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ORIGINAL ARTICLE

Practical Functional Assessment and Behavioral Treatment of Challenging Behavior for Clinically Based Outpatient Services: A Consecutive Case Series Evaluation

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Abstract Behavioral assessment allows a clinician to identify environmental events that are contributing to challenging behavior to inform effective treatment. Recent developments in behavioral assessment and treatment have been devoted to creating practical procedures that can be conducted by clinicians in socially relevant settings. However, the extent to which these procedural modifications affect treatment outcomes has yet to be fully explored. We conducted a consecutive case series with 13 individuals admitted to an outpatient program to address their challenging behavior. The patients experienced a behavioral package conducted in three phases (practical functional assessment [PFA], behavioral treatment, extension). Results demonstrated near elimination of challenging behavior for all patients after extending the treatment to include denials to reinforcement and instructions to complete other tasks.

Keywords Autism spectrum disorder · Behavioral assessment · Behavioral treatment · Challenging behavior · Outpatient program

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Challenging behavior is behavior of clinical relevance that often negatively affects the education and future development of the individual exhibiting said behavior (Hagopian et al., 2013). Challenging behavior can include topographies such as extended tantrums or negative vocalizations and even more severe topographies that are physically harmful to oneself or others. In addition, challenging behavior can develop to the point of needing costly, specialized treatment for those diagnosed with developmental disabilities (Matson et al., 2010), in particular those with autism spectrum disorder (ASD; Jang et al., 2011; Murphy et al., 2009). In fact, individuals with ASD who engage in challenging behavior such as aggression or self-injury are more likely to be admitted to psychiatric hospitals (Mandell, 2008), which can place additional stress on the individual as well as their caregivers. To improve the quality of life of the entire family, parents tend to seek help from professionals in treating challenging behaviors before requiring the need of such specialized and costly inpatient care.

Many behavioral treatments for reducing challenging behaviors currently exist; however, the

entire assessment and treatment process is often time consuming, resource heavy, and requires specialized training to conduct (Oliver et al., 2015; Rogge & Janssen, 2019). In fact, recent quantitative reviews of what has become known as the standard behavioral assessment suggest a lengthy process requiring around 3 hr before a treatment is introduced (Mandell et al., 2012; Saini et al., 2020). These lengthy assessments may not be practical in the typical outpatient setting. This has led to a host of modifications to reduce clinical barriers to application (e.g., Northup et al., 1991; Sigafoos & Saggers, 1995; Smith & Churchill, 2002; Thomason-Sassi et al., 2011). For example, Thomason-Sassi et al. (2011) replaced measures of challenging behavior that required repeated instances to assess behavioral function (i.e., rate or frequency) with latency to the first response. This modification allows clinicians to terminate session quicker and potentially improve safety by reducing overall exposure to severe challenging behavior. In another variation, Sigafoos and Saggers (1995) modified the behavioral assessment to be implemented as trials and integrated into a classroom setting, thereby assessing ecologically relevant contingencies as they naturally occur with the teachers.

Beyond practical obstacles to behavioral assessment, it may also be difficult for clinicians to design comprehensive packages that can demonstrate more global change in challenging behavior due to the nature of behavior-analytic research relying heavily on single-case designs (SCD) and the analytic focus on evaluating specific procedural details over large-scale treatment packages (Smith, 2013). In other words, the nature of SCD research may guide researchers towards elements of rigorous analyses and procedural precision to improve replicability. Although the SCD approach showcases the flexibility of behavior analytic procedures, the inclusion of few participants may limit our ability to disseminate easily consumable and generalizable behavioral programming of practical value to clinicians (Azrin, 1977; Iadarola et al., 2018). It is the continued recognition of the importance of external validity and practical programming that may guide researchers towards other tactics beyond SCD such as (1) careful and comprehensive review of the literature, (2) consecutive controlled case series, or (3) group-design methodology (Cihon et al., 2020).

Hanley et al. (2014) designed a comprehensive behavioral assessment and treatment package intended for use by clinicians working in homes, schools, or outpatient clinics. The behavioral assessment and treatment are conducted in three phases. The first phase includes a practical functional assessment (PFA; https://practicalfunctionalassessment.com/) and involves evaluating caregiver-informed, environmental events contributing to challenging behavior to identify the problematic context in need of treatment. Hanley et al. completed the PFA for the three participants diagnosed with ASD in one or two 1-hr outpatient visits, allowing for the clinicians to initiate the behavioral treatment within three clinical visits. The behavioral treatment was then introduced in Phase 2. Treatment involved teaching appropriate communication to replace challenging behavior in the problematic context by providing the functional reinforcers from the PFA contingent on progressively more complex forms of communication, until participants reached a targeted level of developmental appropriateness. Challenging behavior was reduced for all participants; however, the practicality of providing reinforcers every time the participant communicated without presenting denials would have limited utility for transferring the treatment to caregivers, so the behavioral treatment was extended in Phase 3. During the Phase-3 extension, the treatment promoted sustainability in the home and school by teaching tolerance with denials and cooperation with adult instructions. Participants were informed that their reinforcers were no longer available and were presented with multiple tasks (e.g., academic work) to be completed before the reinforcers were returned. The behavioral requirements during the tasks gradually increased to progressively expand the delay to reinforcement. By the end of Phase 3, the participants were (1) no longer exhibiting challenging behavior, (2) using developmentally appropriate language to communicate for their reinforcers, and (3) were completing difficult tasks when denied access to their reinforcers.

To date, the three-phase treatment package has been replicated in small-scale studies using SCDs in the classroom (Taylor et al., 2018), home (Strand & Eldevik, 2018), and outpatient environment (Ferguson et al., 2020). Jessel et al. (2018) conducted the only large-scale replication of the PFA and behavioral treatment in a consecutive controlled case series

of 25 patients admitted to an outpatient program. The authors reported that the PFA required 35.6 min to conduct and informed an effective treatment that reduced challenging behavior by at least 90% for all patients. Although meaningful improvements in challenging behavior were achieved and validated by caregivers completing social validity questionnaires, the study was limited in that the outpatient program was intensive and required consistent participation with services provided 7 hr each day for 2 consecutive weeks, which may not necessarily be practical for most practitioners or common in many outpatient clinics. This limitation is exemplified by the fact that the time commitment required to conduct the PFA varied drastically across participants ranging from 15 min to as much as 100 min. Although extended durations greater than 60 min were an uncommon occurrence (3 of 25 cases), the difference in PFA duration overall speaks to the clinical relevance of efficiency during an assessment period.

Based on previous research on the PFA, it is difficult to determine the efficiency of the process because (1) there is no standard session duration designated to be used during the assessment period and (2) session durations have varied widely based on clinical discretion. To identify quantifiable boundaries to efficiency, Jessel et al. (2020) examined PFAs conducted with 10-min sessions in a consecutive case series with 18 participants (Study 1). The researchers analyzed the first 3 and 5 min of each 10-min session for each participant to determine whether interpretations of functional control deteriorate with briefer session durations. Jessel et al. evaluated functional control using binary and multilevel methods. In the multilevel structured criteria, strong control was represented by reliably elevated challenging behavior during the test conditions and eliminated challenging behavior during control conditions, whereas weak control included overlap between the conditions as well as occurrences of challenging behavior in the control condition. The results of the PFAs were likely to be differentiated and have strong control regardless of the session duration. Furthermore, the results were replicated in an additional eight consecutive cases using 3-min sessions in Study 2. Jessel et al. suggest that a clinician may only need 15 min to complete the PFA without negatively affecting interpretations of functional control. However, the studies were strictly focused on improving the behavioral assessment period and did

not report any treatment outcomes. It is therefore possible that assessment brevity could affect the efficacy of the subsequent treatment informed by the rapid implementation of the PFA.

The purpose of this study was to extend previous research on the PFA and behavioral treatment package in two ways. First, we evaluated the treatment validity of the rapid implementation of the 15-min PFA procedure with patients admitted to an outpatient clinic. Clinicians often report efficiency and safety during behavioral assessment as major concerns (Hanley, 2012). Effective forms of rapid testing may, therefore, reduce barriers to widespread adoption. Second, we conducted the first consecutive case series replication of the PFA and behavioral treatment process during two to three, 1-hr clinical visits across a week. This is less intensive in comparison to the 2-week, 7-hr day programming in our prior study (Jessel et al., 2018). Although increased dosage of a treatment is likely to improve the rate of treatment gains (Granpeesheh et al., 2009; Linstead et al., 2017), maintaining intensive treatments for multiple clients can often be difficult for clinicians with large caseloads. This is especially true when the goal is to address challenging behavior before returning to typical acquisition programming. The less-intensive model was intended to balance efficacy with practicality by reducing clinical visits to a few sessions interspersed throughout the week. We collected 13 consecutive cases of patients receiving these behavioral assessment and treatment services in an outpatient clinic. In addition, we accumulated the time-requirement to complete the treatment and calculated cost expenditures to determine the practicality of conducting these procedures across other potential outpatient clinics.

Method

Patients and Settings

Thirteen patients who were referred to an outpatient clinic due to the severity of their challenging behavior were included in this study. This included referrals from psychiatrists at a nearby psychiatric hospital, psychologists directing programs for children with autism, and word of mouth from caregivers of patients who experienced our outpatient services. Patient characteristics and demographics are

Table 1 Patient characteristics

Characteristic	n	%
Age		
0–2 years old	1	7.7
3–5 years old	3	23.1
6–10 years old	8	61.5
11<	1	7.7
Sex		
Male	10	76.9
Female	3	23.1
Ethnicity		
Hispanic or Latinx	7	53.8
White	4	30.8
Black or African American	2	15.4
Asian	0	0
Other	0	0
Psychological Diagnosis		
Autism Spectrum Disorder	8	61.5
No formal diagnosis	3	23.1
Dual diagnosis with ASD	2	15.4
Language Ability		
Nonvocal	4	30.8
1-word utterances	5	38.4
Short disfluent Sentences	2	15.4
Fully fluent	2	15.4
Challenging Behavior		
Inappropriate Vocalizations	11	84.6
Aggression	10	76.9
Property destruction	9	69.2
Tantrums	8	61.5
Self-injurious behavior	4	30.8

Note. All participants who were categorized as nonvocal were 2 years of age or above. The sum of challenging behavior does not equal 100% because all patients exhibited more than one type of challenging behavior

presented in Table 1. Specific information on socio-economic status was not recorded. The three patients who did not have a formal diagnosis displayed symptoms of ASD.

All patients exhibited some form of severe challenging behavior in the form of aggression, property destruction, or self-injury. In fact, a majority of the patients exhibited a combination of different topographies of challenging behavior that placed themselves or others at risk of harm. For example, caregivers reported their inability to manage the challenging behavior of one patient due to her size and because, during her most difficult episodes of behavior, she had the ability to throw others to the ground and flip tables. In another example, the self-injurious behavior of a male patient reportedly involved head banging on hard surfaces leaving holes in walls and sometimes required emergency room visits. Fewer dangerous forms of challenging behavior (e.g., inappropriate vocalizations) were also included as target measures when applicable to improve the safety of the PFA (Warner et al., 2020).

Sessions took place at university-based outpatient clinic in a 2.45m x 2.45m room. There were two session rooms available with one designed for children with child-sized furniture and the other designed for adults with classroom materials and tables. Video cameras were installed in both session rooms and provided real-time display of sessions for caregivers in the waiting room. In other words, all procedures were transparently conducted with caregiver consent and caregivers were repeatedly reminded that they could terminate sessions if at any point they felt uncomfortable.

Session Scheduling

Sessions were scheduled with patients between the hours of 8 AM and 6 PM on weekdays. Patients were often provided the option of a Tuesday/Thursday or a Monday/Wednesday/Friday schedule to ensure that the session rooms were available for multiple clients within the week. However, patients were often scheduled to visit the clinic one at a time to maintain anonymity among families. Patient scheduling was dependent on availability of graduate students who served as direct therapists. In addition, we attempted to schedule patients consecutively in that, immediately following discharge, the next caregiver would be contacted and begin intake within a 2-week period. Due to low capacity, patients often experienced a waitlist period of 3 weeks to a month. The patient then experienced all three phases of the PFA and behavioral treatment process sequentially without programmed delays in scheduling during the 1-hr visits. In other words, each assessment and treatment phase began following mastery of the former, and sessions were only cancelled in the event of major holidays or reported health concerns.

Measurement

Challenging behavior included any negative vocalizations (e.g., screaming, yelling, swearing, growling), tantrums (e.g., dropping to the floor, crying, and/or whining for more than 30 s), aggression (e.g., hitting, kicking, scratching, and/or biting others), disruption (e.g., tearing, throwing, or hitting items), or self-injurious behaviors (e.g., hitting, scratching, or biting self). Challenging behavior was recorded as a count and calculated as a rate by dividing the number of responses by the session duration.

During the behavioral treatment, patients were taught a functional communication response (FCR) with at least three levels of expanding complexity (i.e., simple, intermediary, complex). The initial form of communication was directly related to the patient's vocal ability at the beginning of the study. For patients who were nonvocal, the therapist taught them how to communicate using picture exchange icons. The simple FCR form involved the patient handing the therapist a 10 x 10 cm card with a picture of the item or words "My way!" The complexity of the FCR involved reducing the size of the picture cards, placing them on a picture-exchange binder, or moving the icons to more distant locations. All icons were available across phases for nonvocal patients. For patients who communicated vocally, the therapist taught simple FCRs that were reported by caregivers to be within verbal abilities. For example, if the participant could speak in short disfluent sentences, the simple FCR was likely to consist of the two-word utterance, "My way." For those with less extensive verbal repertoires, the simple FCR was likely to be deconstructed further to consist only of "My" or "Mine."

Complexity gradually increased based on two requirements. First, the FCR eventually included some verbal interaction with the therapist by requesting their attention (e.g., saying "excuse me"). Second, following the therapist acknowledgment, the patients asked for reinforcers using a complex phrase beyond the verbal abilities originally reported by the caregivers. Tolerance responses were also a form of communication taught to the patients. The tolerance responses varied for each patient. Denial of reinforcements occurred when the therapist said "No" or "Not right now" in response to the patient's complex terminal communication response. For nonvocal patients, the tolerance response included them either giving the therapist a high five or providing the therapist with a "No Problem" picture icon often found inside of the picture-exchange binder. Vocal patients learned to say a word or phrase such as "ok, no problem." Similar to challenging behavior, FCRs were recorded as a count and calculated as a rate.

We also measured cooperation with instructions as the patients were taught to complete tasks when reinforcers were unavailable. Cooperation with instructions was defined as the patient engaging in the appropriate response within 5 s of the therapist's prompt. Instructions were delivered by the therapist using the three-step prompting procedure (i.e., verbal prompt, model prompt, guidance prompt). Cooperation with the instruction was scored if the patient completed the instruction within the first or second prompt (i.e., without the need for guidance) and divided by the total number of instructions within a session to calculate a percentage.

Experimental Design, Interobserver Agreement, Procedural Integrity

A consecutive controlled case-series (Hagopian, 2020) was used to report the results for all 13 patients who experienced the PFA and behavioral treatment in a SCD with repeated measures between the dates of October 25, 2018 and February 25, 2020. The total number of patients included in the study was dependent on who was admitted to the clinic within that time frame. Data from all eligible patients were included and presented in order of their enrollment in the outpatient clinic. All patients admitted to the outpatient clinic received the same services for their challenging behavior. Using a consecutive controlled case-series allows for a demonstration of consistent outcomes across multiple patients and enables us to examine questions regarding the generality of assessment and treatment procedures while maintaining the experimental rigor of the SCD. That is, within the consecutive controlled case-series, each patient experienced a multiple-baseline design across behaviors and served as their own control. Experimental control during a multiple-baseline design is demonstrated when the change for each target behavior is observed only after the respective treatment is implemented in a systematic and staggered fashion with condition changes determined by the researcher. The patients had a minimum of three demonstrations of the treatment effects

across three different target communication responses for each individual. In addition, each phase had a minimum of three data points.

A secondary independent observer scored video recorded or live sessions to calculate interobserver agreement (IOA). IOA was used to ensure that the measurements of behavior were reliable. Partial-agreement coefficients were calculated using the BDataPro software (Bullock et al., 2017) by dividing each session into 10-s intervals. The smaller number of responses recorded was divided by the larger number of responses recorded on an interval-by-interval basis. The quotient was then converted to a percentage. We obtained IOA for 61% of sessions (randomized) on average across patients (range: 40%–100%). The mean IOA across patients for challenging behavior, communication responses, and cooperation with instruction was 99.8% (range: 99%–100%), 97.6% (range: 96%–99%), and 94.4% (range: 84.3%–100%), respectively.

The same secondary observer also evaluated procedural integrity by coding approximately 43% (range: 35%–60%) of the sessions (randomized) for each participant. Data on the correct implementation of procedures were collected throughout all three phases of the assessment and treatment process (i.e., PFA, behavioral treatment, treatment extension). For example, the secondary observer recorded data on if the therapist provided contingent access to the preferred events following challenging behavior during the PFA or following target communication during the behavioral treatment. We calculated a percentage of procedural integrity by dividing the number of correctly implemented procedural components by the total number of procedural components implemented within the session. The mean procedural integrity across participants was 99% (range: 98%–100%) during the PFA. The mean procedural integrity during the behavioral treatment and extension was 98% (range: 95%–100%). Individualized summaries of procedural integrity and checklists are available upon request.

Procedures

Phase 1: Practical Functional Assessments (PFA)

The procedures of the PFA were similar to those defined by Jessel et al. (2016), and varied only in the rapid-implementation format. That is, the PFA consisted of a single test condition incorporating a synthesized contingency compared to a matched control repeatedly alternated five times (i.e., control, test, control, test, test) at 3 min each, creating a total period of 15 min. At the beginning of each test condition, the therapist arranged the evocative events that were hypothesized to contribute to the occurrence of challenging behavior. If patients engaged in any challenging behavior, the evocative events were removed and the preferred events were presented for 30 s. During the control conditions, the therapist delivered continuous noncontingent access to the preferred events and avoided presenting any evocative events.

The evocative events and preferred events were identified during an open-ended interview with caregivers (see Hanley, 2012, for an example) and a brief, direct observation with the patients,[1] both completed by the first (a master's level clinician) or second author (a doctoral-level clinician). Therefore, each PFA was individualized to identify specific environmental events that could be contributing to the challenging behavior of each patient as described by the caregivers. The open-ended interview was conducted in person with a caregiver while the patient was supervised in the session room by the therapist and given noncontingent access to any reported preferred events. After the interview was complete, the caregivers moved to another area adjacent to the session room so that they could observe while the therapist unsystematically arranged the evocative events and preferred events. That is, the contingency was calibrated during the observation based on the patients' reaction to the presentation of the evocative events, the removal of those events and presentation of the preferred events, and caregiver feedback. Caregivers continued to be consulted during the observation and any feedback as to the ecological validity of the context was incorporated to the final procedures of the PFA. Although data were not systematically collected during the interview and observation

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[1] The interviews and observations were not included in the measure of efficiency because this would be inconsistent with previous calculations of assessment efficiency (e.g., Jessel et al., 2021a; Querim et al., 2013; Saini et al., 2020). However, all procedures are included in the estimated costs and time requirement.

Table 2 Individualized events presented and removed during the practical functional assessment

Patient	Evocative Events	Preferred Events
Adam	Transition to activities without tablet	Independent access to tablet
Amy	Adult-directed play with phone	Child-directed play with phone
Gabie	Reading workbooks	Interactive play
Daichi	Denied access to tablet	Independent access to tablet
Eric	Mother-directed transitions	Interactive play
Nathan	Discrete-trial instructions	Interactive play
Sam	Transition to academic instructions	Independent play
Mark	Adult instructions and transitions	Independent access to tablet
Roni	Adult instructions	Independent access to phone
Larry	Transition to workstation	Child-directed play with phone
Liam	Blocked access to leisure items	Free access to leisure items
Terrance	Independent work completion with adult divided attention	Child-directed play
Ziad	Transitions to less-preferred areas	Interactive play

periods, they required around 15 min and 5 min to conduct, respectively.

The list of individualized evocative events and preferred events are presented in Table 2. The individualized events assessed during the PFA were arranged in a synthesized contingency for all participants. For example, the test condition of the PFA for one patient began with an instruction to transition to a workstation with materials specifically reported by caregivers to evoke challenging behavior. If challenging behavior occurred, the transition or work was discontinued and the child was given the opportunity to direct play with their selected leisure activities for 30 s. In addition, the therapist honored any requests made during the child-directed play period and did not introduce any instructions. For another patient, the evocative event involved interacting with others during activities without access to their tablet. Any social activities were discontinued following challenging behavior and the patient was given 30-s independent access to play with the tablet.

The PFA served four important purposes. First, the test condition identified the problematic context (i.e., synthesized contingency endorsed by caregivers during the interview) in which the behavioral treatment needed to occur. Second, the control condition identified reinforcers to be used during the treatment to strengthen new skills. Third, the differentiated patterns observed when comparing the test and control conditions identified a functional relation between an ecologically relevant, synthesized contingency and

challenging behavior. Fourth, the individual results of the PFA served as the baseline for comparison to the treatment (i.e., do the evocative events still cause challenging behavior after treatment?). In other words, the rates of challenging behavior observed during the test sessions of the PFA were sourced to represent the baseline phase (Scheithauer et al., 2020).

Phase 2: Behavioral Treatment

The behavioral treatment (teaching progressively more complex forms of communication) was similar to that of Ghaemmaghami et al. (2018). Each session consisted of five trials with 30-s access to the reinforcers identified during the behavioral assessment contingent on the target form of FCR. Thus, the session duration varied depending on how quickly those trials were completed. Each patient received training for the simple, intermediary, and complex FCR forms. The therapist began by teaching all patients a novel form of communication to end the evocative events and receive their preferred items. Vocal and nonvocal patients received most-to-least verbal and full physical prompts, respectively. For vocal patients, the therapist began with a full verbal prompt that was gradually faded to a partial prompt, and then finally to a time delay of 2–5 s directly related to the patient's vocal abilities. For nonvocal patients, the therapist began with a full guidance that was faded to a partial prompt and finally to a gestural prompt.

Training began with the therapist presenting the antecedent evocative event (e.g., saying "okay, time's up") followed immediately by the full prompt of the targeted communication. When patients emitted the target FCR, they received access to the reinforcer for 30 s. After 30 s, the therapist presented another training trial. Across all training phases, reinforcers were withheld following challenging behavior. Reinforcers were also withheld for previous forms of communication following successive training of each new targeted response. For instance, simple FCRs were no longer reinforced once the therapist began teaching an intermediary FCR. Patients reached mastery criterion when they achieved 100% independent correct responding across two sessions with no instances of challenging behaviors. Once the mastery criterion was met, the training was discontinued and the patient experienced treatment evaluation sessions with prompts no longer provided.

Phase 3: Treatment Extension

The procedures of the treatment were extended once the challenging behavior was reduced or eliminated (i.e., mean reduction of 80% across three sessions) and the patients were exhibiting the newly acquired communication skills. Meeting these criteria was based on a visual analysis of the data collected. The treatment extension was conducted to promote sustainability in the home or school environment by introducing denials to reinforcers and adult instructions. In other words, the extension slowly reintroduced the patient back into the daily behavioral expectations of their teachers or parents. Training for the tolerance communication response consisted of 10 trials, 5 of which were tolerance trials and 5 were communication trials, presented in alternating order. During communication trials, patients received 30-s access to reinforcers immediately after emitting the target complex communication response. During tolerance trials, the therapist delivered the reinforcer only after the patients emitted the chained responses: complex communication and tolerance response. The therapist taught patients to say "okay" (vocal patients) or to hand another 5 x 5 cm card that said "okay, no problem" (nonvocal patients) in response to the therapist denying them access to reinforcer by saying "Not right now" or "no." The specific denials were informed by caregivers regarding what they typically said to their child. Patients reached mastery criterion when they achieved 100% independent correct responding across two sessions with no instances of challenging behaviors. This indicated that they were tolerating the presentation of denials and were able to communicate their acceptance that the rewards were not immediately forthcoming.

Procedures similar to Ghaemmaghami et al. (2016) were used to progressively introduce tasks and instructions that participants were required to complete before access to the reinforcers were returned. Six trials were presented during a session in random order and consisted of two communication trials where the reinforcers were immediately delivered following the target complex communication response, one tolerance trial where the reinforcers were delivered following the tolerance response, and three instruction trials of varying difficulty (i.e., easy, moderate, and difficult). Once again, the session duration was not fixed and was dependent on the completion of those trials. A schematic of the trials is presented in Fig. 1. The level of difficulty of the instructions was determined by the number of instructions that had to be completed for the patient to receive the reinforcers. In other words, the easy instructional trial included the fewest instructions and the difficult instructional trial included the most. In addition, the difficulty was randomized so that the patient was unable to determine the number of instructions they were going to experience.

During the instructional trial, the patient engaged in the chained responses of emitting the communication response and tolerance response before the instructions were introduced. Upon saying "okay" to the therapist, the therapist provided general praise and then began presenting the programmed number of instructions for that trial. When a patient engaged in challenging behavior, the count of instructions to be completed was reset and the therapist continued providing instructions until the patient completed the entire programmed requirement without challenging behavior. Following successful completion of programmed instructions, the patient received 1-min access to the reinforcer before the next trial was initiated. Instruction difficulty was progressively increased as challenging behavior remained low, which correspondingly resulted in the session duration becoming longer. The initial behavioral requirement was the cooperation with a single,

Schematic of Training Trials across Behavioral Treatment and Extension
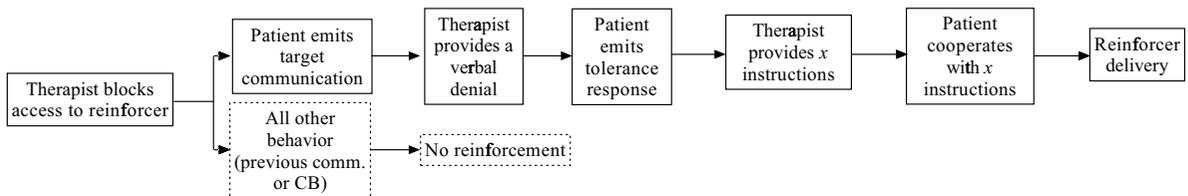
Communication Trials
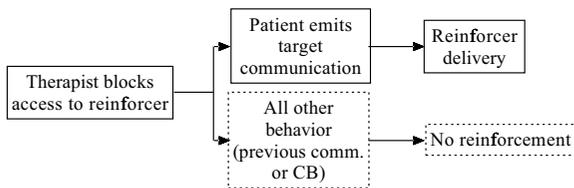
Tolerance Trials
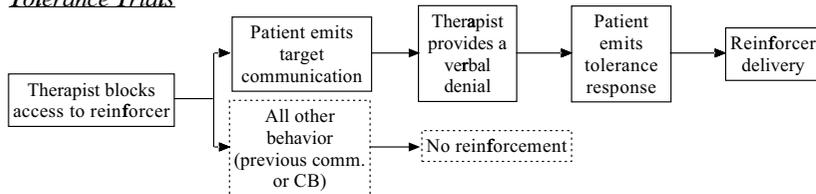
Instructional Trials

Note. A trial refers to a procedural sequence beginning with the removal of the reinforcers and ending with the return of those reinforcers based on some behavioral requirement.

Fig. 1 Schematic of training trials across behavioral treatment and extension. Note. A trial refers to a procedural sequence beginning with the removal of the reinforcers and ending with the return of those reinforcers based on some behavioral requirement

simple instruction such as motor or vocal imitations. The terminal behavioral requirement was the cooperation with a mean of 15 instructions that could vary between 5 and 40 per trial. In addition, the tasks now included completing academic work, engaging in independent daily living skills, and transitioning to different situations appropriately with an adult (e.g., holding an adult's hand while walking to a classroom where they were to then sit in the chair and complete instructions presented on a blackboard). The terminal behavioral requirements were determined on a case-by-case basis based on developmental appropriateness and expectations of the school or home environment.

Data Analysis

Mean Baseline Reduction

The therapist calculated effect size using the nonparametric statistical analysis mean baseline reductions (MBLR; Kahng et al., 2002). The therapist calculated the mean rates of challenging behavior for each phase (baseline, treatment, extension) and the outcome (i.e., final three sessions of the extension phase). MBLR was calculated using the equation: $\left(1 - \left(\frac{Final\ 3_{extension}}{Final\ 3_{baseline}}\right)\right) \times 100$. Where *Final $3_{baseline}$* refers to the mean of the three (if only three

Table 3 Investigator's global assessment (Modified for Behavioral Intervention)

Scale	Designation	Definition
0	Complete Improvement	100% reduction in challenging behavior from baseline performance
1	Excellent Improvement	90% reduction in challenging behavior from baseline performance
2	Marked Improvement	75% reduction in challenging behavior from baseline performance
3	Moderate Improvement	50% reduction in challenging behavior from baseline performance
4	Minimal Improvement	25% reduction in challenging behavior from baseline performance
5	No Change	Similar challenging behavior to baseline performance
6	Worse	Any increase in challenging behavior from baseline performance

sessions were conducted) or final three data points from the baseline and *Final 3$_{extension}$* refers to the outcome data or mean of the final three data points from the extension phase. Percentages could range from negative values, indicating that the treatment worsened challenging behavior, to 100%, indicating a complete elimination of challenging behavior. For example, if a patient was exhibiting challenging behavior at a mean rate of two responses per min (RPM) during the final three data points from baseline and 1 RPM during the final three data points from the extension phase, this would create an MBLR value of 50%:

$$\left(1 - \left(\frac{1}{2}\right)\right) \times 100 = 50 \tag{1}$$

If challenging behavior was eliminated during the final three data points from the extension, the MBLR value would be 100% regardless of the nonzero rate obtained during baseline. That is, the denominator could be 5 RPM of challenging behavior exhibited during the final three data points from baseline but if the numerator was 0 RPM during the final three data points from the extension phase, the quotient will be zero. With a value of zero being subtracted from one and multiplied by 100, the MBLR value will be calculated as 100%:

$$\left(1 - \left(\frac{0}{5}\right)\right) \times 100 = 100 \tag{2}$$

To obtain an MBLR value indicative of a worsening of challenging behavior during the treatment extension, the rate of challenging behavior would have to be higher during the treatment extension phase in comparison to the baseline phase. For example, the patient may be exhibiting challenging

behavior at a rate of 3 RPM during the final three data points from baseline. During the final three data points of the treatment extension, the rate of challenging behavior could increase to 6 RPM. This would result in an MBLR value of -100%:

$$\left(1 - \left(\frac{6}{3}\right)\right) \times 100 = -100 \tag{3}$$

Investigator's Global Assessment

Based on the results of the MBLR calculation, patient outcomes were categorized using a version of the investigator's global assessment (IGA; Rao et al., 2004) modified to be used with challenging behavior as an outcome assessment tool. We included the IGA because it has been used by clinicians for more than 35 years and has shown high clinical construct validity and test/retest reliability (Spuls et al., 2010; Langley et al., 2015). The categories on the IGA corresponded to percentage improvements in symptoms. The IGA included six categorizations that ranged from *worse* (negative MBLR values) to *complete improvement* (100% MBLR value). The entire list of categories and their definitions can be found in Table 3.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for MacBook Air, version 23.0 (IBM Corp., 2015). A repeated measure analysis of variance (ANOVA) with one within-subject factor (assessment vs. treatment vs. extension) was computed for rate of challenging behavior. Significant effects were followed by pairwise comparisons of each condition. The assumption of sphericity was assessed by

Mauchly's test of sphericity. The effect size was calculated using the ANOVA function in IBM SPSS Statistics yielding partial ή squared for the main effect.

Community Involvement

Caregivers of the patients were directly involved in the design and implementation of the PFA and behavioral treatment. Caregivers were present throughout the patient's entire participation and observed every session live. The sessions were also recorded for therapist and caregiver review. Therapists were available at any point for the caregivers to ask questions or provide feedback. During the initial interview, caregivers identified the challenging behavior, target skills, and provided specific material they would like their child to complete. In addition, caregivers were integral in the development of the PFA procedures. The test condition from the PFA was a re-creation of the problematic context the caregivers experienced in their home or school setting. It was, therefore, pertinent that qualitatively rich input from caregivers was included in the design of each patient's respective test condition.

On the final day in the clinic, caregivers were trained on the procedures and were provided with a document summarizing their child's experience and recommendations for maintaining the positive progress achieved. This document was intended to be shared with others in the community who were invested in the child's education and services (e.g., doctors, teachers, psychologists, behavioral therapists). Contact information was also provided on that document to allow for open dialogue with those in the community on how to implement, modify, or improve the recommendations based on the treatment. No data were collected during this time.

A social validity assessment (see Supplemental Materials) was conducted with each caregiver/parent at the end of the study when the patients were discharged from the clinic. The therapist provided the caregiver with the social validity assessment and led them to a separate room to complete the document independently. The therapist remained outside of the room with the door closed unless invited by the caregiver to answer any questions. Once complete, the caregivers placed the social validity assessment in an anonymous "Discharge Documents" box before indicating to the therapists that they were ready to leave.

The social validity assessment included questions about the appropriateness of the assessment and treatment procedures used in this study, the caregiver's satisfactions with the results, and the helpfulness to their home environment. Caregivers rated all items on a 7-point Likert scale ranging from one, indicating not acceptable/satisfied/helpful, to seven, indicating highly acceptable/satisfied/helpful. In addition, space for open-ended comments were provided for each question and a general comments section was available for the caregivers to provide concluding thoughts about their overall experience. Feedback was used to improve services for future patients.

Results

The PFA required a mean of 16 min to complete and elevated rates of challenging behavior were observed for 12 of the 13 patients (see Fig. 2). Most instances of challenging behavior occurred during the test condition ($M = 2.16$ responses per min [RPM]; $SD = 1.16$) of the PFA, and little to no challenging behavior was observed during the control condition ($M = 0.01$ RPM; $SD = 0.03$). Only two patients required modifications to the rapid implementation process. Low and undifferentiated levels of challenging behavior were observed during the first iteration of the PFA for Daichi (data not recorded). The caregiver reported that he was "visibly frustrated" and was likely to exhibit challenging behavior in the arranged context if given more time. Therefore, the PFA sessions were increased to 5 min and differentiated outcomes were obtained. After following up with the caregiver of the other patient (Gabie) who did not exhibit challenging behavior during the assessment (not shown in Fig. 2), the caregiver agreed with the negative results (i.e., the child was unlikely to exhibit overt challenging behavior) and reported that the problem was more internalized. The caregiver suggested she was more interested in services diagnosing her child with a learning disability. We, therefore, provided a referral for other more relevant psychological services and the patient's participation was terminated.

The problematic context was accurately identified during the PFA for the majority of the patients, and the behavioral treatment could be initiated for the remaining 12 participants. The caregiver for one patient (Liam) discontinued services following the

Fig. 2 Results of the practical functional assessment. *Note*. Data are presented on the second iteration for Daichi's PFA, which required an increase to 5-min sessions. Portions of these data for Mark, Adam, and Nathan are presented in Jessel et al. (2021b)

Results of the Practical Functional Assessment
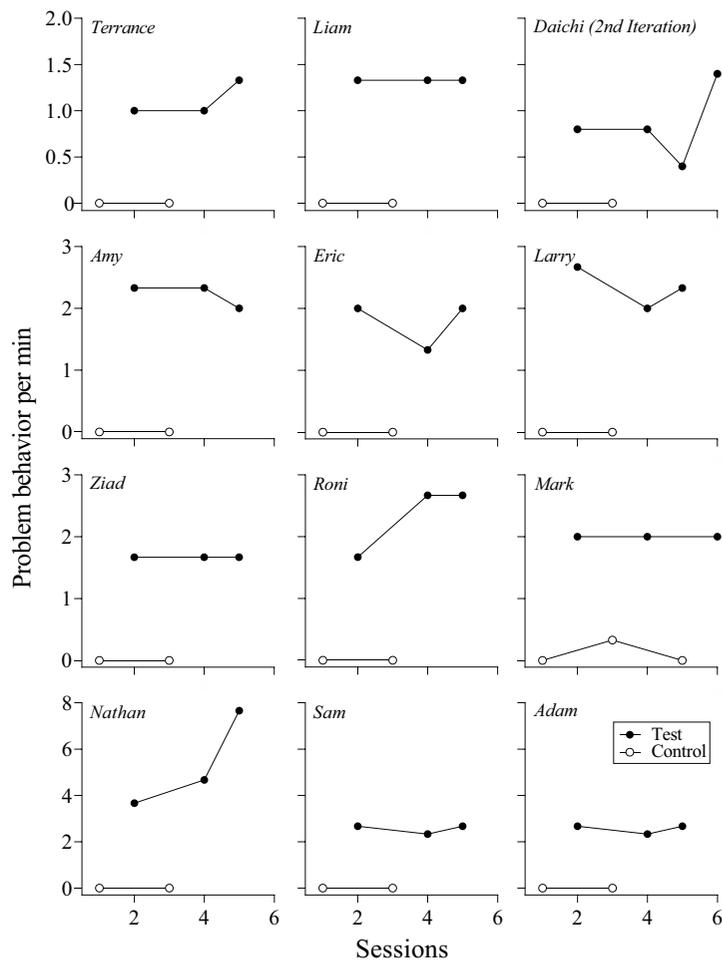
Note. Data are presented on the second iteration for Daichi's PFA, which required an increase to 5-min sessions. Portions of these data for Mark, Adam, and Nathan are presented in Jessel et al. (2021).

first day, before the introduction of the behavioral treatment. The caregiver reported requiring medical attention that would interfere with their ability to bring their child consistently to sessions. The remaining 85% of patients (11 of 13) experienced all three phases of the assessment and treatment process (individual figures available in Supplemental Materials).

Using the MBLR nonparametric statistic, the behavioral treatment teaching complex communication skills reduced challenging behavior by 98.5% (range: 93.4%–100%). In fact, the behavioral treatment eliminated challenging behavior for 7 of the 11 patients who experienced Phase 2. Challenging behavior remained infrequent, with a mean reduction

of 98.5% (range: 93%–100%), during the extension to the behavioral treatment when procedures were introduced to promote sustainability. Using the IGA, 72% (8 of 11) of the patients were designated as having obtained excellent improvement and the remaining 18% (2 of 11) of the patients were designated as having obtained a complete improvement. No patients were categorized as having an IGA designation below excellent improvement. In addition, corresponding increases in communication skills and cooperation with adult instruction were observed across patients (Table 4).

Figure 3 represents an example of an individual patient who experienced all three phases of the

Table 4 Direct measures of behavioral improvement represented as a mean across patients

	Behavioral Assessment (Phase 1)	Behavioral Intervention (Phase 2)	Intervention Extension (Phase 3)
Challenging Behavior (Rate)	2.16 (.85–5.11)	.02 (0–.04)	.03 (0–.06)
Communication Skills (Rate)	0	1.70 (1.29–2.15)	.77 (.50–1.05)
Tolerance to Denial (Rate)	0	--	.46 (.28–.63)
Cooperation Skills (%)	--	--	93% (67–99.3%)

Note. Dashes indicate skills that were not taught. Means were calculated for entire phases. Numbers within the parentheticals indicate the range

behavioral assessment and treatment process. Elevated rates of challenging behavior were observed during the baseline phase, implicating the need for continued behavioral treatment. During the behavioral treatment, a contingency including the delivery of functional reinforcers identified during the PFA was used to strengthen progressively more complex FCRs. Challenging behavior remained low as the target form of communication increased from simple, to intermediary, and ended on a terminal level of complexity. The treatment extension was then introduced, whereby a tolerance response was taught, and the number of instructions were gradually increased. Caregivers for the patient reported a need to achieve independent completion of work and so the terminal behavioral requirement included the completion of 5, 10, or 15 instructions without direct supervision. Challenging behavior remained low by the end of the treatment extension with the continued use of appropriate communication and cooperation with adult instruction.

Figure 4 depicts the differences in the mean rates of challenging behaviors across each phase. The sphericity assumption has been violated with a significant Mauchly's test ($p < .001$). Violating the sphericity assumption may result in an increase in Type I error (false positive). Therefore, the *F*-test result is corrected using the Greenhouse-Geisser correction from $F(2,20) = 42.83$, $p < .001$ to $F(1.001,10.013) = 42.83$, $p < .001$ (degrees of freedom are slightly different due to rounding). The correction has increased the *p*-value to compensate for the fact that the test is too liberal when sphericity is violated; therefore, yielding a more accurate significance value. The rates of challenging behavior were significantly different in the three conditions (baseline, behavioral treatment, and treatment

extension), $F(1.001,10.013) = 42.83$, $p < .001$, $\eta^2 = .81$. Pairwise comparisons show that the rates of challenging behavior were significantly lower during the behavioral treatment and extension phases than baseline ($p < .001$). There were no differences in rates of challenging behavior during behavioral treatment and extension phases ($p > .05$).

Following the patient's discharge from the clinic, the caregivers were provided with a social validity questionnaire. Ten caregivers (91%) of the 11 patients who experienced all three phases of the PFA and behavioral treatment completed the social validity questionnaire. A rating of 1 represented the lowest score and a rating of 7 represented the highest score. Overall, parents were highly satisfied with the assessment ($M = 6.7$; $SD = .6$) and treatment ($M = 6.8$; $SD = .4$) used in the study. Caregivers rated the PFA as very acceptable ($M = 7$), very safe ($M = 7$), and very accurate in identifying the problematic context experienced in the home or school environment ($M = 6.5$; $SD = .76$). With respect to the behavioral treatment, caregivers found the treatment to be very acceptable ($M = 7$) and helpful in their home settings ($M = 7$). Based on the progress in their child's behavior, the caregivers reported high satisfaction with the improvement in communication skills ($M = 6.63$; $SD = .52$) and challenging behavior ($M = 6.75$; $SD = .46$). Full comments from all caregivers who completed the open-ended sections of the social validity questionnaire are presented in the Supplemental Materials. Seven of the 10 (70%) caregivers who completed the social validity questionnaire wrote open-ended comments. All comments were positive in nature and ranged from appreciation for the staff members, overall satisfaction with the changes in their child's behavior, and the indication that they were able to learn something about their child as well.

Example Results of Behavioral Treatment and Extension for an Individual Patient
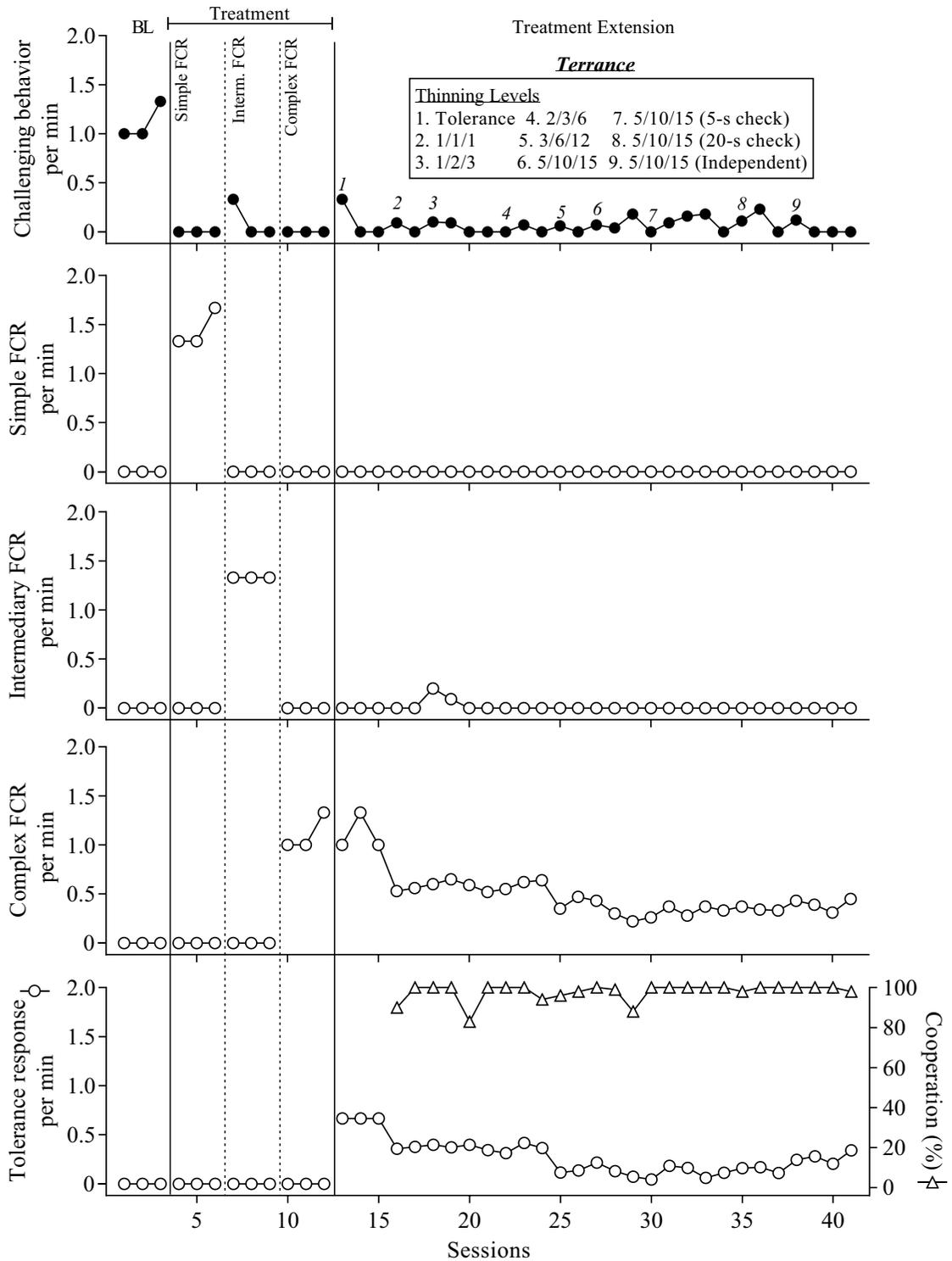
Note. Thinning levels indicate the number of instructions presented in a trial.

◄**Fig. 3** Example results of behavioral treatment and extension for an individual patient. *Note*. Thinning levels indicate the number of instructions presented in a trial

Time and Cost Expenditures

Families who participated in this study were not charged for the services rendered. However, we were able to calculate expenditures based on the hourly rates of staff members had the costs been incurred (see Table 5). The costs were determined by the median hourly rate for a supervising Board Certified Behavior Analyst (BCBA) and Board Certified Assistant Behavior Analysts (BCaBA; Association of Professional Behavior Analysts, 2014). Supervising BCBAs were present for every session. Although the therapists may not have obtained certification as BCaBAs, this would have been the equivalent position held by staff members implementing procedures in the home or clinic environment. In addition, many of the therapists were pursuing a master's degree in Applied Behavior Analysis and met the BCaBA eligibility requirements (Behavior Analyst Certification Board, 2021). The entire behavioral assessment and treatment services required a median total of 11 sessions (range: 8–15) for the patients, creating a staffing cost of $2,090 (range: $1,520–$2,850). In addition, fees would also be accrued for weekly, 1-hr supervision meetings between the BCBA and BCaBA and the time required to write reports or plan for sessions. The grand total cost for all services was $3,940 (range: $3,180–$5,650) per family. It is important to point out that this is a limited cost analysis because it does not account for other potential costs associated with receiving services such as travel, caregiver time off from work, or insurance copays and deductibles.

Discussion

In the current study, we validated a comprehensive behavioral assessment and treatment package that reduced challenging behavior to socially meaningful levels. The PFA was completed in 15 min for almost all patients. In addition, the entire assessment process, including the interview and observation, was completed within a single 1-hr visit for all but one patient. This suggests that on most occasions, under similar circumstances, the therapist can begin treatment by

the second clinical visit when using the rapid implementation procedures with the PFA model. In addition, the process was completed in fewer than thirty 1-hr visits while teaching the patients vital communication, tolerance, and cooperation skills.

Using a similar dosage level to that experienced by the three participants in Hanley et al. (2014), we evaluated the PFA and behavioral treatment model with 13 patients in a consecutive case series. The advantage of conducting a consecutive case series is that we were able to determine that positive outcomes are a probable occurrence by demonstrating clinically significant reductions in challenging behavior for 11 of the 13 cases included in this analysis. Of the two participants who did not demonstrate positive outcomes, one was withdrawn due to the lack of challenging behavior during the analysis and the other was withdrawn by caregivers for reasons unrelated to the study. Efficient outpatient services, such as the ones employed in this study, may reduce the necessity for psychiatric hospitalization among individuals with ASD who exhibit challenging behavior (Mandell et al., 2012).

This study is the second consecutive case series to support the PFA and behavioral treatment package, with earlier preparations using a more intensive outpatient model with increased dosage (Jessel et al., 2018). Without a systematic comparison of the two models, it is difficult to determine relative suitability given patient characteristics such as severity of symptoms or comorbidity of other psychiatric disorders. Therefore, in view of both models being effective, the level of treatment dosage may be dependent on individually determined and socially relevant considerations. For example, one family may prefer the less intensive model with 1-hr sessions because it may be more convenient for their work schedule and the child can continue to attend school. On the other hand, others may prefer the more intensive model with 7-hr sessions to obtain more immediate effects before returning to the school environment. It may also be possible to use a hierarchical approach relying on increased dosage when necessary (i.e., less intensive models fail to maintain reductions in challenging behavior).

One of the main goals of the current study was to demonstrate the efficacy of a set of comprehensive and practical procedures targeting challenging behaviors. Reducing barriers to practical utility may

Fig. 4 Mean challenging behavior across behavioral assessment and treatment phases. *Note.* ** significant difference at the .001 alpha level. Phase 1 refers to the practical functional assessment. Phase 2 refers to the behavioral treatment. Phase 3 refers to the extension to the behavioral treatment. Each point represents the mean across all sessions of each phase for an individual patient. Vertical lines represent standard deviation

Mean Challenging Behavior across Behavioral Assessment and Treatment Phases
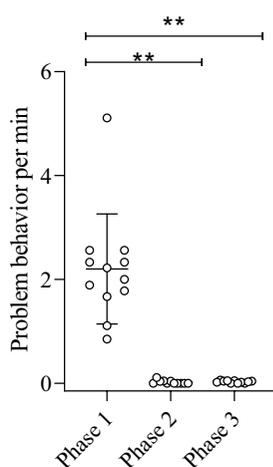
Note. ** significant difference at the .001 alpha level. Phase 1 refers to the practical functional assessment. Phase 2 refers to the behavioral treatment. Phase 3 refers to the extension to the behavioral treatment. Each point represents the mean across all sessions of each phase for an individual patient. Vertical lines represent standard deviation.

Table 5 Estimated costs and time requirement

Steps	Average	
	Visits/Hours	Cost
Phase 1: Practical Behavioral Assessment	1 (1–2)	$190 ($190–$380)
Phase 2: Behavioral Treatment	3 (2–5)	$570 ($380–$950)
Phase 3: Treatment Extension	6.5 (5–12)	$1,235 ($950–$2,280)
Total	11 (8–15)	$2,090 ($1,520–$2,850)
Supervision meetings	7 (6–12)	$1,330 ($1,140–$2,280)
Report writing and planning	4	$520
Grand Total		*$3,940 ($3,180–$5,650)*

Note. Numbers within the parentheticals indicate the range. Visits and cost include all time spent within the clinic (e.g., interviews, observations, training, sessions)

improve adoption of empirically supported procedures among clinicians working with individuals who exhibit challenging behavior. Oliver et al. (2015) conducted a nationwide survey distributed to 14,501 clinicians who were BCBAs and likely to render behavioral services. Of the clinicians who responded, only 36% indicated they used the standard behavioral assessment methods, suggesting that these evidence-based assessment procedures have not necessarily been widely adopted by clinicians. The current study attempted to address issues of clinical relevance and completed the entire

behavioral assessment and treatment in a clinical setting. The PFA and treatment package used in this study may be a possible alternative available to the every-day clinician working with individuals with ASD that is cost efficient and effective. Dissemination of this PFA and behavioral treatment could improve adoption of effective procedures and extend quality of care to the greater population of those diagnosed with ASD. Thus, future researchers may want to eventually consider returning to nationwide surveys to see if these studies addressing issues of clinical relevance will positively affect behavioral

services among clinicians. However, maintaining a high quality of care when implementing the PFA and behavioral treatment will likely require two system-wide approaches to support clinical practice: Development of a manual and design of an effective training package.

First, the continued successful replication of this specific PFA and behavioral treatment process (e.g., Beaulieu et al., 2018; Boyle et al., 2020; Dowdy & Tincani, 2019; Herman et al., 2018; Rose & Beaulieu, 2019; Santiago et al., 2015; Slaton et al., 2017) suggests the possibility of the development of a manual with standardized procedures that can be disseminated among clinicians and researchers. However, there are potential disadvantages to manualization that are worth mentioning. Namely, overly regimented procedures may reduce the practitioner's ability to incorporate their own personal, clinical experiences. In assembling the manual, it is therefore important to keep in mind the balance of uniformity and flexibility among procedures, ensuring a structured treatment program for ease of replication, but also permitting clinicians to individualize when necessary to the needs of the families (Smith, 2013).

Second, proper dissemination of a set of comprehensive assessment and treatment procedures will require the availability and distribution of effective training packages ensuring a mastery of specific procedures before implementation. Although continuing to remain up to date with the research literature is commonly regarded as an ethical responsibility among health professionals (Behavior Analyst Certification Board, 2014), a practitioner may not reach a level of competency in implementing a novel set of procedures without a more active level of training such as didactic teaching in a workshop or seminar-based instruction. Whelan et al. (2021) taught 18 practitioners how to conduct the PFA in a 3-hr seminar that included a prerecorded lecture, video examples with real clients, active responding to quizzes, and discussion. The authors found that the experimental group who received the seminar training outperformed the waitlist group and, when presented with real cases, the practitioners were able to confidently develop and conduct their own PFAs for the clients they served. Thus, improving the widespread availability of such training models may contribute to the adoption of evidence-based, behavioral assessment and treatment packages.

It is important to point out that the services the participants received in this study occurred in an outpatient clinic and did not include further generalization of the treatment to other important behavior-change agents (teachers or parents) or transitioning the intervention to their typical in-home or school services. These are undoubtedly important tasks that would add to the timeline and cost expenditures. Future research should extend this model to incorporate the entire experience of the child until meaningful improvements have been achieved in the intended environment with the relevant individuals. That is, longitudinal studies including follow-up supervision or trainings could be conducted to ensure that the positive outcomes achieved within the outpatient clinic are maintained across the individual's lifetime. At the very least, follow-up visits can be arranged during more immediate, and socially impactful, transitions to the home or school environment.

Although the procedures of the behavioral treatment were individualized for all patients based on the outcomes of the behavioral assessment, the general treatment package remained the same in that all patients were taught communication, tolerance, and cooperation skills. Although the number of intermediary communication responses was dependent on the communication abilities, all patients experienced communication training for simple and complex communication responses. Current clinical recommendations suggest beginning with this process of dense reinforcement for communication before transitioning to teaching tolerance (Hagopian et al., 2011; Tiger et al., 2008); however, it is possible for the time devoted to teaching each skill to be better matched to the therapeutic needs of the individual. For example, some researchers have used terminal complexity probes during communication training to determine the amount of intermediary communication responses that were needed (e.g., Ghaemmaghami et al., 2018), whereas others used terminal delay probes to determine the necessity of the systematic and gradual thinning process during treatment extensions (e.g., Beaulieu et al., 2018; Hanley et al., 2014). In other words, probes may improve the efficiency of the treatment process by reducing redundancy in teaching previously mastered skills and beginning at the individual's specific deficits. In addition, probes can identify limits to a treatment's success, such as the potential for challenging behavior to resurge in tested contexts

(Perrin et al., 2021). Future researchers could adapt the PFA and behavioral treatment to better target possible probes of such communication abilities and determine if the treatment process can be abbreviated but remain effective in teaching complex communication skills.

The efficacy of a standardized set of procedures may be supported by quantitative measures (e.g., MBLR, IGA); however reducing overall barriers to widespread adoption and dissemination is likely to depend on reports of social acceptability among constituents. In fact, behavioral researchers have often relied on such subjective determinations for identifying acceptable treatment results as a core principle of the field of applied behavior analysis (Baer et al., 1968; Wolf, 1978) and yet our adherence to this principle within the research literature is fairly inadequate (Carr et al., 1999). In the current study, caregivers were an integral part of the process beginning with the open-ended interview and observing the entire assessment and treatment process. Following the completion of the family's participation, the caregivers were asked to fill out a social validity questionnaire attempting to validate the entire three-phase process. The social validity results add an important extension to the current literature, highlighting the perceived acceptability, safety, and representability of the assessment process. Clinician and caregiver approval of the assessment process may help to encourage the adoption of the PFA and behavioral treatment process we developed, and researchers should continue to socially validate behavioral treatments to ensure that our impact is meaningful to all those who receive our services.

Declarations

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