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A Family-Centered Positive Behavior Support Approach to the Amelioration of Food Refusal Behavior

An Empirical Case Study

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The purpose of this study was to evaluate the effectiveness of a family-centered positive behavior support approach to the amelioration of food refusal behavior in a child with autism. The study was conducted with the child and his family in their home. It employed an empirical case study design with one meal routine: snack time. Following training and support with the child's mother, results show high levels of child food acceptance, successful child participation in observed snack routines, and high parental ratings of social validity and contextual fit. Improvements maintained up to 26 months postintervention. Implementation also was associated with generalization of the child's eating behavior to new foods and to his father's supporting him during snack time. Child behavioral improvements also were associated with parental reports of gains in family quality of life. Results are discussed in terms of implications for practitioners and researchers involved in behavioral feeding interventions.

Keywords: *positive behavior support; food refusal behavior; autism; behavioral parent training; family-centered service delivery*

Persistent feeding difficulties, such as food refusal and food selectivity, frequently occur in young children with severe developmental disabilities (Babbit et al., 1994; O'Brien, Repp, Williams, & Christophersen, 1991). Studies have reported prevalence figures ranging from 33% (Babbit et al., 1994) to as high as 80% (Shore, Babbit, Williams, Coe, & Snyder, 1998). To be sure, 45% of typically developing children also experience a variety of mealtime problems during childhood (Bentovim, 1970); however, these feeding problems are intermittent and transitory and thus do not require extensive professional involvement (O'Brien et al., 1991).

Chronic food refusal is an enduring problem (i.e., lasting several months or years) in which a child voluntarily limits intake to a highly restricted range of foods, to foods with specific textures, or to an insufficient quantity of foods necessary to maintain age-appropriate weight (Didden, Seys, & Schouwink, 1999; Kedesdy & Budd, 1998). Children with food refusal behavior also are likely to exhibit socially stigmatizing mealtime problems, such as crying, spitting out food, aggression, and self-injury (Babbit et al., 1994). Children's feeding problems have received much attention in the literature owing to the negative consequences that they have on health, development, and socialization (Kedesdy & Budd, 1998).

A defining feature of food refusal behavior is that organic or medical causes (e.g., physical abnormalities, gastrointestinal disease) are ruled out as being sufficient to explain the protracted nature of the problem (Werle, Murphy, & Budd, 1998). Although food refusal may have its origin in organic causes, environmental factors such as ineffective parenting practices during mealtimes contribute to the exacerbation and maintenance of the problem (Sanders, Patel, Le Grice, & Shepherd, 1993). Caregiver feeding practices may inadvertently strengthen the child's inappropriate feeding patterns (Budd & Chugh, 1998; Sanders et al., 1993).

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Since the 1970s, researchers in the area of applied behavior analysis have studied food refusal behavior and developed evidence-based treatments. Using single-subject research methods, researchers have documented the effectiveness of behavioral interventions for the amelioration of food refusal behavior in children with and without developmental disabilities (Linscheid, 2006), including escape extinction (Ahearn, Kerwin, Eicher, & Taylor Lukens, 2001), positive and negative reinforcement (e.g., Bernal, 1972; Palmer, Thompson, & Linscheid, 1975), stimulus fading (Munk & Repp, 1994; Shore et al., 1998), and the manipulation of contextual variables that affect appetite (Levin & Carr, 2001; Werle et al., 1998).

These studies have defined several features of an effective approach to behavioral assessment and intervention. First, studies have shown that parents can be taught to implement behavioral feeding interventions and so improve the eating behavior of their children (Anderson & MacMillan, 2001; Didden et al., 1999; McCartney, Anderson, & English, 2005; Mueller et al., 2003; Werle et al., 1993, 1998). Second, studies have shown the importance of functional assessment procedures for identifying the maintaining consequences of food refusal behavior (Levin & Carr, 2001; Galensky, Miltenberger, Stricker, & Garlinghouse, 2001; Girolami & Scotti, 2001; Piazza et al., 2003; Werle et al., 1993, 1998). Third, studies have documented the value of adjunctive assessments focused on the child's feeding disorder and food preferences (Galensky et al., 2001). Finally, researchers have recognized the importance of multicomponent treatment packages that address the multiple variables (e.g., setting events, antecedent triggers, maintaining consequences) that affect a child's eating behavior (Kern & Marder, 1996; Shore et al., 1998).

Applied behavior analysts have also shown concern for variables related to the acceptability and survivability of food refusal interventions in natural settings (Baer, Risley, & Wolf, 1987). First, the collaborative design of treatment plans with consumers has received attention. Anderson and MacMillan (2001) conducted one of the first studies in which parents were involved as active participants in the development of a treatment plan by taking into account parental preferences regarding the types of food targeted and by modifying the treatment package on the basis of parental concerns. These collaborative features were associated with the child's consuming 100% of the targeted food. In contrast, Galensky et al. (2001) reported moderate treatment outcomes associated with the absence of parental input.

Second, regarding the survivability of the interventions and the durability of outcomes, researchers have begun to recognize the importance of contextual features of natural settings in which eating behavior is to occur. Werle et al. (1998) conducted the first study to assess and manipulate contextual variables associated with a child's problematic eating in the home. These variables included the setting in which eating occurred, the frequency of meals and snacks, and the length of meals. Manipulation of these variables was associated with positive changes in child eating behavior in two of the four parent–child dyads participating in the study. For the other two dyads, inattention to other contextual variables (e.g., cultural factors) was associated with early termination from the study. Galensky et al. (2001) also noted that modest treatment outcomes were associated with inattention to contextual variables (e.g., sibling interactions) during a targeted family mealtime routine.

Third, researchers have begun to measure treatment outcomes that extend beyond child food refusal and acceptance. Galensky et al. (2001) measured family perceptions of the social validity of the treatment plan, whereas Anderson and McMillan (2001), Galensky et al., and Werle et al. (1998) measured parents' accurate use of treatment components (i.e., treatment integrity). Finally, given the long-term nature of feeding problems (Franklin & Rodger, 2003), researchers have begun to examine the durability of food refusal interventions. Ahearn et al. (2001), Mueller et al. (2003), and Piazza et al. (2003) documented the durability of interventions 6 and 9 months postintervention. However, these data represented maintenance in clinic settings only. Yet, McCartney and colleagues (2005) provided the first documentation of the maintenance of child treatment effects 1 year postintervention with the child's parent as the interventionist in the home.

Taken as a whole, the extant literature on the amelioration of food refusal behavior in children provides a solid foundation and clear direction for future research and practice. Consistent with a positive behavior support (PBS) approach, evidence-based practice in the amelioration of food refusal recognizes the importance of conducting a functional assessment, designing multicomponent behavior support plans, and training consumers (i.e., parents) to implement interventions in natural settings. With its expanded focus on ecological validity, stakeholder participation, systems change, and lifespan perspective (Carr et al., 2002), PBS emphasizes additional considerations for research and practice that have been missing from or only have begun to emerge in the food refusal literature—including the development of collaborative partnerships with parents during a process of assessment and intervention; the expansion of the unit of analysis to take into account ecological and family systems variables; the design of behavior support plans that

are contextually appropriate; the measurement of multiple outcomes in addition to food refusal and acceptance behavior; and the promotion and evaluation of the long-term maintenance of treatment outcomes.

We developed a family-centered approach to the amelioration of food refusal behavior in young children with developmental disabilities that builds on the extant literature by incorporating the expanded features of a PBS approach. The approach represents an adaptation of family-centered PBS described by Lucyshyn, Kayser, Irvin, and Blumberg (2002); Buschbacher, Fox, and Clarke (2004); and Vaughn, Clarke, and Dunlap (1997) to the needs of families who are raising young children with developmental disabilities who engage in food refusal behavior. The approach includes six core features, briefly described below.

First, throughout the assessment and intervention process, the interventionist strives to build a collaborative partnership with family members that is aimed at empowering parents to overcome their children's food refusal behavior (Kanfer & Grimm, 1980; Turnbull, Turnbull, Erwin, & Sodak, 2006; Webster-Stratton & Herbert, 1993). Second, the intervention focuses on improving child behavior within the activity settings of mealtime routines in the home (O'Donnell, Tharp, & Wilson, 1993). The activity setting has been viewed as an ecological unit of analysis that may promote the generalization and maintenance of treatment outcomes (Lucyshyn et al., 2004; O'Donnell & Tharp, 1990). Third, a functional assessment of food refusal behavior is supplemented with a feeding assessment and family ecology assessment for the purpose of designing a behavior support plan that is technically sound and contextually appropriate (Lucyshyn et al., 2002). Fourth, implementation training and support are provided to family members who are directly in targeted meal routines in the home. This includes a written behavior support plan, direct training with child, modeling and coaching with parents, and meeting-based problem-solving discussions (Sanders & Dadds, 1993). Fifth, multiple measures of treatment outcomes are assessed, including children's food refusal and acceptance, as well as parents' implementation fidelity and ratings of social validity (Kincaid, Knoster, Harrower, Shannon, & Bustamante, 2002). A final key feature involves the use of strategies designed to promote generalized long-term outcomes. These strategies include general case programming and parents' use of self-monitoring checklists (Horner & Albin, 1988; Sanders & James, 1982). To assess long-term outcomes, measurement may be extended to months and/or years postintervention (Lucyshyn et al., 2007).

The purpose of the present study was to evaluate the efficacy, acceptability, and durability of a family-centered PBS approach to severe food refusal behavior that integrates established evidence-based practices from applied behavior-analytic research on food refusal behavior with the emerging evidence-based practices of PBS. A child with autism and severe food refusal behavior and his family participated in the study.

Method

Participants and Setting

One family of a 6-year-old child with autism participated in the study. The child, Karim, was the second-youngest child in a middle-class Canadian family of Middle Eastern descent. He lived at home with his mother and father, his two older brothers, ages 11 and 9, and a younger brother, age 5, who also had a diagnosis of autism spectrum disorder. At the time of the study, Karim consistently consumed soda crackers, rice, water, donuts, and Dad's Cookies. Foods that Karim had accepted at one time but was no longer accepting included macaroni and cheese, scrambled eggs, hot dogs, and yogurt. His mother reported that they occasionally tried to prompt Karim to eat new foods but that he would engage in severe problem behavior, including throwing food, spitting out food, vomiting, screaming, self-injury (e.g., banging head on table), and physical aggression (e.g., hitting or kicking parent). Reports from an occupational therapist ruled out any organic causal factors. To maintain proper health and development, Karim's parents supplemented his diet by feeding him four cans of Pediasure a day.

One setting in the form of a child snack routine was selected for assessment and intervention. All assessment activities occurred in the kitchen and were implemented by the mother. Initial intensive training sessions occurred in Karim's bedroom and were implemented by the experimenter. The remaining training sessions occurred in the kitchen and were implemented by the mother.

Measurement

This study used a multiple-probe measurement procedure to monitor the dependent variables and to document implementation of the independent variable (Horner & Baer, 1978). Observations during the snack routine were videotaped using a digital video camera and then scored. A computer with a video monitor was used to collect data from each videotaped session.

Observation Sessions

Two kinds of observation sessions were conducted in the snack routine: observation probes with parent and training probes with therapist. Observation probes were conducted during baseline, parent training, generalization, and follow-up phases. During observation probes, the observer videotaped child and parent participation in the snack routine. Training probes were conducted only during the intensive training with therapist. During each training session, the therapist collected data (using a pen and notebook) on Karim's trial-by-trial response to food presentation. Approximately 15% of training probes with the therapist were videotaped for the purpose of conducting interobserver agreement with a second, independent observer.

Dependent Variables

Food Consumption During Training With Therapist

Food consumption included food refusal and food acceptance. These dependent measures were gathered only during training sessions with the therapist. Food refusal included crying or protesting, keeping lips tightly closed, pushing spoon way, and expulsion. Acceptance was defined as either (a) the child's opening his mouth to accept a food item delivered by the therapist and then swallowing that food item or (b) the child's picking up the spoon or food item, placing the food item in his mouth, and then swallowing the food. Food refusal and acceptance were measured as the percentage of trials of occurrence during a training session with therapist. The percentage of trials was calculated by dividing the number of trials that the child engaged in the targeted behavior by the total number of trials and then multiplying that figure by 100.

Food Consumption During Routine With Parent

Child food consumption included self-initiated consumption and total consumption. Self-initiated consumption was defined as the child independently picking up food (i.e., before a prompt from a parent or 10 s after the last prompt from parent), placing the food in his mouth, and then swallowing the food item. Total consumption was defined as either the child's accepting and swallowing the food item independently or his accepting and swallowing the food item within 10 s after presentation of the utensil and/or a physical or verbal prompt from parent. Total and self-initiated consumption was measured using a partial interval recording system (Richard, Taylor, Ramasamy, & Richards, 1999). The observation interval was 30 s. This length of interval closely matched Karim's pace of eating during optimal feeding conditions and thus provided a sensitive measure of change in Karim's eating behavior. The percentage of child self-initiated consumption and total consumption (i.e., self-initiated and parent prompted) was calculated by dividing the number of intervals that the child engaged in the targeted behavior by the total number of intervals and then multiplying that number by 100.

Latency in Minutes to Termination or to Successful Completion of Routine

Karim's problem behaviors were physically harmful to himself and others and discomforting to his mother. For this reason, a criterion level of problem behaviors for terminating the observation of the snack routine was collaboratively defined with his mother (Carr & Carlson, 1993). Latency to termination of the snack routine was defined as the number of minutes that elapsed between the initiation of the routine and (a) the first instance of untolerated problem behavior (e.g., self-injury, physical aggression, vomiting) or (b) the third instance of tolerated behavior (e.g., leaving table, throwing food, expulsion). Latency to successful completion of the routine was defined as the time to completion of all critical steps in the routine without the occurrence of the termination criterion.

Steps Completed in Snack Routine

The mother identified six steps that she wanted her son to complete during the snack routine: come to the table and sit and wait for mom to give snack; eat snack independently or with support; use napkin; stay seated throughout snack; when plate or bowl is empty, put dish in sink; throw napkin in garbage. If the criterion for terminating the routine did not occur, the number of steps completed during the routine was recorded. If the termination criterion occurred, the number of steps completed before termination of the routine was recorded.

Parent Implementation Fidelity of PBS plan

Parental implementation fidelity was defined as accurate implementation of the following six PBS strategies: presentation of foods from a defined instructional universe of foods; visual contingency strategy; positive contingency statement; proactive task prompt; contingent praise; and escape extinction procedure. Approximately one third of the child's intervention sessions were scored using a partial-interval recording system. The observation interval was 1 min. Given that an escape extinction

procedure takes longer to implement than do other strategies in the plan, a 1-min interval was considered a reasonable length of time to measure the mother's use of this procedure, in addition to other strategies in the plan. The percentage of intervals of implementation fidelity was calculated by dividing the number of intervals that the parent exhibited accurate use of the support strategies by the total number of intervals and then multiplying that figure by 100.

Social Validation

The mother evaluated the social validity of the intervention goals, procedures, and outcomes using a 10-item instrument with a 5-point Likert-type scale. The mother completed two evaluations during the intervention phase and two evaluations during the follow-up phase. In the follow-up phase, the first evaluation was completed 2 weeks postintervention, and the second evaluation was completed 26 months postintervention. Average ratings for the mother were used as formative and summative indices of social validity.

Goodness-of-Fit Measure

A goodness-of-fit assessment questionnaire composed of 12 items was adapted from Albin, Lucyshyn, Horner, and Flannery (1996) to evaluate how well the behavior support plan fit with the family's life. The items focused on the following categories relevant to goodness of fit: goals and expectations (e.g., "Does the plan address your highest priority goals?"), congruence with family lifestyle (e.g., "Does the plan disrupt that time of day to the point that stress and hardship will be created?"), implementation effort (e.g., "All things considered, how difficult will it be for you to implement this treatment plan?"), and sustainability (e.g., "If the plan is effective, do you believe you can keep using the strategies for a long time?"). The mother completed the questionnaire twice during intervention and twice during follow-up. The first follow-up questionnaire was administered 2 weeks after intervention was terminated, whereas the second was administered 26 months postintervention. Average ratings were used as indices of contextual fit.

Quality-of-Life Measure

The family's well-being was measured by the *Family Quality of Life Survey* (Park et al., 2003), administered to the parents once during the baseline phase and twice during follow-up (6 weeks and 26 months postintervention). The survey comprises 41 items that assess five family quality-of-life domains: family interaction; parenting; health and safety; family resources; and support for family member with disabilities. For each item, parents rate levels of importance and satisfaction on a Likert-type scale (1 = *very unimportant or dissatisfied*, 5 = *very important or satisfied*). Psychometic evaluations of the instrument has shown that it possesses excellent reliability (Cronbach alpha of .94 on importance ratings and .88 on satisfaction ratings) and concurrent validity (correlation coefficients of .68 and .60, $p < .001$) with two relevant measures of family quality of life (Hoffman, Marquis, Poston, Summers, & Turnbull, 2006; Park et al., 2003).

Interobserver Agreement

A trained observer conducted observations in the home and collected data. The first author served as interobserver agreement data collector. The observer received approximately 5 hr of training before baseline. Baseline data collection began after the observer achieved 90% interobserver agreement for each child behavioral category across two pilot observations in the snack routine. Two independent observers, separated by 1 m and a visual barrier, simultaneously observed the videotape of probe sessions and coded behaviors. Before 26-month follow-up data collection, the original observer was provided with 2 hr of retraining in coding parent and child behavior.

For food consumption with therapist, an agreement was considered when two observers recorded the same target behavior during the same trial. Interobserver agreement checks were completed on 15% of training sessions.

For child food consumption with parent (i.e., total consumption and self-initiated consumption) and for parent implementation fidelity, an agreement was considered when two observers recorded the same occurrence of target behavior during the same interval. Interobserver agreement checks for food consumption were completed in 33% of probe sessions balanced across phases. Agreement checks for parent implementation fidelity were completed in 25% of probe sessions, balanced across intervention and follow-up phases.

Observer agreement for (a) latency to termination or successful completion of routine and (b) number of steps completed was measured using checklists of criterion problem behavior categories and steps in the routine. Two independent observers noted the occurrence of criterion behavior, the steps completed, and the time of termination or successful completion. Observer agreement checks were completed in 15% to 33% of probe sessions for each dependent variable, balanced across phases.

Interobserver agreement was calculated using the following formula: the total number of agreements divided by the number of agreements plus disagreements, multiplied by 100. Average agreements were as follows: 93% for food consumption with therapist, 95% for total consumption with parent, 100% for self-initiated consumption with parent, 100% for latency in minutes to termination or successful completion of routine, 100% for steps successfully completed, and 88% for parent implementation fidelity

Research Design

This study employed a single-subject empirical case study design with one mealtime routine. The design had five phases: baseline, intensive training with therapist, parent training, generalization, and follow-up.

Procedures

The first author served as the primary interventionist throughout the study, conducting all assessments activities and collaborating with the mother on intervention development and implementation activities.

Preliminary Screening Assessment

The *Behavioral Feeding Assessment Parent Interview* (Budd, 1992) was administered to determine whether the child's problematic feeding warranted the need for an intensive intervention for food refusal. The mother answered semistructured, open-ended questions about Karim's feeding history, mealtime habits, current feeding problems, and current feeding techniques employed by her and the father. Information gathered from the screening tool was then incorporated into the comprehensive assessment.

In addition, the primary interventionist conducted a family routine assessment that provided information about daily mealtime routines. The mother identified home-based mealtime routines that were valued yet problematic; she prioritized the routines for intervention; and she selected an afternoon snack routine as her first priority. The mother then described her vision of a successful snack routine in terms of its key elements (e.g., time, place, people, tasks, goals; Lucyshyn et al., 2002).

Baseline

Observation probes were conducted in the snack routine to measure the preintervention percentage of intervals of food consumption (prompted and self-initiated), the latency in minutes to termination or successful completion of the routine, and the number of routine steps successfully completed. The *Beach Center Quality of Life Survey* (Park et al., 2003) was administered once during baseline to assess the family's quality of life before intervention.

Comprehensive Assessment

Functional assessment. A functional assessment of the child's behavior was conducted using the *Functional Assessment Interview Form* and the *Functional Assessment Observation Form*, developed by O'Neill, Horner, Albin, Sprague, Storey, and Newton (1997). One hypothesis about the function of Karim's problem behavior emerged from the assessment: Karim engaged in problem behavior, including food refusal, screaming, self-injury, and aggression, to escape the demand to eat nonpreferred foods and to escape demands to sit at the table and eat preferred foods.

Family ecology assessment. The goal of this semistructured interview was to gather information about the family's ecology for the purpose of designing a behavior support plan that was contextually appropriate. Through a series of informal meetings with the mother and one meeting with both parents, the interventionist gathered information about family strengths, social supports and resources, stressors, and goals for the child and family.

Preference Assessment 1: Determining food preferences of nonpreferred (novel) foods. The purpose of the preference assessment was to develop a hierarchy of most acceptable to least acceptable nonpreferred foods to be presented to Karim as part of an antecedent intervention. However, the assessment revealed that this type of intervention would not be appropriate for Karim, because he vehemently refused all food presentations. Consequently, we decided that an escape–extinction procedure that involved gently depositing food on or inside the child's lip would be a more appropriate and effective strategy (A. Baretto, personal communication, January 12, 2004). A hierarchy of foods was then developed, based on the ease to which the experimenter was able to deposit, with minimal resistance from Karim, a small amount of food on or inside his lip.

Preference Assessment 2: Determining reinforcers for intervention. A second assessment was conducted to compare the three snack foods that Karim ate at the time of the study to determine a hierarchy of edible reinforcers for intervention. As in the preference assessment of novel foods, Karim refused to eat or touch each item that was presented to him. As an alternative, he was

given free access to each of the three food items for 5 min. The amount of food consumed and the order in which the items were consumed were recorded. Results from this assessment indicate that crackers, a staple for Karim, was the most preferred food. In addition, a toy play assessment was conducted to determine other tangible reinforcers to use during intervention. First, the mother identified four toys with which her son liked to play. Each toy was then paired with the other three and randomly presented to Karim 5 times each, yielding a total of 15 presentations per toy. Toy preference was determined by the number of times the the toy was chosen out of the total number of times that it was presented.

PBS Plan Development

After the comprehensive assessment, a multicomponent PBS plan was designed with Karim's mother. A competing behavior analysis framework guided the selection of support procedures designed to make problem behaviors irrelevant, ineffective, and inefficient at achieving their purpose (Lucyshyn et al., 2002). The plan comprised 10 strategies (see Table 1).

To ensure that the plan was as simple and contextually appropriate as possible, the interventionist and the mother reviewed the family ecology information and adjusted the proposed strategies to better fit the snack routine. The following example illustrates how features of the family's ecology contributed to the selection of support procedures: After years of struggling to get her son to try new foods, the mother was not confident that she would have the strength or emotional toughness needed to transform her son's eating patterns. She was also worried that starting intervention in the natural setting (i.e., kitchen) might upset her other children who were home at that time of day. The plan was therefore adjusted in response to these concerns so that initial training began with the therapist and then transferred to the mother once Karim's feeding behavior improved. In addition, training began away from the kitchen, upstairs in Karim's bedroom, with the therapist sitting next to Karim at a small table in the corner of the room.

Implementation Support

Three phases of implementation were sequentially introduced: intensive training with therapist, parent training, and generalization promotion.

Intensive training with therapist. The interventionist began intensive training with Karim. Training with the therapist served two purposes: to bring Karim's eating behavior under stimulus control of the therapist and the targeted foods and to set the stage for a transfer of stimulus control from the therapist to the mother in the natural setting of the snack routine (i.e., the kitchen). During intensive training, the therapist implemented an enhanced version of the PBS plan that included five additional strategies designed to establish stimulus control over Karim's eating behavior (see Table 2). Training sessions occurred 2 to 4 times per week ($M = 62$ min) and required 39 sessions across 14 weeks for a total of 40 hr.

Parent training. Once Karim consistently consumed full-sized spoonfuls/bites of five of the nine targeted foods, the parent training phase commenced. Parent training occurred in vivo at the kitchen table. Behavioral parent training strategies employed by the interventionist included modeling, coaching, feedback, and parental use of a self-monitoring checklist (Sanders & Dadds, 2003). In addition, weekly meetings were held to review progress, to role-play behavior support strategies, and to solve problems in implementation, as indicated by the implementation fidelity data. Training sessions occurred 1 to 2 times per week ($M = 1.9$ days/week) and involved 15 sessions across 8 weeks for a total of 14 hr.

Generalization promotion. Following the parent training phase, a phase was implemented that focused on promoting generalization, and two strategies were used. The first procedure, general case programming, promoted generalization of Karim's eating behavior to nontrained foods. This strategy involved establishing an instructional universe of snack foods that sampled the range of relevant stimulus properties and response requirements (Horner & Albin, 1988). The mother selected three groups of snack foods that varied in type (e.g., fruit versus dairy), texture (e.g., crunchy versus blended), and feeding method (e.g., fingers versus utensils). The second generalization promotion strategy, train to generalize, was used to promote the father's use of support procedures during the snack routine (Stokes & Baer, 1977). The experimenter prompted the mother to teach the father to implement the behavior support procedures with Karim during the snack routine.

Follow-up. Following termination of implementation support, follow-up measures were gathered in two waves. The first was collected 1, 5, and 6 weeks postintervention and the second, 26 months postintervention. After a follow-up measurement, training and support were provided as needed or requested.

Table 1
Positive Behavior Support Plan Strategies

Strategy	Description
Daily eating schedule	Parent establishes set eating routines through out Karim's day, allows 2–3 hr between meals. To ensure that Karim maintains proper health and nutrition, parent continue to give him Pediasure 4 times a day, 30–60 min after a meal.
General case programming	Parent presents to Karim snack foods that adequately sample the range of stimulus properties and response requirements of her envisioned instructional universe of snack foods—namely, crackers with spread, fruit, and soft-blended foods (e.g., pudding). During each snack, parent presents foods from at least two of the three groups.
Stimulus fading of amount of food	Parent teaches Karim to eat new nonpreferred foods, presenting three to four pea-sized amounts on a spoon. If the targeted portion size is accepted and consumed (without gagging) on three consecutive snack sessions, parent increases portion size by a specified amount (one-quarter spoonful, one-half spoonful, three-quarter spoonful). Parent continues this step until Karim is consuming a portion size that is nutritionally appropriate for his age (i.e., full child-size spoonful of food).
Visual strategies	Parent uses two picture sequences with Karim: a picture sequence to increase Karim's knowledge and memory of routine steps and expectations (e.g., eat snack, put plate in sink, throw napkin in garbage, ask for break) and a visually mediated positive contingency. The contingency visually communicates the amount of food that he needs to eat (e.g., three pictures of a food = three bites) and the reinforcer that he will get after eating the expected amount of food (e.g., access to Game Boy).
Positive contingency statement	Parent tells Karim what behavior he needs to do and the positive reinforcer that he will get after engaging in the behavior (e.g., "Finish your food and then you can [get reinforcer]"). The reinforcer can be a preferred item (e.g., Game Boy) or an activity (e.g., playing outside).
Proactive task: Prompting with prompt fading	Parent uses prompts with Karim that promote correct responses to relevant stimuli in eating routine. These prompts are proactive because they occur before performance errors or problem behavior occurs. To avoid Karim's becoming prompt dependent, parent fades from most to least prompts as quickly as possible—that is, from physical prompts to partial physical prompts to gestural prompts to specific verbal prompts to nonspecific verbal prompts.
Contingent praise	Parent delivers praise contingent on Karim's accepting and consuming food and trying, improving, and independently performing steps in routine. Praise may involve an evaluative comment and/or a descriptive comment (e.g., "Great! You ate all of your apple!")
Contingent access to preferred toy or activity	Parent delivers a preferred toy or activity (e.g., Game Boy, playing outside) contingent on Karim's consuming the targeted amount of food.
Escape extinction procedure	If Karim engages in food refusal behavior, parent continues to hold the spoon of food up to Karim's lips, repeating the demand "Take a bite" every 30 s until the food is accepted and consumed. If Karim expels the food, parent presents another spoonful of the same food to Karim until it is accepted and consumed. Parent ignores minor problem behavior (e.g., turning head, pushing spoon away, crying or screaming) and redirects him to task (e.g., "Eat your food").
De-escalation procedure	If Karim engages in major problem behavior, parent minimizes reinforcement by moving away from aggression; quietly blocking self-injury and redirecting when calm; ignoring throwing, prompting hands down, and redirecting; and/or quietly blocking leaving seat and redirecting when calm. If Karim escalates 3 times, meal is terminated.

Results

Implementation of Family Support Approach Results

Eight dependent variables were used to evaluate the impact of implementation of the family support approach: food consumption during training with therapist; food consumption during routine with parent; latency in minutes to termination or successful completion of routine; steps successfully completed; parent implementation fidelity; goodness-of-fit index; social validity rating; and quality-of-life index. Results are summarized below.

Food Consumption During Intensive Training With Therapist

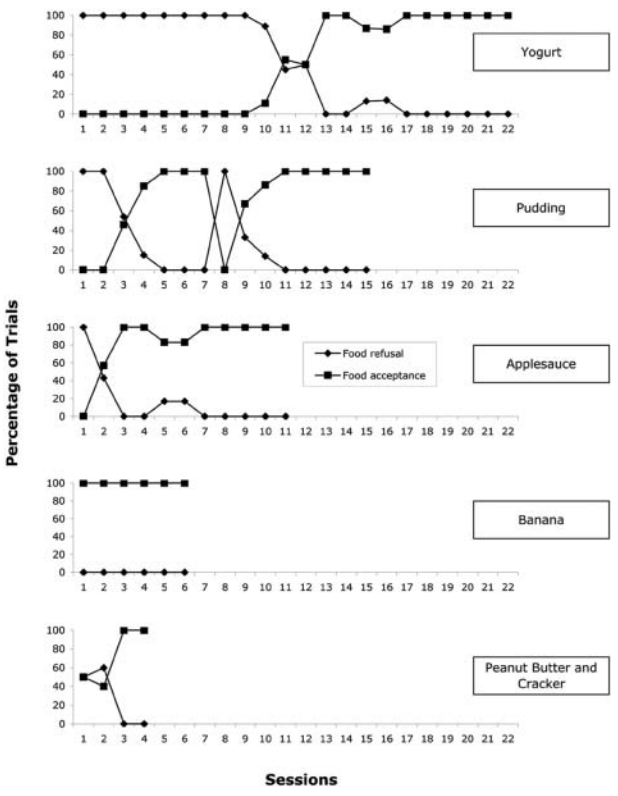
Figure 1 shows the percentage of trials of food consumption and refusal during intensive training with therapist. Foods were presented to Karim in the following

Table 2
Strategies Implemented During Intensive Training With Therapist

Strategy	Description
Massed trials of targeted foods	The therapist teaches Karim to accept and consume a targeted new food by presenting the food to him 10 times in a row. Each presentation of food is represented by a picture symbol attached to a plastic strip. After a trial is complete, the therapist or Karim pulls off the picture symbol and counts how many trials are left in the session. After 10 trials are complete, the therapist gives Karim a 10-min break, followed by another 10 presentations of the targeted food.
Stimulus fading of type of food	The therapist begins the feeding intervention with preferred foods (e.g., crackers and cookies). If the percentage of trials of acceptance is above 80% for two to three consecutive sessions, the therapist introduces targeted nonpreferred foods, beginning with soft-blended foods (e.g., pudding, yogurt). Soft-blended foods are chosen first because such foods can be easily deposited on or inside Karim's lip and are easier for Karim to consume. If the percentage of Karim's acceptance for soft-blended foods is 80% or above for two to three consecutive sessions, the therapist introduces a new type of food—fruit (e.g., banana). Once Karim reaches the desired criterion with a fruit, a cracker with a type of spread (e.g., peanut butter) is then introduced.
Shaping procedure	The therapist teaches Karim to accept and consume targeted nonpreferred foods by differentially reinforcing successive approximations of the terminal behavior (i.e., accepts and swallows a pea-sized amount of food). The progression of successive approximations to the terminal goals include the following: tolerating the therapist depositing food on or inside bottom lip; sitting calmly in chair and tolerating therapist depositing food on or inside bottom lip; opening mouth to accept spoon but spitting out food; opening mouth to accept food and swallowing food within 30 s.
Contingent-preferred food or toy	The therapist delivers a preferred food (e.g., cookie, cracker) or a preferred toy contingent on Karim's meeting the desired approximation in the shaping hierarchy.
Escape–extinction procedure	The therapist holds the spoon up to Karim's lips until there is an opportunity to deposit the food into his mouth. If necessary, another therapist uses nonaggressive physical restraint to keep Karim from leaving his chair or pushing the spoon away with his mouth. Once Karim is behaving cooperatively (i.e., sitting in his chair and allowing the therapist to present the spoon), the second therapist is faded from the feeding sessions.

order: yogurt, pudding, applesauce, banana, and peanut butter and cracker. Once Karim was eating an age-appropriate portion of one food, the next food was introduced. For yogurt, Sessions 1 through 9 evidenced a stable pattern of problem behavior; food refusal averaged 100% of trials, and food acceptance averaged 0% of trials. During Sessions 10 through 14, there was a marked improvement in Karim's eating. Food acceptance rose to 100% of trials, and food refusal fell to 0% of trials. After a temporary deterioration in food acceptance during Sessions 15 and 16 (average 87% of trials), food acceptance maintained at 100% of trials and food refusal at 0% of trials for the remaining six sessions. The introduction of pudding evidenced marked improvement in Karim's acceptance of new foods. Karim accepted his first spoonful of pudding in the third session. From Sessions 3 to 5, food acceptance increased to 100% of trials and remained at this level until Session 8, when a precipitous return to 0% of trials was observed. During this session, Karim was presented with a new flavor of pudding (chocolate), which he vehemently refused. Vanilla pudding was then reintroduced, and it remained the target food for the duration of training. Sessions 9 to 11 evidenced a return to previously obtained food acceptance levels, which stabilized at an average of 100% of trials for food acceptance and 0% of trials for food refusal across the final four sessions (12–15). The introduction of applesauce evidenced continued improvement in Karim's acceptance of new foods. He accepted his first spoonful of applesauce during Session 2 (43% of trials), and acceptance improved and maintained across the nine remaining sessions (80%–100% of trials). For bananas, initial training evidenced immediate food acceptance (100% of trials) and no food refusal (0% of trials). This improvement maintained across the five remaining sessions. Finally, the introduction of peanut butter and crackers evidenced a temporary deterioration in Karim's eating behavior. The first two sessions evidenced food refusal behavior at an average of 55% of trials and food acceptance at an average of 45% of trials. During the final two sessions, however, food acceptance improved to an average of 100% of trials.

Figure 1
Percentage of Trials of Consumption During Intensive Training With Therapist



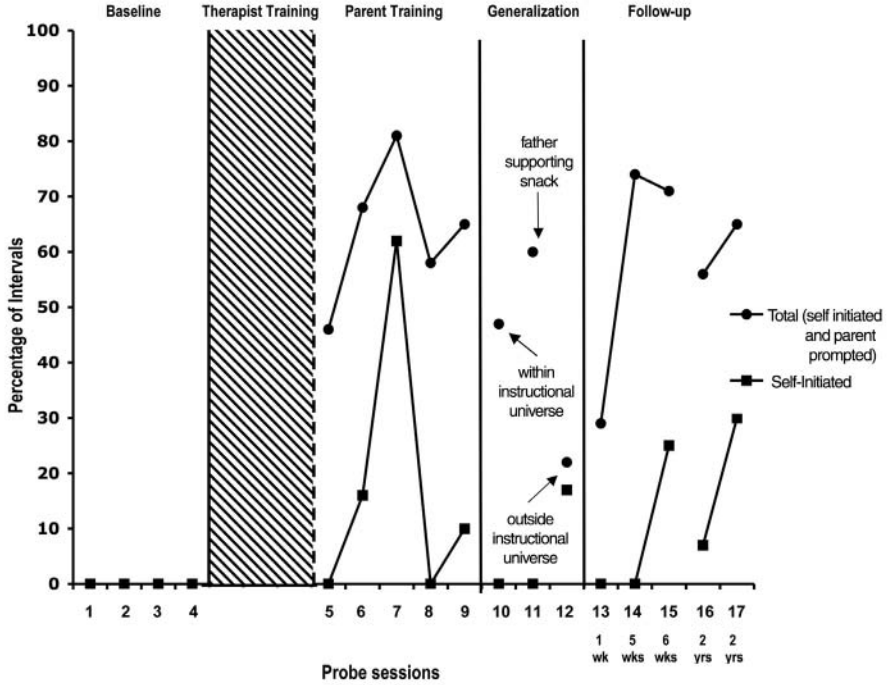
Food Consumption During Routine With Parent

Figure 2 shows the percentage of intervals of total consumption (i.e., parent prompted + child self-initiated) and child self-initiated consumption within the snack routine. During baseline, total consumption and self-initiated consumption averaged 0% of intervals. During parent training, marked improvements in total food consumption were evidenced. Average total consumption increased to 64% of intervals (range = 46%–81%). Self-initiated consumption, however, evidenced only a modest increase, to an average of 18% of intervals (range = 0%–62%). During the generalization promotion phase, total consumption decreased to 47% of intervals (range = 22%–60%), whereas self-initiated consumption dropped to 6% of intervals (range = 0%–17%). During follow-up, total consumption and self-initiated consumption maintained at an average of 56% of intervals (range = 29%–74%). Self-initiated consumption, however, evidenced a slight decrease, to an average of 12% of intervals (range = 0%–30%).

Steps Successfully Completed

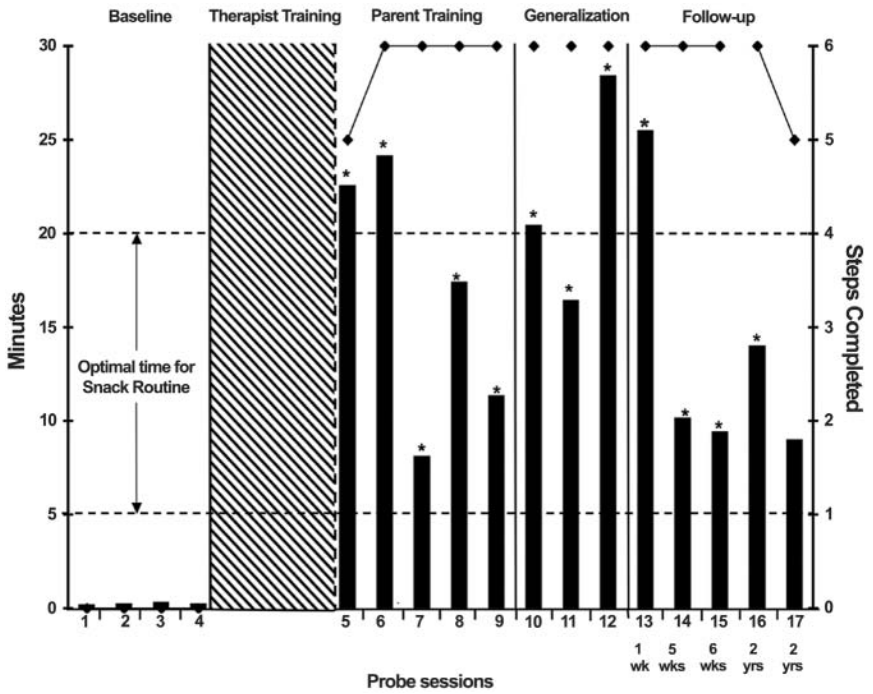
Figure 3 shows the number of steps completed during the snack routine. During baseline, Karim completed an average of zero steps in the routine. Following the introduction of parent training, there was an immediate and

Figure 2
Percentage of Intervals of Food Consumption During the Snack Routine



Note: Total includes self-initiated and parent-prompted consumption.

Figure 3
Steps Successfully Completed and Latency in Minutes to Termination or Successful Completion of Routine



Note: Diamonds (♦) indicate number of steps completed during the snack routine. Bars indicate latency in minutes; bars with asterisks (*) indicate that the routine was successfully completed.

dramatic level improvement. The number of steps completed increased to an average of 5.8 of 6.0 steps (range = 5–6). During generalization promotion, the number of steps completed further improved to an average of 6 steps (i.e., 100% of steps). This improvement remained stable during follow-up, with an average of 5.8 steps completed (range = 5–6).

Latency in Minutes to Termination or Successful Completion of Routine

Figure 3 shows the latency in minutes to termination owing to problem behavior or to successful completion of the snack routine (i.e., all critical routine steps completed and criteria for termination of routine not reached). Figure 3 also shows the mother's ideal time range for completion of the routine (5 to 20 min, as indicated by the horizontal lines). During baseline, Karim spent an average of 24 s in the snack routine (range = 18–32 s). All sessions required termination of the routine because the criterion for problem behaviors was met. During parent training, latency improved to an average of 17 min (range = 8–24 min). For each session, all critical routine steps were completed, and the criterion for termination was not met; thus, all routines were successfully completed. In addition, 60% of the sessions were completed within the optimal time range (i.e., between 5 and 20 min). During the generalization phase, latency averaged 22 min (range = 15–28 min). All routines were completed successfully, but only one of three was completed within the optimal time range. During follow-up, latency decreased to an average of 14 min (range = 9–25 min). Four of five routines were completed successfully, with four of the five being done within the optimal time range.

Table 3
Ratings from *Family Quality of Life Scale*

	Average Satisfaction Score		
Domain	Preintervention	Postintervention (6 weeks)	Postintervention (26 months)
Family interaction	3.7	4.7	4.3
Parenting	2.9	3.9	4.2
Health and safety	3.4	4.6	5.0
Family resources	2.5	3.6	4.6
Supports for persons with disability	2.4	3.8	2.8

Parent's Use of Support Plan Procedures

Parental treatment integrity data were gathered across four observation sessions during the parent's training, generalization, and follow-up phases. These data show an overall average level of treatment integrity of 68% of intervals (range = 64%–73% of intervals). The source of this moderate level of treatment integrity was the mother's inaccurate use of the proactive task prompt strategy. However, for the other five support strategies, the parent's overall implementation fidelity averaged 93% of intervals (range = 81%–100% of intervals).

Goodness-of-Fit Ratings

For Karim's mother, the average contextual fit index (1 = *poor fit*, 5 = *good fit*) across four evaluations—distributed across parent training, generalization promotion, and follow-up phases—was 4.4 (range = 4.1–4.5). Overall, Karim's mother abidingly believed that the support plan fit well with the family's ecology.

Social Validity Ratings

Across four evaluations (1 = *disagree*, 5 = *agree*), the mother's average social validity rating was 4.6 (range = 4.3–4.8). Overall, the mother consistently believed that the plan goals, procedures, and outcomes were acceptable.

Quality-of-Life Ratings

Table 3 presents the average score across five quality-of-life domains before and after the implementation of the support process (1 = *very dissatisfied*, 5 = *very satisfied*). These data suggest that following 7 months of implementation support, quality of life substantially improved for Karim and his family. From the parents' perspective, the greatest shift appeared in the areas of support for persons with disability, health and safety, and family resources.

Discussion

The results from this case demonstration, comprising multiple outcome measures, suggest a strong association between the family-centered PBS approach and durable improvements in a child's eating behavior within a valued snack routine. The therapist's initial implementation of the PBS plan was associated with gradual improvement in eating behavior across a 14-week period. Food acceptance increased from 0% of trials to 100% of trials for five nonpreferred foods. Karim's rate of acceptance also increased significantly with each new food. This improvement in eating behavior remained stable following the transfer of stimulus control from the therapist to the parent in the natural setting of the snack routine. Karim showed high levels of food acceptance (average of 63% of intervals) and participated successfully in 100% of the snack routines, of which 60% were completed within the amount of time desired by the parent. More important, at 26 months postintervention, improvements in eating behavior and routine participation largely maintained. Karim continued to show high levels of acceptance of target foods (average of 56% of intervals) and meaningful gains in independence while eating. He progressed from being spoon-fed his entire snack to sitting at the kitchen table alone and using a utensil to feed himself with only minimal assistance from his mother. Minimal assistance involved brief verbal reminders from a distance or taps on his bowl or utensil as a partial physical prompt to continue eating. Such assistance most often occurred toward the end of the snack routine, when Karim was nearing satiation and therefore less motivated to finish his food. During follow-up, Karim successfully completed 80% of routines, of which 60% were within the desired time frame.

In addition, implementation of the support process was associated with a broader range of improvements in a child's eating behavior and family life. Improvements in eating behavior generalized to two new nonpreferred foods and to the father's implementing the snack routine. Moreover, by the conclusion of implementation support, the parents reported substantial improvements in family quality of life. Additional validation of the support approach was found in high parent ratings of goodness of fit and social validity. High parental treatment integrity data for five of the six support strategies suggests that implementation support procedures (e.g., implementation checklist, modeling, coaching) were efficacious in (a) developing the mother's capacity to effectively support the child's participation in a valued snack routine and (b) empowering the mother to support her son to expand his repertoire of foods within and outside an established instructional universe of snack foods.

At 6 weeks postintervention, Karim's mother reported several collateral effects on Karim and his family. The mother reported that Karim was accepting foods that he had stopped eating several months before the study commenced (e.g., macaroni and cheese, scrambled eggs, hot dogs). She also reported that with the increase in Karim's caloric intake owing to the new foods in his diet, he required only one 235 ml can of Pediasure a day. Finally, the mother reported that Karim had begun to willingly accept medicine. In addition, teaching Karim to sit at the

table, feed himself using a utensil, and put his dishes away appeared to change his mother's perception of him as a child who needed constant support to one who could be taught to be more independent. Given this change in perception, the mother began to assign Karim other responsibilities, such as dressing himself in the morning and putting his shoes and coat away after school.

During 2 years postintervention, Karim's mother reported that many of the collateral effects maintained. She reported that Karim continued to accept many of the foods introduced to him during intervention, in addition to the foods that he had stopped eating before the study, and that he continued to require only one can of Pediasure a day. She also reported that he continued to accept medicine and that he maintained many of the independent living skills that she had taught him. In addition, previously reported improvements in quality of life maintained, with the exception of one area: supports for persons with disability. In this area, the parents' level of satisfaction returned to ratings obtained during baseline (2.8 out of 5.0). This is not surprising considering that the family had no contact with the interventionist for 2 years.

The study contributes to and extends several findings in the feeding literature. The study provides further evidence of the efficacy of a parent-implemented behavioral treatment plan for a child with food refusal behavior (Anderson & McMillan, 2001; Galensky et al., 2001; Luiselli, 2000; Werle et al., 1993). It also provides a case demonstration of the utility of functional assessment procedures for understanding food refusal and related mealtime behaviors and for designing multicomponent interventions that are logically linked to the purpose of problematic feeding behavior and the factors that set up or trigger such behaviors (Galensky et al., 2001; Girolami & Scott, 2001; Levin & Carr, 2001; Luiselli, 2000; Werle et al., 1993). The study also suggests the usefulness of additional assessment procedures that focus on aspects of the feeding disorder (Galensky et al., 2001; Kerwin, 2003). Outcomes from the study also suggest that in severe cases of food refusal behavior, it is useful to first start the feeding intervention with a therapist and, once the child's eating behavior has improved, systematically transfer stimulus control to the parent. This strategy speaks directly to the question posed by Galensky et al. (2001), in which the authors asked if they could have done anything differently to prevent a family from opting out of their study. In the present study, it appeared that delaying the parent's involvement until the behavior had improved with the interventionist helped to reduce the negative impact of problem behavior on the family.

The findings of this investigation make four unique contributions to the literature on behavioral feeding interventions. First, it demonstrated how a parent of a child with autism and severe food refusal behavior can serve as a collaborative partner during a process of assessment, plan development, and intervention. The mother actively participated in several aspects of the research and clinical support process. For example, she shared knowledge and decision making about Karim's problem behavior, the types of reinforcers, and the pace and location of training. Second, the study extends the behavioral feeding literature by documenting the durability of outcomes 26 months postintervention. Third, it is the first example in the feeding literature to use a goodness-of-fit framework to inform the design of a multicomponent support plan. Knowledge of the overall family ecology, as well as the specific ecology of the meal routine, was associated with high parental implementation fidelity for five of the six strategies and with meaningful and durable changes in the child's behavior and participation in the routine.

Fourth, the study demonstrated how the use of multiple measures can paint a holistic picture of change in not only the child's eating behavior but also the child's participation in the routine and the family's quality of life. Taken together, these additional measures serve to strengthen the internal validity of the empirical case study design.

Although the results of this study are encouraging, several limitations in the design and training procedures warrant consideration. First, an empirical case study design cannot control all threats to internal validity, such as history and maturation. Thus, the design does not allow us to unequivocally verify a functional relationship between implementation of the support approach and improvements in Karim's eating behavior and participation in the snack routine. At the same time, Kazdin (1992) has described how case study designs, depending on the results obtained, can provide a basis for drawing scientifically valid inferences about the effect of an intervention. Specifically, characteristics of this study—such as continuous assessment of objective data, stable levels of performance before and after intervention, and an immediate and large treatment effect—help to rule out threats to internal validity in a manner similar to a true experiment. Second, the external validity of the study is limited because of the participation of only one child and family. Third, moderate parental implementation fidelity data (64%–73% of intervals) suggest that the interventionist was not entirely effective at teaching the mother to fade her task prompts as defined in the proactive task prompt strategy. Although parental training, including role-play and precorrection, was associated with the mother's reducing her level of prompting from spoon-feeding

Karim to using partial verbal or physical prompts, the mother was not observed to sufficiently fade out her prompts so that Karim could self-initiate eating more often. Three hypotheses may explain the moderate treatment integrity obtained: First, the interventionist may not have provided sufficient training to the parent on how to fade task prompts; second, Karim's mother may have shown reactivity to the observation protocol by using more prompts during the observation than during the training sessions, to ensure that Karim ate all of his snack during the desired 20 min; and, third, Karim's mother may have viewed the level of independence that Karim had achieved as being acceptable, given the extreme measures that her family had to take in the past to ensure that he be sufficiently nourished. Support for this third hypothesis may be found in the mother's consistently high ratings of social validity, contextual fit, and quality of life during intervention and follow-up phases. Fourth, although the data suggest that the support process was effective for Karim and his mother, it cannot be characterized as being efficient or inexpensive in terms of time and effort. The outcomes summarized above required 54 hr of direct support (training with therapist and parental training) distributed across 5 months. Parental training research suggests that for children with severe clinical disorders, intensive training programs (i.e., 50–60 hr) are more likely to produce positive effects (Ollendick & Cerny, 1981).

Results of the study offer three implications for practitioners and researchers who are involved in behavioral feeding interventions. First, the study demonstrated an enhanced model of support for families of children who exhibit severe food refusal—one that is consistent with what researchers in the behavioral feeding literature recommend as next steps in the treatment of food refusal (Werle et al., 1993, 1998). Integrating the expanded features of PBS (e.g., collaborative partnership, contextual fit, activity setting as a unit of analysis) with established evidence-based practices in applied behavior analysis research on feeding disorders (e.g., functional assessment, multicomponent support plans, behavioral parent training) was associated with a wider range of outcomes than previously reported in the feeding literature.

Second, if interventionists wish to promote long-term meaningful change in feeding behavior, then ongoing maintenance support may be essential (Carr et al., 1999). One anecdote gathered during 2-year follow-up illustrates this point: At 6 months postintervention, Karim's mother reported that her family went to the Middle East for 1 month. During this time, she did not serve Karim fruit, a targeted snack food, because it was not available. Upon returning to British Columbia, she stopped including fruit in Karim's daily snack because she feared that given no exposure to fruit for a month, he might engage in problem behavior. During follow-up measurement, we asked the mother to include fruit among Karim's snack foods because it was a targeted food of the study. The mother did not do so during the first 2-year follow-up probe but with further prompting did so during the second. These data show that Karim ate the fruit despite the mother's apprehension, which suggests that if the interventionist had reinitiated contact much earlier and simply encouraged the mother to continue presenting the foods that Karim had learned to eat, she would have learned much sooner that Karim would still accept fruit despite the 1-month absence. The family's trip to the Middle East is an example of a variety of setting events that are likely to occur during the child and family's life together. In this case, the setting event (i.e., 1 month away from all opportunities to eat fruit) served to increase the value to the mother of avoiding the introduction of fruit to her son for fear that he might engage in intense food refusal behavior. The mother's subsequent nondelivery of fruit was negatively reinforced by the avoidance of problem behavior after she reinitiated the snack routine with her son upon return to Canada. Unless such setting events and forms of negative reinforcement are assessed and addressed shortly before or after they occur, they are likely to disrupt progress. However, as this anecdote suggests, all that may be required to prevent a relapse is a bit of encouragement to the parent to maintain plan goals and procedures.

Third, the range of collateral effects reported by the parents suggests the importance of targeting family routines that are highly valued and include behavior changes important to the child and family. Improving Karim's eating may exemplify what Rosales-Ruiz and Baer (1997) refer to as a *behavioral cusp*. A cusp is a behavior that when changed systematically, causes further behavioral changes that are significant yet not formally programmed. In this study, teaching Karim to eat a range of new foods contributed to the expansion of his eating behavior to several nontrained foods, to his no longer requiring Pediasure to meet his nutritional requirements, and to his accepting medicine. The concept of behavioral cusp, however, does not completely account for the broader collateral effects on the family. The concept of the activity setting or daily routine (O'Donnell et al., 1993), however, may account for these broader reported outcomes. Rather than focus solely on intervening on child problem behavior and food acceptance, we expanded our focus to intervening on a larger, ecological unit of analysis—the activity setting of a snack routine. In this light, the snack routine may be characterized as an

ecological cusp. Theoretically, an ecological cusp expands the concept of a behavioral cusp by including the social and physical ecology in which problem behavior occurs. The concept of an activity setting as an ecological cusp suggests that the selection of specific family routines as a focus of assessment and intervention may contribute to changes in parent and child behavior not formally targeted within a routine. Therefore, the concept may contribute to improving the efficiency and effectiveness of intervention. However, the identification of such routines, or ecological cusps, would require the systematic development of a set of criteria for selecting and prioritizing target routines (Bosch & Fuqua, 2001).

Future research should consider several areas. First, to strengthen the internal and external validity of a PBS approach with families of children with developmental disabilities and food refusal behavior, the use of experimental single-subject research designs is recommended. External validity would particularly be enhanced if the efficacy of the process were demonstrated with diverse families, including families of children at different age levels, single-parent families, and families of different cultures. In addition, the concept of an ecological cusp, although promising, requires further conceptual and empirical development.

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