Greca & Bearman, 2003; Quittner et al., 2014), resulting in disease complications, diminished quality of life, and earlier mortality (Balkrishnan, 2005). In addition, the consequences of poor medical adherence cost approximately $300 billion annually in the United States, including $100 billion for preventable hospitalizations (Osterberg & Blaschke, 2005). Poor adherence is cited as the leading cause of treatment failure (Balkrishnan, 2005), and has been declared "a worldwide problem of striking magnitude" in need of intervention (World Health Organization, 2003). This study will evaluate healthcare providers' implementation of a behavioral problem-solving intervention to improve adherence in adolescents at 18 cystic fibrosis medical centers (N=635). Additionally, this study will model changes in implementation over time, using predictors that include provider discipline, practice delivering PS, clinical supervision, and in-session patient behavior (e.g., receptivity).

Treatment adherence is especially problematic in patients with cystic fibrosis (CF) due to the complex and burdensome nature of the regimen, which takes 2-4 hours per day (Barker & Quittner, 2010; Sawicki, Sellers, & Robinson, 2009). Research indicates that CF patients perform 50% or less of their treatments (Eakin et al., 2011; Modi et al., 2006; Quittner et al., 2014), resulting in serious health consequences, such as more frequent exacerbations, preventable hospitalizations, development of multiresistant organisms, drug resistance, and escalating health care costs (Briesacher et al., 2011; DiMatteo, Lepper, & Croghan, 2000; Quittner et al., 2014). We selected adolescents as the target

population due to the well-documented decline in adherence across disease groups during this developmental period (Ernst, Johnson, & Stark, 2011; Quittner et al., 2014; Radzik, Sherer & Neinstein, 2008), and the corresponding need for intervention.

**Problem-Solving Adherence Interventions**

Meta-analyses have demonstrated that multi-component, behavioral interventions are the most effective at improving adherence across illness groups (Kahana, Drotar & Frazier, 2008; Kripalani, Yao, & Haynes, 2007; Lemanek et al., 2001). Further, problem-solving (PS) has been identified as a key, therapeutic component of these interventions (Modi et al., 2012). PS serves to quickly identify key barriers to adherence, generate individualized solutions that are tailored to his/her lifestyle, and operationalize concrete plans that facilitate patient implementation (Quittner, Alpern, & Blackwell, 2013). Using this approach, adherence interventions for one medical condition can be easily be adapted to other conditions by focusing on the key barriers and solutions identified by the individual patient (Battersby, Von Korff, & Schaeffer et al., 2010; Quittner, Alpern, & Blackwell, 2013).

Several randomized controlled trials (RCTs) support the efficacy of PS interventions for improving treatment adherence. In an RCT with adolescents with inflammatory bowel disease, Greenley et al (2012) found improvements in adherence to oral medications following Problem Skills Training (Greeley, Nguyen, & Kunz et al., 2012). Similarly, Gross and colleagues (2013) reported increases in adherence and decreases in viral load among newly-diagnosed HIV-1 patients assigned to PS, compared to usual care. Finally, a translational study found that children randomized to receive regular in-clinic PS sessions showed improved glycemic control (i.e., lower HbA1c

levels) compared to those in usual care (Nansel et al., 2012). These interventions were delivered by a range of healthcare providers in different settings, including outpatient psychology clinics and tertiary medical clinics; however, none of these studies examined how these interventions were implemented, or which components were most strongly linked to patient outcomes.

Researchers evaluating PS have proposed important theoretical mechanisms that may serve as catalysts to improve adherence (Quittner, Alpern, & Blackwell, 2013). First, adolescents are allowed to select the treatments they would like to problem-solve, which enhances motivation and sense of control (Auerbach, 2000). Second, PS is patient-centered, and recognizes that patients and their families are experts in their own disease management (Sawicki and Tiddens, 2012). For example, *different* solutions are needed for an adolescent who forgets to do airway clearance versus one who is choosing between performing the treatment and participating in an important sports activity.  Third, adolescents' engagement and attention are secured by having them lead the PS session and record the solutions generated during brainstorming. Additionally, the patient's values and lifestyle are reflected in both the solutions they generate and those they vote for (e.g., making time for soccer practice). This enhances the individual's perception of control and ownership of the problem and solution. Finally, the collaboration between patient, parent, and healthcare provider provides a model for positive, nonjudgmental communication and conflict management that families can use when discussing adherence issues outside of the clinic setting.

Given the importance of tailoring adherence intervention to the individual's barriers (Gellad, Grenard, & McGlynn, 2009), evidence-based guidelines recommend

collaborative problem-solving to improve adherence in routine and specialty medical care (Battersby, Von Korff, & Schaeffer et al., 2010; Thompson, Mugavero, & Amico, 2012). Rather than referring patients to an off-site provider, delivering interventions in medical clinics is advantageous because it capitalizes on the regularly-scheduled visits that patients are already attending and the relationships they have already established with the medical team (Quittner, Alpern, & Blackwell, 2013).

Nevertheless, these guidelines do not specify which professionals should engage in PS with patients or how much training is needed for effective implementation. The majority of PS studies have failed to specify the interventionists' discipline(s) (psychologists, social workers, nurses, etc.), and did not measure whether the intervention was delivered as intended. For example, one study found no support for PS compared to asthma education (Apter, Wang, Bogen et al. 2011); however, PS was delivered by research coordinators, and it is not clear whether these null findings were attributable to poor implementation, setting characteristics, or to patient or disease characteristics. Thus, assessment of treatment implementation is critical to accurately interpret study findings and identify the thresholds at which the intervention produces changes in patients' medical adherence.

**Treatment Integrity: Fidelity and Competence**

*Treatment integrity* is a multidimensional construct that refers to the content, quality, and relational components of how a psychosocial treatment is delivered (Southam-Gerow & McLeod, 2013). Specifically, treatment integrity consists of both *fidelity*, or the degree to which the therapist implements the steps of the intervention as intended, and *provider competence*, or the level of skill with which the intervention is

delivered. This separation is important because it is possible to deliver the steps of an intervention (i.e., fidelity) without delivering it well (i.e., competence; Miller & Binder, 2002; Perepletchikova et al., 2007). In turn, competence is comprised of both technical competence (i.e., how well the intervention components were executed), and relational competence (e.g., active listening, managing conflict). Finally, *treatment differentiation*, or how different two treatments are from one another, is another aspect of integrity that is less relevant to the current study because there was only one active treatment group (McLeod et al., 2009; Perepletchikova & Kazdin, 2004). This study will focus on treatment fidelity, technical competence, and relational competence in the context of a PS intervention delivered by multidisciplinary healthcare providers in specialty clinic settings.

Assessing treatment integrity confers important benefits in both clinical and research contexts. Clinically, the degree to which the intervention is delivered as intended can significantly enhance its effectiveness and inform future training efforts (Erhardt, Barnett, Lentz, Stollar, & Raifin, 1996; Frank, Kupfer, Wagner, McEachran, & Cornes, 1991; Greenwood, Terry, Arreaga-Mayer, & Finney, 1992; Gresham, Gansle, Noell, Cohen, & Rosenblum, 1993b; Henggeler, Melton, Brondino, Scherer, & Hanley, 1997; Huey, Henggeler, Brondino, & Pickrel, 2000). In terms of program evaluation, integrity can be used as a mediator of treatment outcome, and can explain whether null findings are attributable to a failed intervention or to poor implementation (Perepletchikova, Treat, & Kazin, 2007; Miller & Rollnick, 2014). In addition, assessment of treatment integrity is crucial not only to confirm standardized treatment delivery across study sites, but to

ensure that patients received an adequate "dose" of the intervention (Bellg et al., 2004; Miller & Rollnick, 2014) and to prevent drift in provider skills over time (Kazdin, 2003).

To adequately assess integrity, measures of fidelity and competence must be intervention-specific (Perepletchikova & Kazdin, 2005). For example, fidelity measures highlight each component of the target intervention and describe the behaviors that are necessary for a clinician to deliver each step (e.g., define the problem before brainstorming). Measures of competence set a higher bar by linking specific behaviors to the skills need to deliver each component (e.g., definition of the problem varying from poor to fair, adequate, and excellent). To date, fidelity and competence measures exist for Motivational Interviewing (Moyers et al, 2010), Multisystemic Therapy (MST; Henggeler et al., 1997), CBT for panic disorder (Boswell et al., 2013), COPERS chronic pain intervention (Mars et al, 2013), Parent Training for children with externalizing disorders (Garbacz et al. 2014), Routine Family Therapy for adolescents with substance use (Hogue & Dauber, 2012) and others (Shoenwald & Garland, 2013). Despite the widespread use of PS interventions in medical populations, no tool currently exists to assess treatment integrity to PS. Thus, a major goal of this study was to develop and evaluate measures of integrity that were specific to this intervention and could be used to interpret outcomes in future PS studies.

The effect of therapists' fidelity and competence on treatment outcomes is inconsistent. A meta analysis by Webb (2010) found effect sizes ranging from -.40 to .47 for adherence and competence, with a mean effect size of .02 across 36 studies. This suggested that greater integrity did not lead to improved outcomes across studies. Effect sizes were not significantly different across treatment modalities, but were moderated by

the treatment target, with stronger effects emerging for depression than for drug use, bulimia, and trauma treatments. Importantly, the author cautioned against aggregating mean effect sizes across studies because the relationship between integrity and patient outcomes may vary across treatments, settings, and populations. Given that most integrity research is conducted in controlled research conditions, the restricted range of fidelity scores generated using research-trained therapists may obscure the relationship between providers' fidelity and patient outcomes (Hogue et al., 2008).

Importantly, little data exists on treatment integrity to interventions for medical adherence. Although one clinic-based adherence intervention evaluated fidelity as a quality control method (i.e., to ensure adequate delivery; Nansel et al., 2009), they used recent college graduates as "health educators" to conduct the intervention, and did not evaluate the relationship between fidelity and interventionist or patient characteristics/outcomes. Despite this, the authors found that 3-4 PS sessions were necessary before changes in patient adherence were detectable, and attributed this finding to improvements in interventionists' fidelity over the course of the intervention. However, to date, no PS studies have examined the amount of training and supervision needed to promote treatment integrity for interventions delivered by a multidisciplinary healthcare team. This step is crucial to developing effective provider training for interventions implemented in routine clinical care.

**Predictors of Treatment Integrity**

Although numerous predictors of treatment integrity have been identified, most studies have utilized univariate analyses that do not account for the interplay between multiple predictors (e.g., training and provider discipline). Clinical supervision, in which

a supervisor reviews each session and provides feedback, is consistently associated with increases in treatment fidelity (Perpletchikova, Treat, & Kazdin, 2007; Resnick et al., 2005; Schoenwald et al., 2009). Moreover, Southam-Gerow and McLeod (2013) refer to supervision as an important method of quality control to enhance treatment integrity in both research and practice settings. Clinical supervision is especially critical for efforts to disseminate evidence-based interventions into usual care (Schoenwald et al., 2011; Southam-Gerow & McLeod, 2013), given that variable integrity is anticipated when novice providers—or providers from different disciplines— are trained to deliver an intervention.

Although research on the relationship between provider discipline and treatment integrity is limited, studies suggest that prior experience with clinical interventions is associated with better fidelity (Macdonald et al. 2014; Miller & Rollnick 2014). Further, practice has been linked to improvements in fidelity in both professionals and lay clinicians (Macdonald et al., 2014). Clinical supervision is also associated with better treatment integrity over time for both psychologists and other providers (Chlan et al., 2011; Herschell et al., 2010; Lochman et al., 2009); however, associations between clinical supervision, prior training, and integrity may depend on the complexity of the intervention. To our knowledge, no study has assessed the relative contribution (i.e., variance explained) of clinical supervision and practice on integrity to PS interventions, or how these relationships vary by provider discipline.

Finally, prior research on fidelity and competence has been limited by the false assumption that therapist integrity is stable across contexts (Waltz et al., 1993). Instead, client difficulty may explain some of the variability in treatment integrity (Imel et al.,

2011; Patterson & Chamberlain 1994; Waltz et al., 1993). Studies have indicated that greater client difficulty (e.g., resistance, hostility) is associated with lower supervisor and therapist ratings of fidelity (Foley et al., 1987; Boswell et al, 2013), indicating that failure to account for client difficulty may also distort the relationship between fidelity and patient outcomes (Waltz et al., 1993). Assessment of client difficulty is also necessary to verify that therapists can successfully deliver the intervention in a variety of contexts, which requires considerable proficiency and skill.

To our knowledge, this is the first study to assess treatment integrity to a PS adherence intervention delivered by multidisciplinary healthcare providers. Few healthcare providers have received training in behavioral interventions, and they often have limited counseling skills. Thus, examining predictors of integrity over time is essential to quantify the type and amount of training needed to disseminate PS interventions into real-world settings. This study focused on: 1) developing PS-specific measures of fidelity and competence, and 2) identifying predictors of clinicians' integrity trajectories over time, including training, practice conducting PS, provider discipline, and in-session patient behaviors.

**Current Study: Aims and Hypotheses**

The current study examined: 1) the reliability of the Treatment Fidelity Rating Scale (TFRS; Alpern et al., 2012); 2) the longitudinal relationship between practice, clinical supervision, and treatment fidelity; 3) the factor structure of the PS-Competence measure developed for this study; 4) the relationship between practice, supervision and therapists' competence over time; and 5) the role of challenging patient behavior in relation to both TFRS and Competence scores. Models allowed for different intercepts,

slopes, and quadratic effects for mental health and non-mental health professionals (e.g., nurses, physicians).

*Aim 1 - Internal Consistency of the TFRS*

Hypothesis 1: The TFRS would demonstrate adequate internal consistency, as evidenced by Cronbach's alpha $\geq 0.70$.

*Aim 2 – Factor Structure of the PS-Comp*

Hypothesis 2: The PS-Comp would yield a 2-factor structure, with PS steps grouped by Technical Competence (e.g., Defining the Problem) and Relational Competence (e.g., Rapport, Active Listening)

*Aim 3 – Predictors of Fidelity (TFRS) Over Time*

Hypothesis 3: TFRS scores would improve significantly over the course of the study, with both practice and supervision emerging as significant predictors.

Hypothesis 4: Mental health providers would have a higher intercept (baseline fidelity score) and flatter slope (rate of change) than non-mental health providers.

Hypothesis 5: Change in TFRS scores would be nonlinear, with steeper rates of change occurring earlier in the provider's training process.

*Aim 4 – Predictors of Competence (PS-Comp) Over Time*

Hypothesis 6: Practice and clinical supervision would be associated with improved Competence over the course of the study.

Hypothesis 7: Mental health providers would have a higher intercept (baseline Competence score) and flatter slope (rate of change) than non-mental health providers.

Hypothesis 8:  The relationship between clinical supervision and Competence scores would be nonlinear, with steeper rates of change occurring earlier in the intervention.

*Aim 5 – Modeling the Association Between Challenging Patient/Parent Behavior and Integrity*

Hypothesis 9: A negative association would be found between challenging patient/parent behaviors and TFRS scores.

Hypothesis 10:  There would be an interaction between Challenging Behavior and Fidelity scores, with challenging behavior more strongly associated with Fidelity earlier in the intervention.

Hypothesis 11:  A negative association would be found between challenging patient/parent behaviors and Competence scores.

Hypothesis 12:  An interaction would be found between Challenging Behavior and Competence scores, with challenging behavior more strongly associated with Competence earlier in the intervention.

**Chapter 2: Method**

**Participants**

This study utilized data from a multicenter, randomized controlled trial comparing a comprehensive adherence intervention for adolescents with CF (iCARE) to standard care (SC). Patients (N = 635) were recruited from 18 CF centers across the United States. Small, medium and large centers were stratified by size and then randomized to one of the two arms of the study. Inclusion criteria were: 1) a diagnosis of CF, 2) age between 11 and 20 years, and 2) prescribed at least one pulmonary medication for a minimum of six months prior to recruitment, including Azithromycin, hypertonic saline, Pulmozyme®, TOBI®, Cayston®, or inhaled compounded tobramycin. Adolescents were excluded from the study if they were listed for lung transplantation or intended to change care teams during the study period. PS sessions were conducted by CF multidisciplinary team members (N = 48, 47.9% social workers, 20.8% nurses, 14.6% physicians, 8.3% dieticians, 8.4% other; see Figure 1 for consort diagram).

**Procedures**

*Provider Training and Clinical Supervision*

The intervention was delivered by members of the multidisciplinary CF team, referred to in this study as Behavioral Interventionists (BIs). BIs attended a half-day, in-person training in PS, consisting of didactics and role-play activities. As part of the iCARE program, adolescents and parents participated in PS sessions four times annually, during regularly-scheduled clinic visits, to identify adherence barriers and brainstorm solutions. Each adolescent's first PS session was videotaped for the purposes of clinical supervision. This served to scaffold the BIs' skills and reduce dependencies in the data.

Next, the videotaped session was rated for treatment fidelity by trained raters (a psychologist and two advanced doctoral students in clinical psychology) using the Treatment Fidelity Rating Scale (TFRS; Alpern et al., 2012).

Clinical supervision was conducted by two doctoral-level psychologists (KM and CK, who reviewed 38.1% and 32.3% of tapes, respectively) and an advanced doctoral student in clinical psychology (AA; 38.1% of tapes). Supervisors periodically conducted supervision sessions jointly to minimize drift in use of supervision strategies (8.5% of tapes). In total, 326 PS sessions from 48 interventionists were videotaped and rated for treatment fidelity.

Supervision consisted of joint video review (via computer screensharing) by the interventionist and supervisor, discussion of PS steps, and feedback highlighting the strengths and challenges of the session. Additionally, the BI and supervisor discussed any patient-related issues (e.g., obstinate or apathetic teen; intrusive or unsupportive parent) and brainstormed strategies for future sessions. If the BI mailed multiple PS tapes at once, the following procedure was utilized: 1) supervision was provided for each tape sent early in the process (supervision sessions #1 to #4) with detailed review of all tapes, 2) After four supervision sessions, the most difficult or most representative session was selected for detailed review during supervision, and the supervisor drew parallels to the other sessions.

*Observational Coding*

Treatment Fidelity was rated by clinical supervisors prior to supervision, providing Fidelity ratings for all tapes (n = 326 tapes). For competence coding, each provider's first tape was automatically coded, and a second tape before the first

supervision (if available) was randomly selected for coding. For example, if a BI sent three tapes at once before his/her first supervision, the first tape was automatically coded and another tape from the remaining two was randomly selected for competence coding. In addition, two PS sessions between each supervision date were randomly selected for competence coding. This process was followed because few BIs completed more than two sessions in the interval between supervision calls (e.g., 6 out of 48 providers submitted $\geq$3 tapes at baseline; 5 providers did so between Supervision 1 and 2). Further, the median number of tapes sent at baseline was one; median number of tapes at each subsequent time point was 2. Finally, only 12 BIs sent tapes after their third supervision; thus, to focus time and effort on tapes by the most representative interventionists, only tapes sent before the fourth supervision were coded. This sampling strategy yielded a total of 171 tapes rated for Competence at the following time points: Baseline (pre-supervision), Post Supervision #1, Post Supervision #2, and Post Supervision #3.

Trained upper-division undergraduate and post-baccalaureate students in psychology coded videotaped PS sessions using the PS Competence Scale (described below). Coder training for competence occurred in four phases: PS training, group coding, individual viewing with group consensus meetings, and final calibration (Forbes et al., 2001). Training and group coding utilized actual PS sessions from iCARE that were not randomly selected for competence coding in this study. Additionally, 10 criterion tapes were rated by doctoral students in clinical psychology (KM and EB), and coders were required to reach ICCs of .80 or greater to proceed to the individual coding stage. During individual coding, regular coding meetings took place to prevent coder drift over time. Videotapes were coded in random order, and raters were blind to provider

discipline, the number of prior PS sessions conducted, and the number of supervision sessions received.

To examine inter-rater reliability, 20% of tapes (n = 34) were randomly selected for coding by two independent raters. Across codes, the average ICC for Technical Competence was 0.86, and ranged from .81 (Operationalizing the Solution) to .92 (Defining the Problem; Table 1). For Relational Competence, ICC's ranged from .50 (Facilitating Teen Engagement) to .71 (Rapport/Warmth), with an average of .63. Notably, for Managing Conflict, reliability for coders agreeing on the amount of in-session conflict was .77, whereas it was .62 for coders that did not rate in-session conflict the same. Details are presented in Table 1.

**Measures**

The Treatment Fidelity Rating Scale (TFRS, Alpern et al., 2012, Appendix A) is a 35-item observational measure developed by Alpern, Quittner and colleagues in accordance with extant guidelines (Bellg et al., 2004; Stein et al., 2007). Sample items included "elicits adherence barrier from teen," "explains brainstorming," and "redirects criticism/evaluations." Trained coders review videotaped PS sessions and rated fidelity on a dichotomous scale ("0"- no, "1"-yes). Inter-rater reliability in this sample was .88 for absolute agreement based on independent ratings of 10% of tapes. The factor structure and internal consistency of this measure was examined to derive scoring algorithms and subscales, thus providing data on its validity.

The PS Competence Scale (PS-Comp; Appendix B) assessed both technical and relational competence, and was developed for this study using the following procedures: 1) conceptualized the aspects of PS considered essential to the intervention, as well as

those that could theoretically enhance study outcomes, 2) review existing competence and PS measures (Forbes et al., 2001; Hogue et al., 2008; Long et al., 2010; McLeod et al., unpublished; McLeod & Weisz, 2010), 3) drafted a preliminary measure, 4) pilot tested the measure with three coders on 10 tapes with a range of fidelity scores, and 5) revised the content and clarity of the measure during group coding. The PS-Comp consisted of 8 technical items (e.g., defining the problem, explaining brainstorming) and 6 relational items (e.g., rapport/warmth, active listening) scored on a scale 4-point Likert-type scale, with "1" indicating poor competence and "4" indicating excellent competence. Additionally, raters coded adolescents' level of participation and enthusiasm separately on a 4-point Likert-type scale (1 = poor; 4 = excellent), as well as challenging behavior for the adolescent and parent, respectively (0 = very receptive, no difficulties; 4 = extremely difficult).

Technical items "quality of problem description," "quality of solutions," and "quality of solution description" were adapted from the Family Problem-Solving Code (FAMPROS; Forbes et al., 2011), a well-established macro coding system that assesses individual and group-level behaviors in the context of problem-solving interactions. Relational and patient items "warmth/rapport," "adolescent challenging behaviors," and "parent challenging behaviors" were adapted from the TF-CBT Adherence and Competency Scale (McLeod et al., unpublished). The remaining items, generated for this study, were written based on their theoretical relationship with adolescent outcomes. For example, we believe that the degree to which the adolescent selects the final solution to try—versus being guided to select a particular solution—may enhance outcomes. Thus,

the PS-Comp contains an item to capture how skillfully the interventionist elicited the

adolescent's final solution from the adolescent in an open-ended manner.

The cumulative <u>number of supervision sessions received</u> and <u>number of PS</u>

<u>sessions conducted</u> prior to the date of each PS session were calculated from study

tracking logs to examine the relative effects of clinical supervision and practice on

treatment integrity. Due to variability in adolescents' willingness to consent to

videotaping, variable clinic schedules, and the need to conduct multiple PS sessions in

one day, BIs completed anywhere from 0-9 untaped PS sessions between each

supervision session. This allowed us to examine the variance explained by supervision

above and beyond variance explained by practice alone.

**Analyses**

*Aim 1: Internal Consistency of the TFRS*

Cronbach's alpha was examined as an indicator of internal consistency, with

scores greater than 0.70 considered adequate (Nunnally & Bernstein, 1994).

*Aim 2 – Factor Structure of the PS-Comp*

Numerous Confirmatory Factor Analysis (CFA) models were conducted to assess

the factor structure of the PS-Comp using 1- and 2-factor solutions. The best-fitting

model was selected based on established cut-offs for model fit indices, including CFI ($>$

.95), RMSEA ($<$ .05), SRMR ($<$ .08), and change in chi-square ($p < .05$) (Hu & Bentler,

1999; Kline, 1998).

*Aims 3 and 4: Longitudinal Predictors of Fidelity and Competence*

Hierarchical Linear Modeling (HLM) was utilized to examine longitudinal

trajectories of integrity, with separate models for Fidelity, Technical Competence, and

Relational Competence. Given that integrity assessments occurred at different intervals for each BI based on recruitment and clinic flow, the "number of PS sessions" and "number of supervisions" functioned as the time variable. Predictors were entered into the model in a stepwise manner: 1) number of PS sessions (e.g., practice); 2) number of supervision sessions; 3) quadratic effect for number of supervision sessions (or, for some models, quadratic effect for the number of PS sessions).

HLM is advantageous because: 1) it examines relationships within and between levels of nested data, thus accounting for shared variance, and 2) it allows for variable timing of measurement across individuals (Woltman, Feldstain, MacKay, & Rocchi, 2012). With only 18 centers and a design effect <2 ($D_{eff}^1$ = 1.18, 1.43, and 1.31 for Fidelity, Technical Competence, and Relational Competence, respectively), analyses indicated that the variance accounted for by site was not sufficient to necessitate grouping at the site level (Muthen & Satorra, 1995). Further, some sites only had one BI, yielding site-interventionist redundancies.

Four common techniques are available to examine nonlinear change: 1) data-transform the outcome variable to model linear change; 2) test a non-linear relationship (e.g., logarithmic) with specified polynomial growth parameters; 3) test an unconditional model with freely-estimated trajectories; or 4) utilize a spline (i.e., piecewise) method to fit lines with different equations to different ranges of DV values (Welch, 2007). These techniques have unique strengths and weaknesses with respect to ease of coefficient interpretation, need for manual manipulation, and model convergence. Importantly, the current study lacked a clear "intervention" point at which the rate of change should

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[1] Design effect = 1 + (average cluster size at site level - 1) x (Level 2 intercept variance component x Level 2 $r$ variance component)

increase, thus, there was no theoretical basis to determine the breakpoint(s) for piecewise modeling. I incorporated quadratic effects into models for Fidelity, Relational Competence, and Technical Competence to examine acceleration (or deceleration) in slopes, and whether these changes in slope vary by provide discipline (Level 2). Model equations were specified as follows:

Level 1 (Repeated Measures Model):

$$\textit{Treatment Integrity}_{ti} = \pi_{0i} + \pi_{1i} \text{ (n PS sessions)} + \pi_{2i} \text{ (Supervision)} +$$
$$\pi_{3i} \text{ (Supervision}^2) + e_{ti}$$

Level 2 (Interventionist-Level Model):

$$\pi_{0i} = \beta_{00} + \beta_{01} \text{ (Mental Health Provider)} + r_{0i}$$

$$\pi_{1i} = \beta_{10} + \beta_{11} \text{ (Mental Health Provider)} + r_{1i}$$

$$\pi_{2i} = \beta_{20} + \beta_{21} \text{ (Mental Health Provider)} + r_{2i}$$

$$\pi_{3i} = \beta_{30} + \beta_{31} \text{ (Mental Health Provider)} + r_{3i}$$

In the Level 1 equation, Treatment Integrity at time $t$ for interventionist $i$ ($Y_{ti}$) was estimated as a function of the intercept ($\pi_{0i}$), or the mean baseline score across interventionists; the number of PS sessions completed at time $t$ ($\pi_{1i}$); the number of supervision sessions received at time $t$ ($\pi_{2i}$); the quadratic effect for supervision ($\pi_{3i}$); and the residual of Treatment Integrity at time $t$ for interventionist $i$ after adjusting for Level 1 variables ($e_{ti}$).

In the Level 2 equations, one interventionist-level variable (mental health provider status, dummy-coded) was incorporated as a predictor. As a result, the intercept ($\pi_{0i}$) was a function of the mean baseline fidelity ($\beta_{00}$), the mean differences in baseline Treatment Integrity associated with mental health provider status ($\beta_{01}$), and the random

effect associated with the intercept ($r_{0i}$). Level 2 equations for the slope associated with the number of PS sessions completed ($\pi_{1i}$) was a function of the mean differences in Treatment Integrity per unit change in number of PS sessions across interventionists ($\beta_{10}$), the mean differences in slope associated with mental health provider status ($\beta_{11}$), and the random variance associated with each estimated mean difference ($r_{1i}$). Next, the slope for the number of supervisions ($\pi_{2i}$) was a function of the mean differences in treatment integrity per unit change in supervision sessions across interventionists ($\beta_{20}$), the cross-level interaction of mental health provider status with supervision ($\beta_{21}$), and the random variance associated with each estimated mean difference ($r_{2i}$). Finally, the quadratic slope for the number of supervision sessions was a function of the mean acceleration (or deceleration) in the supervision slope across interventionists ($\beta_{30}$), the mean differences in acceleration (or deceleration) associated with mental health provider status ($\beta_{31}$), and the random variance associated with each estimated mean difference ($r_{3i}$).

*Aim 5: Modeling the Effect of Challenging Patient/Parent Behavior on Treatment Integrity*

To examine the role of challenging patient/parent behavior on treatment integrity, a challenging patient/parent variable was calculated as the sum of observed patient and parent challenging behavior on the PS-Comp. Challenging behavior and the challenging behavior X n PS sessions interaction effect (or n supervision x challenging behavior interaction, if appropriate) were then entered as predictors using the models from Aims 3 and 4.

**Chapter 3: Results**

PS sessions were delivered by 48 BIs who submitted a mean of 6.83 taped sessions over the three-year active course of the study (SD = 7.04, Range: 1-32; Table 2). The average number of supervision sessions received by interventionists was 3.88 (SD = 3.02, Range: 1-11). Further, BIs completed an average of 17.06 PS sessions (taped and untaped) prior to their final supervision session (SD = 23.48, Range: 1-116). The number of supervision sessions received over the study was highly correlated with both # tapes sent ($r$ = .88, $p$ < .001) and # PS sessions administered ($r$ = .73, $p$ < .001). As expected, there was also a strong correlation between # tapes sent and # PS sessions conducted ($r$ = .82, $p$ < .001).

No significant differences were found between mental and non-mental health providers in the time that elapsed between in-person training and their first PS session, or with respect to the number of supervision sessions received, tapes sent, or PS sessions administered ($T$'s 1.45 to 1.75, $df$ = 46, $n.s.$). Importantly, there was a significant relationship between time elapsed since initial training and poorer baseline Fidelity for mental health providers ($r$ = -0.36, $p$ < .05); this was not true for non-mental health providers ($r$ = -0.13, $n.s.$). There were no significant differences in baseline Fidelity, Technical Competence, or Relational Competence between those who received ≤3 or >3 supervision sessions ($T$'s .88 to 1.6, $df$ = 46, $n.s.$).

**Baseline Integrity**

Across interventionists, mean and median Fidelity scores at baseline indicated that 17 out of 30 steps were completed (SD = 4.61), suggesting that half of the BIs completed less than 60% of PS steps. The most- and least-implemented PS steps at

Baseline are shown in Table 3. Overall, the most frequently completed PS steps were structural tasks (e.g., voting process). In contrast, the least frequently implemented steps involved eliciting information, including: a) obtaining enough information to clearly operationalize the problem (e.g., who, what, when where?), and b) operationalizing the solution in sufficient detail to maximize the probability of success (e.g., do you need help implementing this solution?).

Competence ratings provided a more fine-grained resolution of implementation at baseline, with ratings of 3 or higher considered adequate (Table 4). Average and median Technical Competence scores indicated that most BIs allowed the teen to choose a solution independently (Median = 4); however, no other Technical scales had average ratings ≥3 across interventionists. Consistent with the Fidelity data, BIs struggled to adequately Define the Problem (Mean = 2.04, SD = 0.96) and Operationalize the Solution (Mean = 2.17, SD = 1.06). They also failed to explain voting adequately (Mean = 2.09, SD = 2.09, SD = 0.96). With respect to Relational Competence, the highest mean rating across BIs was Active Listening (3.14), followed by Rapport/Warmth (2.76), Managing Conflict (2.67), and Facilitating Teen Engagement (2.64).

Finally, baseline ratings suggested that adolescents were, on average, highly participatory and engaged during PS (Means = 3.07 and 2.87, respectively). Challenging behavior was infrequent and of low intensity for both teens (M = 0.93, SD = 1.01) and parents (M = 1.28, SD = 1.09).

**Aim 1: Internal Consistency of the TFRS (Fidelity)**

The internal consistency of the TFRS was examined using Cronbach's alpha. Internal consistency for all 30 items was 0.74, which is considered adequate (Nunnally et

al., 1994), and all item-total correlations were positive. The 30 TFRS items were summed to create a Total Score, and then z-transformed for added interpretability. The z-transformation also offered the advantage of rescaling TFRS scores to be more comparable to Competence factor scores.

**Aim 2: Factor Structure of the PS-Comp (Competence)**

The hypothesized factor structure of the PS-Comp was supported by a Categorical CFA (Table 5). As proposed in Hypothesis 2, a two-factor solution with Technical and Relational competence as separate factors was confirmed, and evidenced significantly better model fit than a 1-factor solution ($\Delta\chi^2$ (2) = 6.35, $p < .05$). Model coefficients are shown in Table 5.

As previously discussed, coder reliability for competence in Managing Conflict was acceptable only when coders agreed on the intensity of in-session challenging behavior (ICC = .77). In other words, differences in coders' perceptions of the intensity of challenging behaviors gave rise to discrepancies in their ratings of how well BIs managed these behaviors. Further, Managing Conflict was negatively associated with the frequency and intensity of in-session challenging behaviors. To control for differences in challenging behavior across sessions, Managing Conflict was regressed on the total Challenging Behavior score (parent + child challenging behavior). This corrected score was then used in the factor analysis. Model fit for the final model was above established cut-offs, $\chi^2$ (46) = 49.10, *n.s.*, CFI = 0.98; RMSEA = .04. Technical and Relational competence factor scores were correlated (B = .25, $p < .001$). Associations (accounting for nesting) between study variables are shown in Table 6.

**Aim 3: Predictors of Fidelity**

To test the hypothesis that practice and supervision would predict changes in Fidelity scores, models in HLM were run to examine the incremental variance explained by different predictors. Based on the unconditional 2-level model, 47% of the variance in Fidelity was *between* BIs (Level 2), and the remaining 53% was attributable to repeated measures *within* BIs (Level 1). In terms of fixed effects, adding # PS sessions accounted for an additional 12% of the variance in Fidelity. A model with both # PS and # Supervision sessions as predictors explained 13.8% more variance than the unconditional model, with both predictors meeting statistical significance. Adding a quadratic effect for # Supervisions explained an additional 3.2% of the Level 1 variance. Finally, the addition of a dummy variable for mental health providers explained 35% of the Level 2 variance between BIs (Table 7).

The random effect for individual variation in baseline Fidelity (intercept) was significant; however, random effects for the # PS sessions (linear slope) and # supervisions (linear and quadratic slopes) were not. Models with and without non-significant random effects were not significantly different, $\chi^2_\Delta (9) = 3.94$, $p > 0.5$, *n.s.*, so the most parsimonious model was retained and the non-significant random effects were removed.

Hypothesis 3, which posited that practice and supervision would predict gains in Fidelity, was moderately supported by the final model. Supervision was the strongest predictor of Fidelity (B = 0.48, $p < .001$; Table 7); however, the number of PS sessions (i.e., practice) was not a significant predictor of Fidelity once Supervision was added to the model (B = 0.01, *n.s.*). Strong support was also found for Hypothesis 4 regarding

differences in intercepts and slopes by provider discipline: as predicted, mental health providers performed significantly better at baseline, but had a significantly less-steep rate of change than non-mental health providers. In strong support of Hypothesis 5, the quadratic slope for Supervision was negative and significant, indicating a deceleration (plateauing) in rates of change. Further, the deceleration in slope was only significant for non-mental health providers, suggesting that those with a mental health background showed linear gains and less plateauing over time (Figure 2).

Because the median number of Supervision Sessions was 3, it is arguable that the significant effects of # PS sessions or # Supervisions were driven by a nonrandom subsample of BIs that received more supervision. The final Fidelity model was re-run, this time restricting the data to the first four time points (Baseline and Supervisions 1, 2, and 3). Results were replicated: all model coefficients retained the same significance status (significant or non-significant), and were within .02 points of the coefficients from the model that incorporated all time points. Thus, the model with fewer time points was not different from the model that included all of the data.

## Aim 4: Predictors of Competence

### *Technical Competence*

To test the hypothesis that both practice and supervision would predict gains in Technical Competence, model-building steps were followed as described above. Similar to the Fidelity model, the unconditional model revealed that 47% of the variance in Technical Competence was *between* BIs, and the remaining 53% was associated with repeated measures *within* BIs. There was substantially less overall variance in Technical Competence factor scores than there was in Fidelity ($SD_{Fidelity} = 1.00$, range -2.39 to 2.82;

$SD_{TechnicalComp}$ = 0.39, range -2.08 to 0.86). Adding # PS as a Level-1 predictor explained

an additional 11% of the variance beyond the unconditional model. In the next model

with both # PS and # Supervision, neither predictor was significant; however, #

Supervisions as the only Level-1 predictor explained 22% of the variance in Technical

Competence. Thus, these predictors were tested in two separate models to identify which

explained more variance (Model A: # PS; Model B: # Supervisions). Quadratic effects for

both Model A and Model B were not significant and were removed from subsequent

models. Finally, adding a Level-2 dummy variable for mental health providers explained

38% of the variance between BIs in Model A and 25% of the variance between BIs in

Model B (Table 8).

In terms of random effects, both models had significant random intercepts (i.e.,

significant individual differences in intercept across providers) and non-significant

random slopes. Chi-square difference testing did not reveal significant differences

between the models with and without non-significant random effects for Model A ($\chi^2_\Delta$ (2)

= 0.56, $p > 0.5$, $n.s.$) or Model B ($\chi^2_\Delta$ (2) = 1.12, $p > 0.5$, $n.s.$). Thus, the more

parsimonious models were retained and non-significant random effects were dropped

(Table 8).

In support of Hypothesis 6 that both practice and supervision would predict gains

in Technical Competence, Number of PS and Supervision sessions were significant

predictors of Technical Competence in separate, final models ($B_{PS}$ = .02, $p < .01$;

$B_{Supervision}$ = 0.10, $p < .01$). Moderate support was found for Hypothesis 7 (different slopes

and intercepts based on discipline): in terms of provider discipline, significant differences

in baseline Technical Competence between mental health and non-mental health

providers were found, with mental health providers performing significantly better at baseline than non-mental health providers in both models. This difference was in the expected direction. In contrast to the Fidelity model, no differences in slopes emerged between mental health and non-mental health providers. Finally, Hypothesis 8 was not supported, as no quadratic effects were found overall or by discipline.

*Predictors of Relational Competence*

To test the hypothesis that practice and supervision would predict gains in Relational Competence, model building proceeded similarly to previous models. Based on the unconditional model, 38% of the variance in Relational Competence was associated with BIs (Level 2), and the remaining 62% was attributable to repeated measures within BIs. As the only Level-1 predictor, # PS sessions explained an additional 0% of the variance in Relational Competence, and # Supervisions explained 8.7%. Because neither predictor was significant when included simultaneously, they were tested in separate models (Model A: # PS; Model B: # Supervision). Adding mental health provider status at Level 2 accounted for 68% of the variance in Relational Competence in Model A and 55% in model B.

In terms of Relational Competence, there was no support for Hypothesis 6 that practice and supervision would be associated with improved competence over the course of the study. In contrast to previous models, # PS and # Supervisions did not predict Relational Competence either uniquely or in combination (Table 9). Also in contrast to the Fidelity and Technical Competence models, Hypothesis 7 was not supported, and no differences in intercepts or slopes were found between mental and non-mental health

providers. Finally, no quadratic effects were found, and thus, Hypothesis 8 was not supported.

**Aim 5: Associations Between Challenging Patient/Parent Behavior and Integrity**

Next, analyses were conducted to examine associations between challenging patient/parent behaviors and Fidelity and Competence scores (Hypotheses 9 through 12). In-session Challenging Behavior was not associated with Fidelity, Technical Competence, or Relational Competence on its own or with other predictors. Null findings also emerged using a log-transformed variable for Challenging Behavior (due to skew). This is likely due to the restricted range of Challenging Behavior observed in our sample. In contrast, the Teen Engagement code had more variability and evidenced better inter-rater reliability. Consequently, Teen Engagement was added to the final models from Aims 2 and 3. Lastly, the interaction between # Supervisions and Engagement was examined for all outcome variables (Table 10).

Hypothesis 9 was proposed to examine whether negative associations between challenging behavior and TFRS scores existed. Overall, Teen Engagement emerged as a strong predictor than other variables when added to the final models from Aims 2 and 3, which lent strong support to Hypothesis 9. Specifically, it was the strongest predictor of Fidelity after # Supervisions, controlling for # PS sessions. The addition of Teen Engagement also strengthened the magnitude of the associations between other predictors and Fidelity, possibly by accounting for what had previously been a source of error variance. Hypothesis 10 posited that interventionists' fidelity would be less associated patient behaviors as time progressed. This hypothesis was partially supported, but in an unexpected direction: a separate model did reveal a significant Supervision x

Engagement interaction, with a *stronger* association emerging later in the intervention (Table 10).

In support of Hypothesis 11 that patient challenging behavior would be associated with competence, Teen Engagement was also significantly associated with Technical and Relational Competence, and was the strongest predictor when added to prior models. Again, adding Engagement amplified the relationship between # Supervisions and Technical Competence, and uncovered a previous non-significant relationship between # Supervisions and Relational Competence by removing a source of error variance. No interactions between # Supervisions and Engagement were found when predicting Competence. Thus, there was no support for the Supervision x Engagement interaction effect proposed in Hypothesis 12 (Table 10).

**Chapter 4: Discussion**

Measuring treatment integrity is critical to understanding the outcomes of clinical interventions because it can be tied directly to improved training and dissemination (Bellg et al., 2004; Perepletchikova, Treat, & Kazin, 2007; Miller & Rollnick, 2014). Specifically, it facilitates identification of the intervention components that require more specialized training for successful delivery, and thus, can be used to broaden the types of providers who can be successful. This is particularly important in medical settings for two reasons: 1) Patients are most likely to receive and benefit from adherence interventions that are made accessible to them in routine medical care, and 2) patients have already established relationships with their medical teams, who are well-positioned to intervene (Quittner, Alpern & Blackwell, 2013).

This is the first study to develop measures of Fidelity and Competence for PS interventions conducted in specialty medical clinics, and the first to examine treatment integrity in an adherence intervention delivered by multidisciplinary CF teams. This study also provided information on the reliability and validity of two intervention-specific measures of fidelity and competence. Based on these preliminary data, both measures demonstrated adequate to strong reliability, good concurrent validity, and sensitivity to change. Although future work is needed to improve inter-rater reliability for relational competence codes (e.g., Facilitating Teen Engagement), these tools would be valuable additions to assess integrity in problem-solving intervention research. Moreover, both measures could be incorporated into clinical trainings and supervision to improve healthcare providers' intervention efforts in real-world clinical settings.

Finally, the current study examined key predictors of gains in integrity over time, with a particular focus on practice, supervision, provider discipline, and patient engagement (i.e., receptivity) as key sources of variation in provider implementation. Overall, findings highlighted both practice and supervision as key predictors of gains in Fidelity and Technical Competence over time. Additionally, mental health professionals performed significantly better at baseline than non-mental health providers, and had a slower response to practice and supervision in some integrity domains, but not others. Interestingly, neither practice nor supervision accounted for gains in Relational Competence until adolescent engagement was added as a predictor. These results have important implications for training multidisciplinary teams, including the timing, intensity, and content of initial training and ongoing supervision.

**Initial Performance Prior to Supervision**

Between the initial training and the provision of clinical supervision, treatment integrity to PS was poor across disciplines. Two of the most theoretically important aspects of PS—Defining the Problem and Operationalizing the Solution—were not implemented adequately across providers. These two steps of PS are crucial to generating solutions that are patient-centered and customized to the individual adolescent's schedule (e.g., balancing homework and soccer) and lead to specific and well-defined solutions. Importantly, only 27% of interventionists asked teens to specify who helps them with their treatment, and only 37% asked whether the teen would like help from a parent or friend to implement their solution. Establishing who is involved is especially important given that adolescents often continue to rely on parents for help with their treatments, but spend increasing amounts of time with peers. Further, adolescents may be less likely to

perceive that parents as "nagging" them if they can voice their preferences about the nature and timing of assistance. Thus, mental-health and non-mental health providers alike require additional training in many of the key features of PS.

**Factor Structure of the PS-Comp**

As hypothesized, PS-Comp scale yielded separate factors for Technical and Relational Competence. Notably, the range of scores for Technical Competence was restricted at baseline and for the duration of the study. This highlights the challenges of teaching multidisciplinary providers to deliver behavioral interventions in medical clinics: fidelity is an easier bar to reach, but implementing PS *well* was a challenge for interventionists across disciplines. Possible explanations include insufficient or poorly-timed training, busy and stressful clinic schedules, and diminished buy-in from BIs or other members of the multisciplinary team. A qualitative study is currently under way to systematically assess barriers to successful implementation in this study (Eakin et al., manuscript in preparation). Despite these barriers, the current study demonstrated that providers with varying degrees of experience with behavioral interventions can be trained to deliver an adherence intervention, and one-time training is not enough for successful implementation.

**Predictors of Integrity at Baseline and Over Time**

Results across the various measures of integrity measures indicated that a one-time, 2.5 -hour training session was not sufficient for adequate implementation. Instead, training efforts should be both ongoing and tailored to the provider's current level of competence. The provision of supervision was an important component of our implementation plan and was the strongest predictor of gains in Fidelity and Technical

Competence over time. Notably, this directly contrasts with the "usual" medical model of training, which focuses on brief workshops without ongoing training and supervision. Although we initially encountered tremendous resistance to our model of videotaped phone supervision, an interventionist satisfaction survey at the end of the study suggested that providers recognized its importance and wanted *more* supervision (McLean et al., unpublished data).

Further, mental health providers demonstrated significantly better Fidelity at baseline by nearly half a standard deviation, and evidenced a flatter rate of change than non-mental health providers. These differences may be explained by the better foundation that social workers typically have in clinical interventions vs. other medical providers, however non-mental health clinicians also had more room to improve over time. Based on these results, providers who are less familiar with behavioral interventions should receive additional training prior to implementation with patients.

The observed rates of improvement in Fidelity could serve as a guide for the timing of ongoing training. As expected, changes in Fidelity were nonlinear, with more rapid gains occurring earlier in the supervision process-- following a classic "learning curve." The diminishing rate of change (i.e., negative quadratic slope) was significantly stronger for non-mental health providers, while the quadratic slope for mental health providers was virtually 0 (linear). Taken together, mental health providers who received more supervision were the highest-performing interventionists in our study. This was true even when restricting analyses to the first four supervision sessions to reduce the effects of non-representative clinicians (i.e., those who received more than 3 supervisions, conducted more PS sessions, and may have been more open to receiving supervision).

Future training efforts should provide more intensive supervision at the beginning, which would both scaffold interventionists' skills and allow for strategic allocation of resources (e.g., supervisors' time). These findings can also be used to increase providers' buy-in for supervision.

Similar to the Fidelity scores, gains in Technical Competence over the course of the study were associated with both practice and number of supervision sessions, however, these effects washed out when both predictors were included in the same model. This may be attributed to collinearity between these predictors, combined with the restricted range of Technical Competence scores observed in our sample. Importantly, supervision explained more variance in Technical Competence (22%) than number of PS sessions (11%). Results suggested supervision is more strongly related to Technical Competence than practice, and is key to ensuring adequate intervention delivery. Future studies should examine interactions between Supervision and Practice; supervision may have limited benefits if providers have fewer opportunities to practice the techniques that were discussed.

In terms of provider discipline, those with formal mental health training had significantly better Technical Competence scores at baseline; however, there were no differences in *rates of change* between types of providers in response to supervision. Assuming both groups improved at the same rate, those without a mental health background were not able to "catch up" to the more behaviorally-experienced clinicians. Similar to Fidelity, the highest performing interventionists were mental health providers who had received ongoing supervision. These results underscore the need for more

intensive initial training and supervision, especially for providers who lack formal mental health training.

Rates of change in both Technical and Relational Competence were constant, and therefore, they are best conceptualized as linear. One explanation for the lack of tapering or plateauing is that interventionists were held to higher standards for Competence than for Fidelity, which is simply whether they completed the steps of PS. Accordingly, competent implementation may take more time and practice beyond the window of time for which data are available. Future research should follow interventionists over a longer period of time or a greater number of supervision sessions.

We found no support for the hypotheses pertaining to Relational Competence. Compared to Fidelity and Technical Competence, Relational Competence was more difficult to model because 62% of the variance was attributable to repeated measures within interventionists, and neither practice (# PS sessions administered) nor supervision predicted changes over time. Moreover, mental health providers did not demonstrate better Relational Competence at baseline than non-mental health providers, and no differences in rates of change by discipline were found.

There are several possible explanations for these null findings. First, active listening and rapport are skills that enhance patient-provider relationships regardless of discipline and are not unique to mental health providers. There may also be a high proportion of clinicians who have better relational skills given that they are employed at competitive academic medical centers, and there are more opportunities for continuing education. Third, our supervision sessions systematically targeted proficiency in performing the steps of PS  (e.g., adequately Defining the Problem), with less emphasis

on improving relational variables (e.g., rapport) unless a problem emerged. Finally, the high proportion of variance at the session level suggested that other factors may have influenced these scores, such as the amount of time interventionists had to fit PS into their busy clinic that day, or the receptivity of the patient and family. Based on these results, future supervision efforts should incorporate process variables (e.g., rapport) more systematically into training and supervision to enhance integrity (Schoenwald et al., 2011). Active listening is a potential target to improve relational skills because the associated behaviors can be taught (e.g., reflecting, asking open-ended questions; Charon, 2001).

**Patient Receptivity**

Although researchers have acknowledged theoretical relationships between patient behavior and integrity (Foley et al., 1987; Patterson & Chamberlain 1994), very few studies have empirically examined the role of patient behaviors on providers' implementation of an intervention (Boswell et al, 2013; Imel et al., 2011). In this study, overt challenging adolescent and parent behaviors (e.g., criticizing, dismissiveness) were mild and infrequent, making it difficult to examine associations between these behaviors and providers' integrity. However, adolescent Engagement evidenced more variability and was coded more reliably (ICC = 0.82). Scores at the lower end of the scale represented resistance to the intervention, which is a milder form of "challenging behavior," and higher scores indicated participation and even enthusiasm about problem-solving. Importantly, it should be noted that the relationship between Engagement and Integrity is likely reciprocal: it may be easier to deliver an intervention and establish

rapport with an adolescent who appears interested and motivated. Similarly, a competent provider is able to more readily secure the patient's engagement.

The inclusion of Adolescent Engagement was integral for several reasons. First, it was the second strongest predictor of Treatment Fidelity (after Supervision). In addition, there was a trend indicating weaker associations between Engagement and Fidelity for mental health clinicians, suggesting they may be less derailed by patients' disinterest. The significant Engagement x Supervision interaction indicated that the Fidelity/Engagement relationship became stronger over the course of the intervention, across providers. It is possible that interventionists became burnt out and were more affected by teens' receptivity later in the study. Alternatively, this may have been an artifact of the CF Centers' recruitment strategy: perhaps more difficult patients were enrolled in the intervention later, once the more engaged and approachable patients had already been recruited.

Adolescent engagement was also significantly associated with both Technical and Relational Competence. Specifically, it predicted Technical Competence more strongly than practice, and was a comparable predictor to Supervision. Thus, personalized coaching and in-session patient behaviors contributed equally to competent delivery of this intervention. As mentioned, this association is likely to be reciprocal, with both adolescents and providers influencing one another's behavior. The addition of Engagement also revealed a stronger relationship between Supervision and Technical Competence than was found in prior models, and uncovered a previously non-significant association between Supervision and Relational Competence.

These findings have important implications for future research on treatment integrity, which is a dynamic construct that goes beyond the training and characteristics of the clinician. Variations associated with patient behaviors should not be treated as "noise," but as meaningful sources of information to better understand integrity across contexts. Without including measures of patient engagement or receptivity, studies may underestimate or otherwise distort the relationship between other predictors (e.g., supervision) and integrity. Based on these findings, measuring patient behaviors is critical to understanding how best to train providers to deliver interventions to less receptive or even apathetic patients.

Overall, these results strongly suggest that multidisciplinary teams can be trained to deliver behavioral adherence interventions, and that supervision and monitoring is necessary to support their skill development and improve implementation. A more sustainable approach to training could incorporate a train-the-trainer approach, in which multidisciplinary teams are trained by an "expert" in their own clinic. This study also highlighted the importance of assessing fidelity in the context of adolescent receptivity and engagement. Because interventions are not delivered in a vacuum, future studies should examine patients' receptivity so that a more complete picture of the provider-patient therapeutic process can be obtained.

**Limitations and Future Directions**

Despite this study's strengths, several limitations should be noted. First, to reduce dependencies in the data, only the first session with each new participant was taped; thus, supervision was not random or regularly-occurring, but was dependent upon clinic schedules. Supervision also was provided to all interventionists as a quality control effort

and thus, we lacked a control group who received no supervision. A control group would have allowed us to better isolate the effects of clinical supervision from practice alone. Additionally, causality could not be determined with these data. For example, fidelity was associated with adolescents' engagement, however, it was not clear whether "easier patients" increased therapists' fidelity or vice-versa. Finally, adolescents with CF who agreed to participate may not have been representative of the larger patient group. Those patients and parents who enrolled in this adherence intervention may have been more cooperative and open to changing their behavior; however, the use of gift cards to reward time and effort may have led to a more diverse group of participants.

In terms of measurement limitations, interrater reliability for some of the Relational Competence codes were below accepted cut-offs. Facilitating Teen Engagement should be broken into two components to enhance reliability: Encouraging Engagement (e.g., asking questions, enthusiasm) and Discouraging Engagement (e.g., lecturing, being monotone). Moreover, to increase feasibility, we used undergraduate and post-baccalaureate level coders. We may have found better reliability using Master's or doctoral level coders.

Another set of limitations arose because some information was not systematically collected. Numerous barriers interfered with both videotaping (e.g., teen refusal, insufficient time to set up camera, equipment malfunction) and supervision (e.g., provider unwillingness, insufficient time). Although we attempted to measure adolescents' and parents' challenging behaviors as an index of session difficulty, other session-specific variables could not be measured (e.g., whether a particular treatment or barrier was harder to problem-solve). Finally and importantly, mental health provider status was a

proxy variable for prior training in counseling skills and behavioral interventions. Some mental health providers (e.g., case management social workers) may have lacked such training, and some non-mental health providers may have had this type of training earlier in their careers. Future research should assess these skills more systematically to better understand how much training and supervision is needed to promote integrity for differing levels of experience. Finally, future research is needed to link integrity to patient outcomes, which would determine thresholds of integrity that are needed to affect behavior change.

Despite these limitations, this study has notable strengths and implications. It was one of the first studies to assess treatment integrity in an adherence intervention delivered by multidisciplinary teams. Data came from 18 CF clinics from diverse geographic regions across the United States, suggesting good generalizability to other medical centers. Additionally, the measures developed for this study can be used in both research and clinical settings to train providers to conduct PS sessions skillfully. We found that both practice and supervision are key components to enhancing providers' treatment integrity, and that patient engagement is strongly associated with implementation. Thus, it is possible to train multidisciplinary healthcare teams to deliver an adherence intervention successfully. Providing such training would give patients built-in access to an evidence-based adherence intervention as part of their specialty medical care, which can enhance their health and quality of life for years to come.

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**Table 1.** Inter-rater Reliability for the PS-Competence Scale

| Scale | ICC (absolute agreement) |
|---|---|
| *Technical Competence* | |
| Eliciting Treatment | 0.85 |
| Defining the Problem | 0.92 |
| Setting Ground Rules | 0.86 |
| Explaining Voting | 0.92 |
| Eliciting the Solution | 0.81 |
| Operationalizing Solution | 0.81 |
| *Technical Codes MEAN* | *0.86* |
| | |
| *Relational Competence* | |
| Active Listening | 0.64 |
| Facilitating Teen Engagement | 0.50 |
| Rapport/Warmth | 0.71 |
| Managing conflict (full sample) | 0.68 |
|     When coders agree on amount of teen conflict | 0.77 |
|     When coders disagree on amount of teen conflict | 0.62 |
| *Relational Codes MEAN* | *0.63* |
| | |
| *In-session patient factors* | |
| Teen Participation | 0.85 |
| Teen Engagement | 0.81 |
| Teen Challenging Behavior | 0.90 |
| Parent Challenging Behavior | 0.67 |
| | |
| *Other codes (not used in multilevel models)* | |
| Mean BI Solution Quality | 0.66 |
| Quality Chosen Solution | 0.84 |
| Quality of PS | 0.79 |

**Table 2**. Interventionist Characteristics. No significant differences between mental health and non-mental health providers in time since in-person training, N BI's with >3 supervision sessions, # supervision sessions over the course of the study, # tapes sent, or # PS sessions.

| | Entire Sample | | | | Mental Health Providers | | | Non-Mental Health Providers | |
|---|---|---|---|---|---|---|---|---|---|
| | *Mean* | *SD* | *Median* | *N* | *Mean* | *SD* | *N* | *Mean* | *SD* |
| **Baseline: Time since in-person training (days)** | 164.27 | 107.96 | 144.00 | 24 | 183.58 | 109.60 | 24 | 144.96 | 103.11 |
| **Baseline Fidelity (Max = 30)** | 17.00 | 4.61 | 17.00 | 24 | 18.08 | 4.61 | 24 | 15.92 | 4.43 |
| **Baseline Technical Competence Factor score** | -0.21 | 0.39 | -0.27 | 24 | -0.06 | 0.41 | 24 | -0.35 | 0.32 |
| **Baseline Relational Competence Factor score** | -0.16 | 0.64 | -0.15 | 24 | -0.07 | 0.14 | 24 | -0.26 | 0.13 |
| **N BIs with >3 supervisions over the course of the study** | n/a | n/a | n/a | 13 | n/a | n/a | 9 | n/a | n/a |
| **# Supervision sessions over the course of the study** | 3.88 | 3.02 | 3.00 | 24 | 4.50 | 3.22 | 24 | 3.25 | 2.74 |
| **# Tapes sent over the course of the study** | 6.83 | 7.04 | 4.50 | 24 | 8.54 | 7.49 | 24 | 5.13 | 6.26 |
| **# PS sessions conducted** | 17.06 | 23.48 | 7.50 | 24 | 22.33 | 28.07 | 24 | 11.79 | 16.74 |

**Table 3.** Most and Least difficult PS Steps at Baseline (Fidelity), based on frequency of implementation

| Step | N performing this step (of 48 BIs) | % |
|---|---|---|
| *Least difficult* | | |
| Refer to teen's form (Treatments and Barriers) | 46 | 95.83 |
| Explain brainstorming | 43 | 89.58 |
| Narrow possible solutions to those with all "+" votes | 41 | 85.42 |
| Define the problem: what gets in the way? | 39 | 81.25 |
| Solutions brief with little explanation | 39 | 81.25 |
| Allow the adolescent to choose which treatment to problem-solve | 37 | 77.08 |
| *Most difficult* | | |
| Defining the problem: where does the problem occur? | 11 | 22.92 |
| Operationalizing the solution: when will you start? | 11 | 22.92 |
| Operationalizing the solution: where will the solution occur, where will you keep the necessary supplies (i.e., pills)? | 11 | 22.92 |
| Defining the problem: who is involved (e.g., does anyone help you with your treatment?) | 13 | 27.08 |
| Operationalizing the solution: when will your solution fit into your schedule? | 14 | 29.17 |
| Operationalizing the solution: will anyone help you implement your solution? | 18 | 37.50 |

**Table 4.** PS Comp performance at baseline (1 = Poor; 2 = Fair; 3 = Adequate/Good; 4 = Excellent)

| | Mean | Median | SD |
|---|---|---|---|
| *Technical Competence* | | | |
| Eliciting Solution from Teen | 3.41 | 4 | 1.05 |
| Eliciting Treatment from Teen | 2.70 | 2 | 1.13 |
| Setting the Ground Rules | 2.57 | 3 | 0.97 |
| Operationalizing the Solution | 2.17 | 2 | 1.06 |
| Explaining Voting | 2.09 | 2 | 0.96 |
| Defining the Problem | 2.04 | 2 | 0.96 |
| | | | |
| *Relational Competence* | | | |
| Active Listening | 3.14 | 3 | 0.88 |
| Rapport/Warmth | 2.76 | 3 | 0.83 |
| Managing Conflict (if present; n = 39) | 2.67 | 3 | 1.11 |
| Facilitating Teen Engagement | 2.64 | 3 | 0.94 |
| | | | |
| *Other variables* | | | |
| Teen Participation | 3.07 | 3 | 0.81 |
| Teen Engagement | 2.87 | 3 | 0.84 |
| Parent Challenging behavior (Max = 5) | 1.28 | 1 | 1.09 |
| Teen Challenging behavior (Max = 5) | 0.93 | 1 | 1.01 |
| | | | |
| Quality of Session | 2.32 | 2 | 0.84 |

**Table 5.** Factor Structure of the PS-Comp

| | Standardized Estimate | SE |
|---|---|---|
| *Technical Competence* | | |
| Defining the Problem | 0.44 | 0.00 |
| Eliciting Treatment [a] | 0.32° | 0.38 |
| Setting Ground Rules [a] | 0.32* | 0.38 |
| Explaining Voting | 0.51° | 0.51 |
| Eliciting Solution [a] | 0.32° | 0.38 |
| Operationalizing the Solution | 0.86** | 0.68 |
| *Relational Competence* | | |
| Rapport/Warmth | 0.79 | 0.00 |
| Active Listening | 0.80*** | 0.15 |
| Managing Conflict [b] | 0.79*** | 0.14 |
| Facilitating Teen Engagement [b] | 0.79*** | 0.14 |

[a] loadings constrained equal to prevent Setting Ground Rules from driving the factor
[b] loadings constrained equal to prevent Managing Conflict from driving the factor
   °$p < 0.06$
   *$p < 0.05$
  **$p < 0.01$
 ***$p < 0.001$

**Table 6.** Associations between level-1 session variables (B, nested within individuals)

*Outcome Variable*

| Predictor | Fidelity | Technical Competence | Relational Competence | Quality of Chosen Solution | # PS | # Supervision |
|---|---|---|---|---|---|---|
| # Supervision sessions | 0.15*** (SE = .03) | 0.07*** (SE = .02) | 0.06 | | 0.18*** | |
| # PS sessions conducted | 0.03* (SE = .01) | 0.02*** (SE = .005) | 0.01 | | | 0.14*** |
| Time since training (days) | 0.002*** | 0.001* | 0.00 | | | |
| Time since last supervision | 0.00 | -0.002* | 0.00 | | | |
| Teen Participation | 0.18* | 0.07* | 0.17*** | | | |
| Teen Engagement | 0.09 | 0.05 | 0.20*** | | | |
| Teen Challenging Behavior | 0.05 | -0.02 | -0.02 | | | |
| Overall In-Session Conflict | 0.01 | -0.01 | -0.02 | | | |
| Quality of Chosen Solution | 0.12, p = .08 | 0.14*** (SE = .02) | 0.15*** (SE = .04) | | | |
| Fidelity | -- | 0.13*** | 0.19*** | 0.16* | | |
| Technical Competence | 0.96*** | -- | 1.15*** | 1.04*** | | |
| Relational Competence | 0.51*** | 0.47*** | -- | 0.50*** | | |
| Quality of PS Session | 0.41*** | 0.34*** | 0.50*** | 0.50*** | | |

*p < 0.05
**p < 0.01
***p < 0.001

**Table 7.** Model coefficients for changes in Treatment Fidelity (z-scores) over time

| Fixed Effects | Coefficient | Standard error | t-ratio | d.f. | p-value |
|---|---|---|---|---|---|
| Intercept, $\pi_0$ | | | | | |
|   Baseline Fidelity, $\beta_{00}$ | -0.14 | 0.17 | -0.80 | 46 | 0.43 |
|   MH Provider, $\beta_{01}$ | 0.59 | 0.24 | 2.50 | 46 | **0.02** |
| Linear Slope for # supervisions, $\pi_1$ | | | | | |
|   Supervision, $\beta_{10}$ | 0.48 | 0.10 | 4.77 | 267 | **<0.001** |
|   MH Provider, $\beta_{11}$ | -0.31 | 0.12 | -2.68 | 267 | **<.01** |
| Quadratic slope for # supervisions, $\pi_2$ | | | | | |
|   Supervision, $\beta_{20}$ | -0.05 | 0.01 | -4.55 | 267 | **<0.001** |
|   MH Provider, $\beta_{21}$ | 0.04 | 0.01 | 3.26 | 267 | **0.001** |
| Linear Slope for # PS Sessions, $\pi_3$ | | | | | |
|   PS Sessions, $\beta_{30}$ | 0.01 | 0.01 | 0.09 | 267 | 0.93 |
|   MH Provider, $\beta_{31}$ | 0.00 | 0.01 | 0.03 | 267 | 0.97 |

| Random Effects | Variance Component | SD | $\chi^2$ | d.f. | p-value |
|---|---|---|---|---|---|
| Baseline Fidelity (intercept), $r_0$ | 0.39 | 0.62 | 270.00 | 46 | **<0.001** |
| level-1, $e$ | 0.48 | 0.69 | - | - | - |

**Table 8.** Model Coefficients for Technical Competence (factor score) Trajectories. Level-1 predictors are # PS sessions and # Supervision Sessions in Models A and B, respectively.

| *Model A Fixed Effects* | *Coefficient* | *SE* | *t-ratio* | *d.f.* | *p-value* |
|---|---|---|---|---|---|
| Intercept, $\pi_0$ | | | | | |
| Baseline Competence, $\beta_{00}$ | -0.34 | 0.07 | -4.73 | 45 | <0.001 |
| MH Provider, $\beta_{01}$ | 0.29 | 0.10 | 2.86 | 45 | **<0.01** |
| Slope for # PS sessions, $\pi_1$ | | | | | |
| PS Sessions, $\beta_{10}$ | 0.02 | 0.01 | 3.36 | 121 | **0.001** |
| MH Provider, $\beta_{11}$ | -0.01 | 0.01 | -1.16 | 121 | 0.25 |

| *Model A Random Effects* | *Variance Component* | *SD* | $\chi^2$ | *d.f.* | *p-value* |
|---|---|---|---|---|---|
| Baseline Competence (intercept) $r_0$ | 0.06 | 0.24 | 147.97 | 45 | **<0.001** |
| level-1, $e$ | 0.08 | 0.29 | - | - | - |

| *Model B: Fixed Effects* | *Coefficient* | *SE* | *t-ratio* | *d.f.* | *p-value* |
|---|---|---|---|---|---|
| Intercept, $\pi_0$ | | | | | |
| Baseline Competence, $\beta_{00}$ | -0.34 | 0.07 | -4.64 | 45.00 | <0.001 |
| MH Provider, $\beta_{01}$ | 0.29 | 0.10 | 2.98 | 45.00 | **0.005** |
| Slope for # Supervision sessions, $\pi_1$ | | | | | |
| Supervision Sessions, $\beta_{10}$ | 0.10 | 0.03 | 3.21 | 121.00 | **0.002** |
| MH Provider, $\beta_{11}$ | -0.06 | 0.04 | -1.35 | 121.00 | 0.18 |

| *Model B Random Effects* | *Variance Component* | *SD* | $\chi^2$ | *d.f.* | *p-value* |
|---|---|---|---|---|---|
| Baseline Competence (intercept) $r_0$ | 0.06 | 0.24 | 158.14 | 45 | **<0.001** |
| level-1, $e$ | 0.08 | 0.28 | - | - | - |

**Table 9.** Model Coefficients for Relational Competence (factor score) Trajectories. Level-1 predictors are # PS sessions and # Supervision Sessions in Models A and B, respectively.

| *Model A Fixed Effects* | *Coefficient* | *SE* | *t-ratio* | *d.f.* | *p-value* |
|---|---|---|---|---|---|
| Intercept, $\pi_0$ | | | | | |
| Baseline Competence, $\beta_{00}$ | -0.23 | 0.11 | -2.00 | 45 | 0.051 |
| MH Provider, $\beta_{01}$ | 0.06 | 0.16 | 0.40 | 45 | 0.689 |
| Slope for # PS sessions, $\pi_1$ | | | | | |
| PS Sessions, $\beta_{10}$ | 0.01 | 0.01 | 0.81 | 45 | 0.42 |
| MH Provider, $\beta_{11}$ | 0.00 | 0.02 | 0.18 | 45 | 0.861 |

| *Model A Random Effects* | *Variance Component* | *SD* | $\chi^2$ | *d.f.* | *p-value* |
|---|---|---|---|---|---|
| Baseline Competence (intercept) $r_0$ | 0.12 | 0.35 | 66.37 | 33 | <0.001 |
| level-1, $e$ | 0.23 | 0.48 | - | - | - |

| *Model B Fixed Effects* | *Coefficient* | *SE* | *t-ratio* | *d.f.* | *p-value* |
|---|---|---|---|---|---|
| Intercept, $\pi_0$ | | | | | |
| Baseline Competence, $\beta_{00}$ | -0.23 | 0.12 | -1.86 | 45 | 0.07 |
| MH Provider, $\beta_{01}$ | 0.05 | 0.17 | 0.30 | 45 | 0.76 |
| Slope for # Supervision sessions, $\pi_1$ | | | | | |
| Supervision Sessions, $\beta_{10}$ | 0.05 | 0.06 | 0.75 | 45 | 0.46 |
| MH Provider, $\beta_{11}$ | 0.03 | 0.08 | 0.39 | 45 | 0.70 |

| *Model B Random Effects* | *Variance Component* | *SD* | $\chi^2$ | *d.f.* | *p-value* |
|---|---|---|---|---|---|
| Baseline Competence (intercept) $r_0$ | 0.17 | 0.42 | 76.66 | 31 | 0.000 |
| level-1, $e$ | 0.21 | 0.46 | - | - | - |

**Table 10.** Contribution of Teen Engagement as a Predictor in Models from Aims 2 and 3

| Changes to model results | Teen Engagement added alone | Teen Engagement and Interaction Term added |
|---|---|---|
| **Fidelity (Table 7)** | | |
| *Strength of Teen Engagement as a predictor* | $2^{nd}$ strongest predictor ($B = 0.41$, $p < .01$) after # Supervisions ($B = 1.36$, $p < .001$) | Significant, positive Supervision X Engagement interaction term ($B = 0.13$, $p < .05$) |
| *Effect on other predictors* | Amplified relationship between Supervision and Fidelity ($B = 0.48 \rightarrow 1.36$, $p < .001$) | |
| *MH vs. non-MHP* | Trend: MH providers showed a weaker relationship between Teen Engagement and Fidelity ($p = .07$) | |
| **Technical Competence (Table 8)** | | |
| *Strength of Teen Engagement as a predictor* | Stronger predictor than # PS; comparable to # Supervisions (B's = 0.14 and 0.15, $p$'s $< .01$) | Interaction *n.s.* |
| *Effect on other predictors* | Amplified relationship between # Supervisions and Technical Competence ($B = 0.10 \rightarrow 0.14$, $p < .001$) | |
| *MH vs. non-MHP* | Trend: MH providers showed weaker relationship between Engagement and Technical Competence ($p = .09$) | |
| **Relational Competence (Table 9)** | | |
| *Strength of Teen Engagement as a predictor* | Only significant predictor when controlling for # PS ($B = 0.26$, $p < .01$)<br><br>Strongest predictor when including # Supervision ($B = 0.29$, $p < .001$) | Interaction *n.s.* |
| *Effect on other predictors* | Revealed previously n.s. association between # Supervisions and Relational Competence ($B = .11$, $p < .05$) | |
| *MH vs. non-MHP* | No differences | |

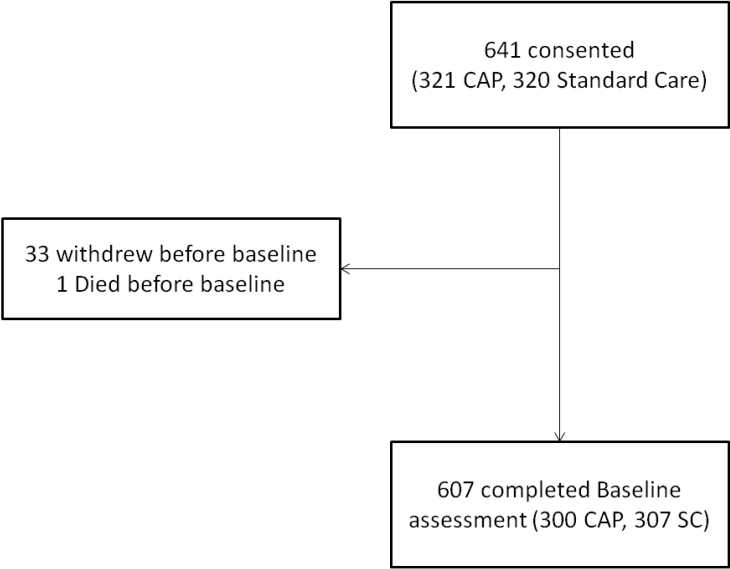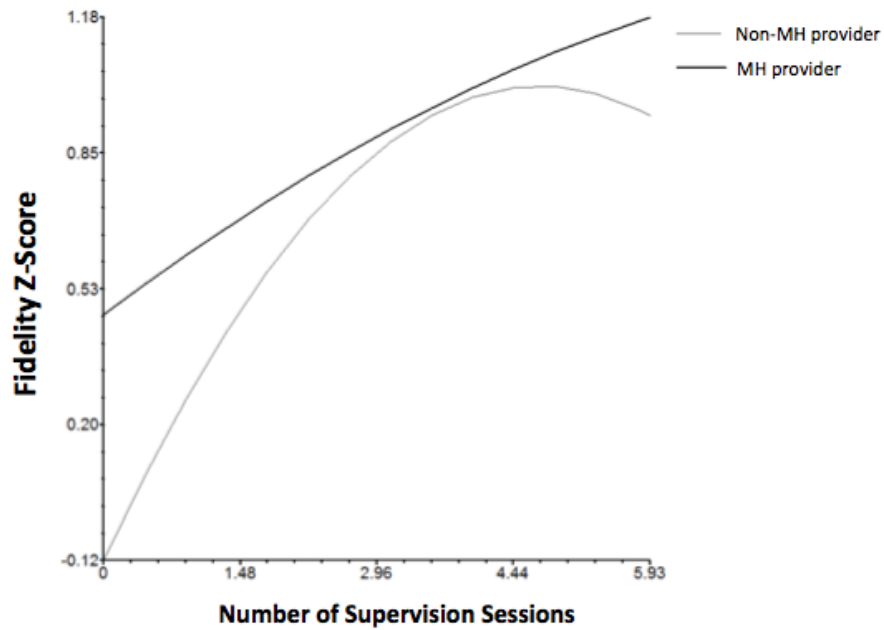Figure 1. Consort Diagram of Adolescent Patients

**Figure 2. Longitudinal Trajectory of Fidelity Z-Scores, controlling for number of PS sessions.** Coefficients shown in Table 7.

Appendix A: Treatment Fidelity Rating Scale (TFRS)

**ID #:** _____ **Date of Session:** _____
**Behavioral interventionist:** _____
**Behavioral interventionist discipline:** _____
**People participating: Parent(s) □   Sibling □   Friend □   HCP □   Other □:** _____
**Supervisor**: _____**Date of Supervision:** _____
**Method of feedback** (ex. Phone, written, individual, group):_____
**Start Time**: _____       **Stop Time**: _____

| | **Problem-Solving Steps** | **Yes** | **No** |
|---|---|---|---|
| **Self-reported adherence and barriers** | | | |
| 1. | Adolescent completes form independently [a] | 1 | 0 |
| 2. | BI refers to form | 1 | 0 |
| 3. | BI provides praise | 1 | 0 |
| 4. | BI asks open-ended question to elicit problem from teen without providing suggestions ("what do you want to work on?") | 1 | 0 |
| 5. | Adolescent selects treatment | 1 | 0 |
| 6. | Adolescent selects barrier ("what gets in the way?") | 1 | 0 |
| **Define the problem** ("last time this barrier happened…") | | | |
| 7. | Who? | 1 | 0 |
| 8. | What happened? (Describe treatment & barrier) | 1 | 0 |
| 9. | When? | 1 | 0 |
| 10. | Where? | 1 | 0 |
| **Set the ground rules** | | | |
| 11. | Explains brainstorming process | 1 | 0 |
| 12. | States no judgments or evaluations | 1 | 0 |
| 13. | Explains voting | 1 | 0 |

[a] *Item dropped from the final measure due to inconsistent capture on camera*

[b] *Item dropped due to redundancy with PS-Comp*

Appendix A: Treatment Fidelity Rating Scale (TFRS)

| Problem-Solving Steps, continued | | Yes | No |
|---|---|---|---|
| **Brainstorming** | | | |
| 14. | Teen writes on sticky notes | 1 | 0 |
| 15. | Starts with teen | 1 | 0 |
| 16. | Goes in order (teen, parent, BI) | 1 | 0 |
| 17. | Generates 8 or more solutions | 1 | 0 |
| 18. | Facilitates teen's brainstorming (give a point if not needed) | 1 | 0 |
| 19. | Redirects criticism/evaluations at least once (Include active ignoring; give a point if not needed) [b] | 1 | 0 |
| 20. | Solutions brief with little explanation (BI cuts off rambling if needed) | 1 | 0 |
| **Voting** | | | |
| 21. | Re-explains voting process ("+" for something you are "willing to try," "-" to veto) | 1 | 0 |
| 22. | Teen records votes | 1 | 0 |
| 23. | Starts with teen | 1 | 0 |
| 24. | Goes in order (teen, parent, BI) | 1 | 0 |
| 25. | Redirects criticism/evaluations (give a point if not needed) [b] | 1 | 0 |
| 26. | Identifies solutions that receive all '+'s | 1 | 0 |
| 27. | Directs teen to select 1 solution | 1 | 0 |
| 28. | Uses clinical judgment if teen wants to combine solutions (give a point if not needed) | 1 | 0 |
| **Operationalize solution** | | | |
| 29. | Who? | 1 | 0 |
| 30. | What? | 1 | 0 |
| 31. | When will you start using the solution? | 1 | 0 |
| 32. | When will the solution occur (in your day/schedule)? | 1 | 0 |
| 33. | Where? | 1 | 0 |
| 34. | Explains follow-up phone call [a] | 1 | 0 |
| 35. | Writes solution on PTP [a] | 1 | 0 |

# iCARE Problem Solving Competence (PS-Comp)
# Coding Manual
Revised AA 8/27/2013

Important Abbreviations:
BI = Behavioral Interventionist
\* = not included in BI's competence score

I.     Introduction (adolescent selects treatment and barrier)

*Eliciting Treatment*: BI effectively elicits the treatment from the adolescent; asks open-ended question ("what do you want to work on") without leading the teen; provides assistance to help the teen decide (if necessary). Providing examples of *specific treatments* that are going well (or poorly) is considered leading, and can receive a *maximum* score of a "3."

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| Any of the following: BI does not ask the teen to choose a treatment; Allows the parent to choose a treatment; Chooses a treatment for the teen | Asks 1-2 leading questions or asks the teen to choose from a limited set of treatments | Asks 1 subtle leading question (e.g., it looks like airway clearance is going well… what would you like to work on?") but it seems like the teen made the final choice | BI asks an open-ended question; teen chooses treatment |

II.     Defining the Problem

*Eliciting Problem Description – How clearly was the problem defined?*: BI effectively elicits information about the barrier from the teen. BI asks enough questions about the barrier to create a mental picture of what is happening. Not all questions will be relevant for all teens, but BI asks targeted questions (generally: *what* the barrier is, *who* is involved, *where* the medication/equipment is kept or performed, *when* treatment is performed). If the barrier is "can't find the time," BI should also get information about the teen's daily schedule and activities. BI should ask for clarification when something is

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unclear. Open-ended questions are used appropriately (e.g., "what do you do after school?" vs. "do you do your treatments right after school?")

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| BI makes no attempt to define the problem OR lacks critical information; earns a "2" but asks too many leading Qs | BI asks some (1-2) questions but lacks some important information; earns a "3" but asks too many leading Qs | BI asks some (2-3) questions about the barrier *and* obtains enough information to generate some solutions; earns a "4" but asks too many leading Qs | BI asks nearly all relevant questions (who, what, when, where) |

III.     Setting the Ground Rules

**Sets the Ground Rules: "no judgments"** – BI clearly explains we will **not judge or evaluate the ideas** (\*\*saying "there are no bad ideas" or "any idea is a good idea" is not clear enough on its own, because it is only implied—not stated—that we will not judge/evaluate the solutions), and we will all get to **vote** later

⏰ ⊖   Subtract 1 point if the BI explains this at the wrong time (should be after defining the problem and before brainstorming)

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| BI fails to mention both "no judgments" *and* voting (or provides a "2" explanation at the wrong time) | BI implies but does not clearly state the "no judgments rule" OR mentions voting, but not both (or provides a "3" explanation at the wrong time) | BI implies but does not clearly state the "no judgments" rule and mentions voting, OR explicitly states "no judgments" but doesn't mention voting (or provides a "3" explanation at the wrong time) | BI clearly explains that we will not judge/evaluate any of the ideas, and everyone will vote later; correct timing |

IV.     Brainstorming

**\*Quality of BI's proposed solutions**. Good solutions are: 1) tailored to the barrier, 2) realistic/feasible (high potential to work), and 3) consistent with the teen's priorities. Feasibility is only factored into the scores of '3' and '4.' Tailored barriers: For "forgetting," solutions could include reminders/alarms/cues. For "can't find the time,"

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solutions could focus on changing the time of day, re-arranging the teen's schedule, combining treatment with something else, or trying a treatment that takes less time. For "I'm embarrassed," solutions could include being more secretive/sneaky, explaining CF to friends, or coming up with a cover story. *Humorous solutions should not hurt or enhance the BI's score.*

**777 = funny solution** = solution that was intended to lighten the mood or be playful (regardless of how the other people in the room respond to it)

⊖ Subtract 1 point if *one or more* of the BI's solutions is not consistent with the teen's priorities (e.g., if soccer is important to the teen, "skip soccer" is not consistent with his or her priorities!)

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent | N/A *use sparingly* |
|---|---|---|---|---|
| Solution is poorly matched to the barrier (e.g., rewards for "can't find the time") | Solution is moderately related to the barrier | Solution is highly tailored to barrier, but has limited feasibility (e.g., high potential for error) | Solution is highly tailored to barrier, and is feasible | BI made no attempt to define the problem; cannot judge appropriateness of solutions |

## V.  Voting

*Effective Communication- explains voting*: BI clearly explains voting in a way the teen can understand. A highly effective BI explains what a "+" and "−" mean (not just "give each solution a plus or minus," but "give a plus for something you are willing to try and a minus for something you are not willing to try").

*If the BI uses language from both the "3"and the "4" box, rate the BI for whichever concept was emphasized ("good idea" or "willing to try")

⏰ ⊖ Subtract 1 point if the BI explains voting at the wrong time (should be after brainstorming and before voting begins)

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| Does not explain voting OR provides a "2" explanation at the wrong time | Says, "now we'll give each solution a plus or minus" without elaborating OR provides a "3" explanation at the wrong time | + = "good idea" or "an idea you like," - = "bad idea" or "if you don't like it" OR provides a "4" explanation at the wrong time | + = willing to try - = not willing to try (or veto) |

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## VI. Operationalizing the Solution

**A.** **Eliciting Solution** from Teen – *How much was this truly the teen's decision?*
BI effectively elicits the solution from the adolescent; asks open-ended question ("what do you want to try") without leading the teen; provides assistance to help the teen decide (if necessary; e.g., what are your top 3? Which ones do you not want to try?). If BI's assistance could be considered leading, score no higher than a "3."

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| Any of the following: BI does not ask the teen to choose a solution; Allows the parent to choose a solution; Chooses a solution for the teen | Asks 1-2 leading questions, or asks the teen to choose from a limited set of solutions | Asks 1 subtle leading question (e.g., it looks like reminders are a good option… what would you like to try?") but it seems like the teen made the final choice | BI asks an open-ended question; teen chooses solution and it is truly the teen's choice |

**B.** **Eliciting Info – How clearly was the solution operationalized?**: BI asks enough questions about the solution to create a *clear mental picture* of what will happen, increase the *odds of success*, and to prevent future disagreements between parent and teen. Not all questions will be relevant for all teens, but BI asks relevant questions (generally: *what* is the solution, *who* will help (ask "do you want any help/reminders?" or "who will buy the pill box?"), *where* the treatment will be kept or performed, *when* treatment will fit into the teen's schedule).

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| Not attempted or leaves out critical information | Some plan developed; leaves out some info that would have significantly improved the odds of success | Mostly clear plan developed; leaves out information that could slightly improve the odds of success | Clear plan developed; everyone on board about who, what, when, and where |

**C.** **\*Quality of Chosen Solution**: *Regardless of what other solutions were generated in the session*, is the chosen solution tailored to the barrier, realistic/feasible, and consistent with the teen's priorities?
(Think about this relative to the full universe of possible solutions they could have generated)

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*Given that the teen chooses the final solution to try, this scale will not be included in the BI's competence score

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| Solution and barrier are a poor fit (e.g., rewards for "can't find the time") | Solution and barrier are moderately related | Solution and barrier are highly related; other solutions may be more practical or feasible | Solution and barrier are highly related AND solution seems feasible for teen's life/preferences |

## RELATIONAL COMPETENCE

***Quality of overall PS process***: How competently was the session delivered overall, including completion of major PS steps, and making the session collaborative and engaging? Hint: think about how much the session captured the "spirit" of iCARE

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| BI completes *few* major PS steps and/or behaves in critical/judgmental manner | BI completes *some* major PS steps; session is not engaging | BI completes *most* major PS steps appropriately | BI completes *all* major PS steps appropriately; session is somewhat engaging |

*Active listening:*  BI actively listens to the teen. This includes nonverbal (e.g., nodding, looking at the teen when teen is speaking) and verbal signs of listening (reflecting—e.g., "so, you said that the barrier is forgetting"). BI asks for more information whenever needed, remembers what the teen says, and uses information about what has been said previously

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| Disregards or forgets information teen/parent said; Active listening evident less than 25% of the time (including poor listening during some crucial moments) | Few signs of active listening; Active listening evident 25-50% of the time (including poor listening during a few crucial moments) | BI shows some signs of active listening; Active listening evident 50-75% of the time (including good listening during many of the crucial moments) | BI shows good verbal and nonverbal signs of listening; remembers what teen says; Active listening evident more than 75% of the time (including good |

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| | | | listening during most or all crucial moments) |
|---|---|---|---|
| | | | |

*Facilitating Teen Engagement***:** BI keeps own speech clear and focused *without tangents* or lectures (NO over-explaining or lecturing!). BI makes an effort to keep the teen engaged and motivated, is *enthusiastic*, and helps teen if he/she is stuck during brainstorming or voting (e.g., "is there someone who can help you?" "could you do it at a different time of day?"). BI gives the teen little opportunity to zone out.

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| Overt occurrences of over-explaining or lecturing; and/or BI makes an effort to engage teen less than 25% of the time (poor effort to engage during some crucial moments) | Subtle occurrences of over-explaining or lecturing; and/or BI goes on minor tangent(s); makes an effort to engage teen 25-50% of the time (poor effort to engage during a few crucial moments) | Keeps own speech clear without tangents or lectures; makes an effort to engage teen 50-75% of the time (good effort to engage during some crucial moments) | Keeps own speech clear and focused without tangents or lectures; makes an effort to engage teen more than 75% of the time; helps the teen whenever necessary (good effort to engage during most crucial moments) |

*Rapport/Warmth toward teen*: BI acts in a warm, supportive manner toward the teen, maintains a nonjudgmental approach, and does not make assumptions about the teen's schedule or priorities. BI may validate the teen's difficulties ("we know you have a lot of treatments") and recognize the teen's efforts. In voting, BI may choose to side with the teen ("if you don't like it, I'll give it a minus") or recognize the teen's priorities ("you said soccer is really important to you, so I don't think you should skip soccer to do your treatments"). Nonjudgmental can be verbal or nonverbal (e.g., keeping a straight face when the teen describes poor adherence). Praise is appropriate and genuine.
**\*note**: can account for teen's response to BI's behavior (consider whether the teen appears offended by the BI's behavior/language, and whether this has an impact on their relationship during the session)

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| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| Rarely behaves in a warm, supportive manner (praise, warmth, and/or nonjudgmental behavior evident for little of the session) | Occasionally behaves in a warm, supportive manner (praise, warmth, and/or nonjudgmental behavior evident for some of the session) | Behaves in a warm, supportive manner when relevant for much of the session (praise, warmth, and/or non-judgmental behavior evident during *some* crucial moments) | *Consistently* behaves in a genuinely warm, supportive manner for the vast majority of the session (praise, warmth, and/or non-judgmental behavior evident during *most* crucial moments) |

*Managing Conflict*: BI exercises good judgment about handling conflict from both the parent and teen. BI redirects (some *subtle* conflicts, like scoffing from a parent, can be ignored if they only happen once or twice, but should otherwise be addressed). If parent attempts to influence the teen's decision during treatment selection or solution selection, BI reminds the parent that the teen gets to choose. Conflict may occur during brainstorming (e.g., evaluating a solution, saying a solution won't work), voting (e.g., providing extended explanations of why a solution got a "minus" vote), and other times.

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent | N/A – no conflict observed *use sparingly |
|---|---|---|---|---|
| BI makes no attempt to redirect conflict during crucial moments; misses many opportunities to redirect | BI makes some attempt(s) to redirect conflict but misses a few *important** opportunities to do so | BI makes some attempt(s) to redirect conflict, but misses a 1-2 *minor** opportunities to do so | BI exercises excellent judgment when redirecting or actively ignoring conflict | Teen and parent are highly cooperative; no one evaluates any ideas during voting or attempts to influence the teen's decision |

*important = addressing conflict in this moment reduces the likelihood of future conflict
*minor = addressing conflict in this moment does not reduce the likelihood of future conflict

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**Individual Codes** (these are not part of the BI's "competence" score)

**\*Teen Participation (On-Task Behavior):** Teen is on-task (e.g., listening, paying attention, writing solution ideas, offering his/her perspective). A highly participatory teen asks questions and clarifies his/her own statements without being prompted.

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| Withdrawn; disinterested; occasionally refuses to respond. Participates less than 25% of the time. | Participates only when asked; inattentive or off-task at times; may be apathetic. Participates 25-50% of the session. | Generally involved and on-task; follows others' lead. Participates 25-75% of the session. | Takes the lead, responds to most of what is said; initiates. Participates more than 75% of the session. |

**\*Teen Engagement:** Nonverbal signs of engagement and enthusiasm include smiling, nodding, and other expressions of excitement. Verbal signs of enthusiasm include praising others' ideas, saying "yeah!" or "cool!"

| 1 – Poor | 2 – Fair | 3 – Adequate/Good | 4 – Excellent |
|---|---|---|---|
| Teen expresses verbal or nonverbal disinterest in the PS process; e.g., teen may say "I don't care" or shrug often | Teen does not express enthusiasm or resistance; may seem ambivalent or apathetic | Teen is appropriately enthusiastic about PS | Teen seems excited about PS and about his/her chosen solution |

**\*Teen Challenging Behavior**: includes hostility, criticism, negative affect, accusing, complaining, harsh tone, resistance, agitation, restlessness, and sighing. During brainstorming, challenging behavior includes dismissing or evaluating another person's idea. During voting, challenging behavior includes making negative comments about the solutions.
- Indecision choosing a solution does *not* count as challenging behavior unless done with negative tone.
- Improving upon someone elses idea collaboratively (without negative tone) is *not* challenging behavior …that is the point of brainstorming!

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Mild intensity: sighing, eye-rolling, dismissing another's idea mildly.
Moderate intensity: dismissing another's idea with some negativity, implied criticism
(e.g., "I don't think you'll actually wake up early" with a tone).
High intensity: shouting, mocking or insulting another person, accusing, harshly
rejecting.

| 0<br>Very<br>receptive | 1<br>Slight<br>difficulty | 2<br>Moderate<br>difficulty | 3<br>Very difficult;<br>poor<br>receptivity | 4<br>Extremely<br>difficult |
|---|---|---|---|---|
| No difficulties | Slight challenging behavior is present. Frequency: **infrequent** (3 or fewer instances) Intensity: **mild** | Occasional (approx. **4-5**) displays of mildly challenging behavior, Or a few (**1-3**) displays of moderately challenging behavior | Occasional (approx. **4-5**) displays of moderately challenging behavior | Frequent (6 or more) displays of moderately challenging behavior or one very intense bout of hostility (e.g., burst of name calling) |

**\*Parent/Caregiver Challenging Behavior**: Behaviors or comments that could
undermine the effectiveness of the intervention: includes hostility, criticism, negative
affect, accusing, complaining, harsh tone, resistance, agitation, restlessness, and sighing.
During brainstorming, challenging behavior includes dismissing or evaluating another
person's idea. During voting, challenging behavior includes making negative comments
about the solutions.
- Parents who are mildly intrusive (butting in, offering many comments or suggestions to
the point that the teen is overshadowed) should receive a "1;" Moderately intrusive
parents that take BI time/attention away from the teen should receive a score of "2."
If more than one parent/caregiver is present, rate each separately.

| 0<br>Very<br>receptive | 1<br>Slight<br>difficulty | 2<br>Moderate<br>difficulty | 3<br>Very difficult;<br>poor<br>receptivity | 4<br>Extremely<br>difficult |
|---|---|---|---|---|
| No difficulties | Slight challenging behavior is | Occasional (approx. **4-5**) displays of | Occasional (approx. **4-5**) displays of | Frequent (6 or more) displays of moderately |

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| | present. Frequency: **infrequent** (3 or fewer instances) Intensity: **mild** | mildly challenging behavior, Or a few (approx. **1-3)** displays of moderately challenging behavior | moderately challenging behavior | challenging behavior or one very intense bout of hostility (e.g., burst of name calling) |
|---|---|---|---|---|