Development and Content Validation of the Pediatric Eating Assessment Tool (Pedi-EAT)

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Purpose: In this article, the authors describe the development and content validation of a parent-report measure of problematic eating behaviors: the Pediatric Eating Assessment Tool (Pedi-EAT).

Method: In Phase I, items were generated from parents’ descriptions of problematic feeding behaviors of children, review of literature, and review of existing eating-related instruments. In Phase II, interdisciplinary experts on pediatric eating behaviors rated the items for clarity and relevance using content validity indices (CVI) and provided feedback on the comprehensiveness of the instrument. In Phases III and IV, 2 groups of parents of children with and without feeding difficulties participated in cognitive interviews to gain respondent feedback on content, format, and item interpretation. The authors analyzed interviews using matrix display strategies.

Results: Experts rated the total scale CVI > .90 for both relevance and clarity; item CVI ranged from .67 to 1.0 for relevance and .5 to 1.0 for clarity. Analysis of each item with low scores, along with experts’ and parents’ feedback, resulted in refinement of the items, scoring options, and directions. Experts and parents added additional items. Readability after refinements was acceptable at less than a 5th-grade level.

Conclusion: The Pedi-EAT was systematically developed and content validated with input from researchers, clinicians, and parents.

Key Words: eating behavior, content validity, parent report, instrument development, cognitive interviews, feeding difficulty

The eating behaviors children express reflect codependent interactions among intrinsic properties of the child, the environment, and dimensions of the task itself (Thelen & Smith, 1994). Problematic eating behaviors, such as refusal of specific or all foods, gagging during mealtime or in anticipation of eating, avoidance of specific food textures, or insistence on food being offered in a certain way, pose significant challenges for children, families, and health care providers (Arvedson, 2008; Linscheid, 2006; Stoner, Bailey, Angell, Robbins, & Polewski, 2006). As problematic behaviors repeat over time, they can become entrenched and difficult to change, and nutrition and growth often suffer (Williams, Riegel, & Kerwin, 2009). Families report it can be difficult to gain a clinician’s agreement that a problem exists (Rogers, Magill-Evans, & Rempel, 2012; Thoyre & Van Riper, 2010), and clinicians are often faced with a problem that may be difficult to differentiate from typical behavior of children (Kerzner, 2009). Comprehensive measurement of eating behaviors is a necessary component of the diagnostic process (Williams et al., 2009) and critical to moving clinical care and empirical study of childhood eating problems forward.

In this article, we describe the conceptual framework and development of a new instrument, the Pediatric Eating Assessment Tool (Pedi-EAT). We present content validity testing of the instrument by two methods: (a) testing of the relevance and clarity of items and comprehensiveness of the Pedi-EAT by interdisciplinary clinical and research experts and (b) content validation by parents of children with and without feeding difficulty using cognitive interviews. We present readability testing and plans for further psychometric testing.

Background and Conceptual Framework

Many families seek assistance in solving feeding issues of their young children. Recent published estimates indicate...
approximately 20% of families of typically developing children have feeding concerns (Mascola, Bryson, & Agras, 2010; Wright, Parkinson, Shipton, & Drewett, 2007). This number increases to as high as 80% when children have developmental disabilities (Gal, Hardal-Nasser, & Engel-Yeger, 2011; Sullivan et al., 2000), such as autism (Emond, Emmett, Steer, & Golding, 2010; Martins, Young, & Robson, 2008; Rogers et al., 2012) or cerebral palsy (Erkin, Culha, Ozel, & Kirbiyik, 2010; Wilson & Hustad, 2009). Feeding difficulties are common among children with genetic disorders (Cooper-Brown et al., 2008; Dobbelsteyn, Peacocke, Blake, Crist, & Rashid, 2008) and multiple medical conditions, such as past history of prematurity (DeMauro, Patel, Medoff-Cooper, Posenetcheg, & Abbasi, 2011; Samara, Johnson, Lamberts, Marlow, & Wolke, 2010; Törölä, Lehtihalmes, Yliherva, & Olsén, 2012), congenital heart disease (Medoff-Cooper, Naim, Torowicz, & Mott, 2010), gastrointestinal problems (Wu, Franciosi, Rothenberg, & Hommel, 2012), cystic fibrosis (Sheehan et al., 2012), and Type 1 diabetes (Patton, Williams, Dolan, Chen, & Powers, 2009).

In all feeding difficulties, the specific eating behaviors exhibited are central features of the problem (Williams et al., 2009). A wide range of eating behaviors can be exhibited, even within the same condition; and many conditions share the same problematic behaviors (Berlin, Lobato, Pinkos, Cerezo, & LeLeiko, 2011). Broad categorization or classification of a feeding problem, such as “food refusal,” can have multiple etiologies (Berlin et al., 2011; Bryant-Waugh, Markham, Kreipe, & Walsh, 2010) and therefore offers limited diagnostic value. Alternatively, thorough description of problematic behaviors provides the basis for determining the most likely etiology of the problem and is essential for the development of targeted and effective interventions. A means of measuring these behaviors is therefore essential.

Dynamic systems theory guides our understanding of the development of eating behaviors during childhood (Thelen & Smith, 1994). Problematic behaviors are viewed as an emergent property of the continuous interaction of multiple subsystems within the child, the environment, and features of the task itself. Because subsystems are dynamic, interacting, and changing as the result of development, learning, experience, and health, the expression of problematic eating behaviors may change over time (Davids, Button, & Bennett, 2008; Rogers et al., 2012; Rommel, De Meyer, Feenstra, & Veereman-Wauters, 2003). Furthermore, performance capacities intrinsic to children constrain or shape the possibilities of their eating behavior (Davids et al., 2008; Humphry, 2002). Capacities include neurological, oral motor, and gross and fine motor development; sensory regulation; cognitive abilities; and health, including cardiac, gastrointestinal, metabolic, and respiratory functioning. Some constraints will more strongly restrict behavior than others. For example, children with cardiac disease who have limited energy for exercise may take a long time to eat (Medoff-Cooper et al., 2010) or require shorter, more frequent feedings (Hartman & Medoff-Cooper, 2012). Limited energy reserves, in this case, can be a rate-limiting constraint on eating.

Eating behaviors develop within a complex system that is self-organizing and drawn to stable states through pattern formation when emergent behaviors achieve intended outcomes (Humphry, 2002; Thelen, 2005) and as neuronal connections become more defined and preferred (Knudsen, 2004). Eating behaviors therefore reflect capacities and the patterns of behavioral organization that have become familiar and successful. Previous experiences with food and mealtimes, surrounded by performance-limiting capacities, and specific environmental and task constraints drive the behaviors that emerge. For example, children who have difficulty chewing have several behavioral options when foods require chewing are offered. They may refuse the food, swallow the food without adequately chewing, expel or spit the food out, or soften the food by sucking on or storing it in the cheek or roof of mouth (Morris & Klein, 2000). Each of these behaviors, however different, can reflect difficulty chewing. Which behavior emerges is a function of multiple factors: the behavior’s stability given the specific current constraints, the behavioral solutions perceived to be effective based on past success, and the behavioral patterns that have become strengthened over time.

An adequate measure of problematic eating behaviors needs to include the wide range of behaviors that children may exhibit and be applicable to the measure’s various intended functions, including clinical assessment, family-provider communication, and research.

Measurement of Problematic Eating Behaviors in Children

Given the variety of intended functions and users of a measure of problematic eating behaviors, several features are important to consider. Direct observation of the child or report by a valid observer, with an aim to identify the range of behaviors children exhibit, is essential. In addition, the measurement method needs to be clinically useful, family-friendly, and psychometrically sound. Finally, the method needs to support repeated measurement to evaluate change over time, response to treatment, and yield quick results with minimal time and cost.

Measurement of behavior can be accomplished through systematic observation, using reliable coding schemes or rating scales with trained observers, or through report by an observer who is directly involved in feeding the child on a regular basis, such as a parent. Systematic observation has psychometric strength; however, capturing a full description of problematic eating behaviors may require repeated observations over a period of time and across settings (Piazza-Waggoner, Driscoll, Gilman, & Powers, 2008; Young & Drewett, 2000). This presents time and cost burdens and diminishes the usefulness of systematic observation for frequent assessment. Moreover, the lag between systematic observation and the availability of a resulting report would limit clinical utility. Alternatively, in clinical settings, practitioners often adopt a homegrown and untested method for observing and describing problematic eating behaviors using a checklist and/or interview schedule. Although these tools
have some clinical utility, they lack the psychometric testing needed for research use or widespread acceptance.

Parent report of the child’s problematic eating behaviors has several advantages. Parents are more likely than an outside observer to be able to report frequency of a wider range of eating behaviors that occur across the settings the child naturally encounters. As an example, Piazza-Waggoner et al. (2008) compared the agreement between parent report of child mealtime behaviors with systematic observation of those behaviors during an average of three meals observed in the child’s home. There was significant agreement between the two observation methods for some behaviors (e.g., length of meal or child leaving table) but little agreement for others (e.g., whines, cries, or tantrums at feeding time or refuses to eat meals but requests food immediately after the meal). Some behaviors are not elicited with every instance of eating, and the child’s behavior may be altered by unfamiliar mealtime settings and/or unfamiliar observers (Haidet, Tate, Divirgilio-Thomas, Kolanowski, & Happ, 2009). Because parent-report measures are relatively inexpensive and place minimal burden on the family, they permit frequent measurement, making them ideal for tracking the development of eating problems and response to feeding interventions over time. In addition, results of parent-report measures have the potential for immediately available results, which further strengthens their utility.

Parent-report instruments, however, are not without limitations. They are a measure of parents’ perception of their child’s behavior, and this comes with inherent bias that needs to be considered in the construction of the instrument and during interpretation of results. Parents may be motivated to magnify problematic behaviors to gain a clinician’s attention. In contrast, they may underreport the frequency of behaviors that they have become accustomed to. Although parent-report scales have been found to be a valid means of measuring early child communication skills (Määttä, Laakso, Tolvann, Ahonen, & Aro, 2012) and behaviors representing developmental risk (Martin et al., 2012), others note minimal congruence between teachers and parents or clinicians and parents when rating behavioral problems (De Los Reyes & Kazdin, 2005). There is no definitive way to judge which reporter is able to provide a more accurate measure of behavior because there is no gold standard for identifying problematic behaviors. Different reporters may have different interpretations and definitions of what constitutes “problematic” (Dirks, De Los Reyes, Briggs-Gowan, Cella, & Wakschlag, 2012). Given their utility yet potential for bias, it is essential that parent-report measures be designed to minimize error and have high content validity (DeVellis, 2012; Drennan, 2003).

**Evaluation of the Content Validity of Available Instruments**

Content validity is defined as the degree of confidence that the instrument’s items adequately represent the construct being measured and that all elements of the instrument (directions, response options, and items) are relevant and clear (DeVellis, 2012). As such, content validity focuses on the strength of the instrument itself and is the first step in instrument development (DeVellis, 2012). Content validity is accomplished through a multistage, quantitative, and qualitative process, including (a) instrument development that includes domain identification and item generation representative of the identified domains of the construct being measured (DeVellis, 2012; Lynn, 1986); (b) a quantified evaluation of the instrument’s content by experts in the field (Lynn, 1986); and (c) systematic qualitative review of the instrument for clarity, relevance, and completeness by the intended respondents (Willis, 2005).

We evaluated the strength of the content validity of eight available parent-report instruments that measure problematic eating behaviors of children (see Table 1). Although all eight instruments included items related to the construct of problematic eating behaviors, several of the instruments mixed constructs such as parent feeding strategies, parent feelings, or family mealtime interactions. This makes the operationalization of problematic eating behaviors imprecise and the ability to isolate the frequency and severity of the child’s eating behaviors difficult. One instrument is designed for use with children with autism (Brief Autism Mealtime Behavior Inventory [BAMBI]; Lukens & Linscheid, 2008), thus limiting its use to a narrow audience. Although some of the instruments were specifically designed to be brief, none of the instruments measure the range of problematic eating behaviors families have reported (e.g., Marquenie, Rodger, Mangolig, & Cronin, 2011; Thoyre & Van Riper, 2010).

Items on the reviewed instruments were derived from clinical experience, studies reported in the literature at the time of their development, and through a process of borrowing from prior instruments addressing children’s eating behaviors. Although these are excellent sources for item generation, none of the instruments generated items from parent interviews. Because parents are the intended respondents of the instrument, these instruments’ items may lack parents’ perspectives and the language parents typically use.

Finally, only one of the instruments (BAMBI) reported any assessment of content validity. Items of the BAMBI were reviewed by clinical experts; however, no standardized process for this review was reported (Lukens & Linscheid, 2008). When the Screening Tool of Feeding Problems Applied to Children (STEP-CHILD; Seiverling, Hendy, & Williams, 2011) was adapted from the STEP, no content validity assessment was reported, although the original STEP for adults was judged by clinical experts for comprehensiveness and appropriateness (Matson & Kuhn, 2001). Neither the BAMBI nor the STEP-CHILD had quantified content expert assessments; thus, they do not meet the standards set for content validity testing and may, more accurately, be referred to as having face validity (Lynn, 1986). Of all available instruments, none were developed with both quantified expert and qualitative parent evaluation of content validity. The available instruments therefore do not meet standards for content validity for research purposes.
<table>
<thead>
<tr>
<th>Instrument name (author)</th>
<th>Construct(s) of interest</th>
<th>Item content</th>
<th>Item generation</th>
<th>Content validation testing</th>
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<tbody>
<tr>
<td>Children’s Eating Behavior Inventory (Archer et al., 1991)</td>
<td>Eating and mealtime problems: child, parent, and family domains</td>
<td>Child: Food preferences, motor skills, behavioral compliance (28 items) Parent/family system: Child behavioral controls, cognitions and feelings about feeding, impact on family members, mutuality between family members, family mealtime interactions (12 items)</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Pediatric Assessment Scale for Severe Feeding Problems (Crist et al., 2004)</td>
<td>Severity of feeding difficulty when also tube-fed: child and parent domains</td>
<td>Description of reliance on tube (2 items); eating behaviors (8 items); quality of life for child/parent (4 items); acceptance of food texture and temperature (9 items)</td>
<td>X</td>
<td>X</td>
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<tr>
<td>About Your Child’s Eating—Revised (Davies et al., 2007)</td>
<td>Behavioral and parent-child interactional mealtime difficulties</td>
<td>[Factor-derived] resistance to eating (parent and child, 11 items), positive mealtime environment (5 items), and parent aversion to mealtime (4 items)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Brief Autism Mealtime Behavior Inventory (BAMBI; Lukens &amp; Linscheid, 2008)</td>
<td>Mealtime behavior problems in children with autism</td>
<td>[Factor-derived] limited variety (8 items), food refusal (5 items), features of autism (5 items)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Instrument name (author)</td>
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<td>Content experts</td>
<td>Parent interview</td>
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<td></td>
<td>Literature review</td>
<td>Review of existing instrument(s)</td>
</tr>
<tr>
<td>Mealtime Behavior Questionnaire (Berlin et al., 2010)</td>
<td>Mealtime behavior problems</td>
<td>[Factor-derived] food refusal/avoidance (12 items), food manipulation (7 items), mealtime aggression/distress (9 items), and choking/gagging/vomiting (3 items)</td>
<td>X</td>
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<tr>
<td>Montreal Children’s Hospital Feeding Scale (Ramsay et al., 2011)</td>
<td>Feeding problems in children</td>
<td>Oral motor, oral sensory, appetite, maternal concerns, mealtime behaviors, maternal strategies, family reactions (14 items)</td>
<td>X</td>
<td></td>
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<tr>
<td>Screening Tool of Feeding Problems Applied to Children (STEP-CHILD; Seiverling et al., 2011)</td>
<td>Child feeding behavior problems</td>
<td>[Factor-derived] chewing problems (3 items), rapid eating (3 items), food refusal (3 items), food selectivity (2 items), vomiting (2 items), stealing food (2 items)</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Note. Data are presented for revised tool versions when available.
(Knafl et al., 2007; Lynn, 1986). Although the instruments may demonstrate reliability, we cannot know with certainty the degree to which the items are relevant, clear, and representative of the construct. Furthermore, whether parents interpret the items as intended and find the instruments to be clear and comprehensive have not been reported.

**Method**

Based on DeVellis’ (2003) guidelines for scale development, development of the Pedi-EAT was conducted in four phases, with readability adjustments made before and after each phase of validation by parents, as illustrated in Figure 1.

**Phase I: Item Generation**

The Pedi-EAT was designed to be a comprehensive parent-report measure of eating behaviors parents may observe with their children—both positive (e.g., enjoys eating, acts hungry before meals, is willing to feed him- or herself) and problematic (e.g., eats too fast, breathes faster or harder when eating, gags with foods that need to be chewed). Items were selected to capture the range of eating-related behaviors observed in children ages 6 months and older and currently being offered solid food (nonliquids), as recommended by the American Academy of Pediatrics (Eidelman et al., 2012), with acknowledgment that some behaviors will not be relevant at all ages. Items were selected from three sources: (a) an available set of interviews with parents of children with a wide range of feeding problems, which included descriptions of their child’s eating behaviors; (b) literature descriptions of problematic eating behaviors during childhood at the time of item generation; (c) and examination of the eating behavior items of available instruments.

Secondary analysis of focus groups and individual interviews conducted by Thoyre and Van Riper (2010) provided input about problematic eating behaviors as described by parents of children with Down syndrome. Children with Down syndrome, as in most conditions with associated comorbidities, display a range of feeding difficulties (Van Riper & Thoyre, 2006). Thoyre and colleagues recruited participants in three states (North Carolina, Ohio, and Utah) through support groups, pediatric specialty clinics, and word-of-mouth. Focus groups averaged four
participants per group. Prior to the interview, participants were asked to subjectively assess whether their child had any feeding difficulties, and if “yes,” to rate severity on a scale of none, mild, moderate, or severe.

Additional items for the Pedi-EAT were generated from a review of English language literature and examination of existing measures of problematic eating behaviors of children. We searched PubMed and CINAHL databases for feeding and eating behaviors of children at high risk for feeding problems, including, but not limited to, children with congenital heart disease, Down syndrome, prematurity, autism spectrum disorder, and cerebral palsy. We then performed a content analysis of descriptive clinical articles (e.g., Cooper-Brown et al., 2008; Hyman, 1994; Mason, Harris, & Bliss, 2005; Norris & Hill, 1994), research reports (e.g., Carruth & Skinner, 2002; Mercado-Deane et al., 2001), and books (e.g., Kedesdy & Budd, 1998; Morris & Klein, 2000), looking specifically for normal and abnormal behaviors related to eating. The following instruments addressing childhood eating behaviors available at the time of item development were reviewed: Children’s Eating Behavior Questionnaire (Wardle, Guthrie, Sanderson, & Rapoport, 2001), Behavioral Pediatrics Feeding Assessment Scale—Child Behaviors subscale (Crist et al., 1994), Pediatric Assessment Scale for Severe Feeding Problems (Crist, Dobbelsteyn, Brousseau, & Napier-Phillips, 2004), Children’s Eating Behavior Inventory (Archer, Rosenbaum, & Streiner, 1991), BAMBII (Lukens & Linscheid, 2008), About Your Child’s Eating—Revised (Davies, Ackerman, Davies, Vannatta, & Noll, 2007), and the Behavioral Assessment Scale of Oral Functions in Feeding (Stratton, 1981).

Phase II: Content Validity Testing by Interdisciplinary Clinical and Research Experts

The second phase of instrument development involved validation of the Pedi-EAT content by professionals with expertise in pediatric eating behaviors. A panel of 18 clinical and research content experts from four countries representing a range of disciplines, including psychology, speech-language pathology, nutrition, and occupational science, were invited to review the Pedi-EAT for relevance and clarity of the items and comprehensiveness of the instrument. Although the content experts were cross-disciplinary, the majority of the invited participants were speech-language pathologists. Experts were selected on the basis of history of publication, presentations, and research and/or clinical expertise.

We sent invitations to participate via e-mail; the messages contained an attached file of the Pedi-EAT, a description of the instrument’s purpose, and a link to an online survey. Survey responses were received anonymously; we did not request demographic data about the respondents. A reminder email was sent 1 month following the initial invitation. Once initiated, the survey directed the participant to examine each item of the Pedi-EAT and provide two ratings, one for the item’s relevance, and a second for the item’s clarity, using 4-point ordinal scales (1 indicating no relevance/clarity, 4 indicating high relevance/clarity). Participants were given the opportunity to provide feedback on the wording of items and to suggest additional items.

Content validity indices (CVIs) were calculated at both the item level (I-CVI) and at the scale level (S-CVI) for both relevance and clarity (Lynn, 1986; Polit & Beck, 2006). For each item, an I-CVI for relevance was calculated as the proportion of content experts who rated the item moderately or highly relevant (Polit & Beck, 2006). An I-CVI for clarity was calculated using the same process. The S-CVI was calculated as the proportion of S-CVI items that were consistent with I-CVI items for all of the items on the scale (Polit & Beck, 2006). Acceptable limits for I-CVIs and for the S-CVI are dependent on the number of content experts surveyed. With more than six experts, the minimum acceptable I-CVI is .78 (Lynn, 1986). An I-CVI of less than .78 indicates that the item is either irrelevant or unclear and changes need to be made to remove the item, make the item more relevant, or improve clarity. At the scale level, with more than six experts, the acceptable S-CVI is .90 or higher (Polit & Beck, 2006).

Five of the Pedi-EAT investigators conducted systematic item-by-item analysis of expert ratings and feedback. They made decisions to eliminate or revise items, separate an item into two or more items, retain an item unchanged, or add suggested items.

Phase III: Content Validation by Parents of Children With Feeding Difficulty

The third phase of instrument development involved establishing content validity of the Pedi-EAT by the target respondents of the instrument—that is, parents of children with feeding difficulties. Cognitive interviewing, a widely used technique to learn how respondents of questionnaires process and respond to items, was used in this phase (Drennan, 2003; Knafi et al., 2007; Willis, 2005).

Parents who identified having a child over the age of 6 months with feeding difficulty were recruited from a feeding disorders clinic, several websites for parents of children with disabilities, and by word of mouth. Once parents consented, we arranged an interview of approximately 1 hr in length. Parents completed a demographic questionnaire. During the interview, each item of the Pedi-EAT was read aloud, and parents were asked to state their interpretation of the meaning of the item. Parents were also asked whether the directions were clear, if the response options were understandable, and how easy or difficult they thought it would be to complete the Pedi-EAT. Verbal probing was used to clarify responses (Willis, 2005). Finally, parents were invited to share suggestions for improving the instrument, including additional items that would better capture behaviors seen in their own child. No compensation for participating was provided.

All interviews were audio-recorded and summarized in a matrix format. Prior to analysis, a second team member verified the transcribed data by listening to the interview recording. Five of the Pedi-EAT investigators conducted systematic column-by-column analysis (Miles & Huberman, 1994). Problem categories, such as “unclear meaning” and...
“redundancy” were created based on parent feedback (Knafl et al., 2007). Decisions were made by the team to retain an item unchanged, revise, delete, split an item into two, or add an item.

**Phase IV: Content Validation by Parents of Children With and Without Feeding Difficulty**

After analysis of the Phase III cognitive interviews, it became clear that a second round of cognitive interviews was needed. The comprehensiveness and interpretation of the newly revised items needed to be evaluated, and information was needed on parents’ experience of completing the instrument. In addition, because the instrument may be used with parents of children with and without feeding difficulty, it was necessary to assess whether parents of children without feeding difficulty understood the items in the same way as did parents of children with feeding difficulty.

We recruited parents of children over the age of 6 months who were orally feeding at least some solid foods. Parents self-identified whether their child had feeding difficulty (yes/no); no clinical diagnosis was required. We aimed to have an equal balance of parents of children with and without feeding difficulty represented in the sample. Invitations to participate were posted on local parenting Listservs, including parent-run support groups for families with children with conditions that often include feeding challenges. Recruitment also involved participant word of mouth. Efforts were made to increase the income range and diversity of the subjects compared with the Phase III cognitive interviews by posting invitations to participate in targeted public locations and a feeding disorders clinic.

As in the Phase III of cognitive interviews, once parents consented, we arranged an interview of approximately 1 hr in length. No compensation for participating was provided. Prior to the interview, parents were asked to complete the Pedi-EAT, note the length of time for completion, and indicate items needing clarification. During the interview, we again used verbal probing to elicit information about the ease of completing the questionnaire, the clarity of the directions, and appropriateness of response options (Willis, 2005). Items that were changed after the Phase III cognitive interviews were then reviewed, and participants were asked to provide their interpretation of the items’ meaning. Probes were used to clarify parents’ responses. Again, parents were invited to share any additional thoughts and suggest additional items. As in Phase III, the interviews were digitally audio-recorded, summarized into a matrix format by the interviewer, and verified by a second team member using the audio recording. Seven of the Pedi-EAT investigators replicated the analytic procedures from the Phase III cognitive interviews (Miles & Huberman, 1994).

**Results**

**Phase I: Item Generation**

Thirty-seven caregivers of children with Down syndrome (33 mothers, 3 fathers, and 1 care provider) participated in the focus group or individual interviews (see Table 2), as described by Thoyre and Van Riper (2010). Participants reported that the target child (ages 9 months through 13 years) had an average of 5 (range 1–13) eating behaviors that were challenging. Two children were reported to have severe feeding difficulty, 32 had moderate difficulty, and 3 had no or mild feeding difficulty. Thirty-four participants expressed concern that the child was underweight, and 29% were offering enhanced calorie formula. The most commonly reported difficulties were selectivity about types of foods eaten, delayed initiation of chewing or difficulty with chewing, avoidance of textured foods mixed with smooth foods, lack of interest in eating, difficulty swallowing, selectivity about

<table>
<thead>
<tr>
<th>Table 2. Demographics of samples by phase of development.</th>
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<tbody>
<tr>
<td><strong>Variable</strong></td>
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<tr>
<td>Mean age of child in years (range)</td>
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<tr>
<td>Difficulty breast or bottle-feeding</td>
</tr>
<tr>
<td>Current tube feeding</td>
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<tr>
<td>Race/ethnicity of child</td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td>African American</td>
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<tr>
<td>Self-defined</td>
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<tr>
<td>Mean family income (range)&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>Family type: Two-parent&lt;sup&gt;c&lt;/sup&gt;</td>
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</tbody>
</table>

*Note. Phase I = item generation; Phase III = content validation by parents of children with feeding difficulty; Phase IV = content validation by parents of children with and without feeding difficulty. Van Riper & Thoyre, 2006. Income in thousands of dollars; the upper limit the parent could select was >$60,000 in Phase 1 and >$100,000 in the remaining three samples. Includes step-parent and same-sex parents.*
how foods are offered, delayed skill development, and spitting up.

A list of 44 items was generated from the interviews. We added 39 additional items from the literature review and 25 items from the review of existing instruments for a total of 108 items. All items were written to be concise and to begin with the phrase “My child...” We avoided language of interpretation; respondents reported observable behaviors rather than the meaning of the behavior, their perception of the child’s intentions, or their interpretation of the etiology of the behavior. For example, an item may state “my child stops eating after a few bites” rather than “my child seems to get full before eating enough.” Approximately half of the items are worded positively and half negatively. The response format began as a five-point balanced response scale with the following options: never, almost never, sometimes, often, and almost always. Directions at the beginning of the instrument asked parents to think back over a typical 2-week period and to check the response that best described their child. The research team chose the 2-week time frame to be large enough to detect the frequency of current behaviors yet small enough to facilitate accurate parent recall and enable the instrument to be used for repeated measurements of progress over time.

**Phase II: Content Validity Testing by Interdisciplinary Clinical and Research Experts**

Thirteen of the 18 invited experts provided feedback on the Pedi-EAT. Nine participated in the content validity survey, and four provided written feedback only. Ratings for item clarity were omitted by one respondent; therefore, content relevance of each item was rated by eight experts, and the clarity of each item was rated by nine experts, and the clarity of each item was rated by eight.

The I-CVIs for relevance ranged from .67 to 1.0, and the I-CVIs for clarity ranged from .50 to 1.0. Thirty items (28%) did not meet the criteria of .78 for relevance and/or clarity (Lynn, 1986). The S-CVI was acceptable for both relevance (.93) and clarity (.90; Polit & Beck, 2006). Table 3 provides examples of items rated as having low relevance and/or clarity and illustrates the decisions and rationale for the item’s management.

Of the 30 items with low I-CVI scores, five had both low relevance and low clarity, five had low relevance, and 20 had low clarity. Item-by-item analysis of problematic items and expert feedback (both on the survey and written) resulted in the following decisions. Seventeen items were eliminated due to low relevance or redundancy. Eleven additional items were determined to be inconsistent with the conceptual purpose of the Pedi-EAT and were eliminated. Five of these items asked parents to interpret what their children were capable of doing (e.g., can drink from a straw, is able to sit up without support during feeding), and six items described the adequacy of diet (e.g., my child eats foods with protein [beans, cheese, meat, fish]). A total of 39 items were revised to improve clarity or grammar. Three items were determined to be measuring two behaviors each; therefore, they were each split into two items. Four new suggested items were added. The revised Pedi-EAT consisted of 87 items.

**Phase III: Content Validation by Parents of Children With Feeding Difficulty**

Nine parents of children between the ages of 9 months and 10 years with feeding difficulty participated in the Phase III cognitive interviews. See Table 2 for demographics of the sample. Over half were caring for children with an enteral feeding tube, and all reported an early origin of their child’s feeding problems.

Column-by-column analysis of the summarized data from the cognitive interviews led to the revision of 33 items; elimination of four items; and, in response to

<table>
<thead>
<tr>
<th>Decision</th>
<th>Sample items</th>
<th>I-CVI</th>
<th>Rationale or revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eliminated</td>
<td>My child wants to eat.</td>
<td>.75</td>
<td>Low I-CVI for relevance and redundant with other items.</td>
</tr>
<tr>
<td></td>
<td>My child sighs during mealtime.</td>
<td>.63</td>
<td>Low I-CVI (both for relevance and clarity).</td>
</tr>
<tr>
<td></td>
<td>My child can drink from a straw.</td>
<td>.89</td>
<td>Represents a skill rather than an eating behavior.</td>
</tr>
<tr>
<td>Rewarded</td>
<td>My child drinks between mouthfuls.</td>
<td>.67</td>
<td>My child needs to take a drink between mouthfuls.</td>
</tr>
<tr>
<td></td>
<td>My child is particular about how food is offered.</td>
<td>1.00</td>
<td>My child insists on food being offered in a certain way (such as how food is arranged on the plate or what dishes or spoon or fork is used).</td>
</tr>
<tr>
<td>Separated</td>
<td>My child over-fills his/her mouth.</td>
<td>.78</td>
<td>My child puts too much food in at one time.</td>
</tr>
<tr>
<td></td>
<td>My child spills food or liquid out of mouth while eating.</td>
<td>1.00</td>
<td>My child spills food out of mouth while eating.</td>
</tr>
<tr>
<td></td>
<td>My child will eat warm or cold food.</td>
<td>.99</td>
<td>My child eats warm food.</td>
</tr>
<tr>
<td>Retained</td>
<td>My child will touch food with his/her hands.</td>
<td>.67</td>
<td>Critical eating behavior described in the literature related to sensory modulation disorders.</td>
</tr>
<tr>
<td></td>
<td>My child pauses in the middle of eating to take a rest.</td>
<td>.75</td>
<td>Critical eating behavior described in the literature related to physiologic functioning.</td>
</tr>
</tbody>
</table>

Note. I-CVI = Item Content Validity Index.
parents’ suggestions and new literature, the addition of 12 items. Fifty items were interpreted by parents as intended and therefore were retained without modification. Parents commented that the Pedi-EAT was straightforward and reasonable in length. The Pedi-EAT was found to be of limited use for children who were not eating at least some solid foods. The directions for completion of the Pedi-EAT were revised to improve clarity, and the resulting Pedi-EAT consisted of 95 items.

**Phase IV: Content Validation by Parents of Children With and Without Feeding Difficulty**

Twenty parents of children between the ages of 17 months and 10 years participated in the Phase IV cognitive interviews. Half of the parents identified their children as having feeding difficulties. Compared with Phase III, participants in Phase IV were slightly more diverse in both income and race/ethnicity (see Table 2).

Phase IV led to the revision of seven items, abbreviation of 38 items, elimination of three items, and the addition of five items. The resulting Pedi-EAT consisted of 97 items. The directions were further revised to focus parents on reporting their children’s typical, current behavior. Parents’ postcompletion feedback resulted in our changing the response format to a six-point balanced response scale with the following options: never, almost never, sometimes, often, almost always, and always. Parents of children without feeding difficulty were less familiar with descriptions of problematic eating behaviors; we revised several items based on this feedback. The average length of time to complete the Pedi-EAT for these 20 parents was 16 min. Figure 2 illustrates the format of the final Pedi-EAT.

**Readability Testing**

Readability of the Pedi-EAT was tested before and after each phase of cognitive interviews. As recommended by Friedman and Hoffman-Goetz (2006), an average score from two readability formulas was applied to the content to achieve a more valid and reliable estimate. At each time point, the SMOG and Flesch-Kincaid formulas estimated the reading level to be less than fifth grade.

**Discussion**

The Pedi-EAT was developed to measure the presence or absence and frequency of a comprehensive set of discrete behaviors related to eating. Through a systematic process of item development (Phase I), clinical and research expert review (Phase II), and cognitive interviews with parents (Phases III and IV), we have gathered evidence to support the content validity of the Pedi-EAT.

In Phase I, the use of focus groups and individual interviews to generate an initial set of items for the Pedi-EAT grounded the early development of the Pedi-EAT within the perspective of parents, the intended respondents (Thoyre & Van Riper, 2010). The focus group format was particularly useful. As parents described problematic eating behaviors, they clarified their descriptions for one another, often comparing specific behaviors and differentiating between similar-sounding feeding problems. We were alerted to terms or phrases that families disagreed on the meaning of as well as descriptions that they readily agree upon. Forty-one percent of the Pedi-EAT items were developed from these interviews. The remaining items were derived from literature and review of available instruments measuring eating behaviors of children.

In Phase II, quantified content validity of the Pedi-EAT was established using systematic CVI processes, defined by Lynn (1986) and Polit and Beck (2006). The Pedi-EAT was found to have acceptable content relevance and clarity by the recommended number of content experts (Lynn, 1986). The expert CVI process was informative; all but two items with I-CVI below acceptable levels were adjusted or eliminated according to the expert ratings and written feedback. The two retained items (will touch food with his/her
hands and pauses in the middle of eating to take a rest) had both clinical support and subsequent parental support.

The content experts strengthened the comprehensiveness of the Pedi-EAT by suggesting additional items. Moreover, their comments further clarified the Pedi-EAT conceptually. Sensory items were found to reflect observed sensory behaviors rather than caregiver perceptions of the child’s experience of sensory input during feeding. Motor items were likewise aligned to reflect what parents observe their children choosing or willing to do rather than what children can do physically. Measuring parents’ perceptions of what their children are able to do (i.e., motor skill) would mix constructs and stray from the intent of the Pedi-EAT. Items that asked parents to rate the quality of their children’s diet were also eliminated. Although it is important to understand the impact of problematic eating behaviors, the Pedi-EAT is not designed to measure the adequacy of diet. Separate assessments of motor skill and diet would augment the Pedi-EAT in future studies to increase understanding of factors that contribute to or are associated with problematic eating behaviors of children.

Cognitive interview methodology improved the content validity of the Pedi-EAT by using parents’ experience and expertise with their own children to shape the instrument, ensuring that directions, items, and response options were understood in the way intended. Phase III focused on assessment of parents’ interpretation of the items and evaluation of the comprehensiveness of the instrument, whereas Phase IV focused on parents’ experience of completing the Pedi-EAT. A wide range of parents for whom the instrument is intended participated: five parents of children who were partially tube feeding, 19 of children with feeding difficulties, and 10 of children with no feeding difficulties. The Pedi-EAT was found to be optimal for children eating at least some solid foods. Although the instrument had a less than fifth-grade reading level, parents asked that the language of the Pedi-EAT be simplified to improve the readability and speed with which they could complete the tool. For example, they would mix constructs and stray from the intent of the Pedi-EAT. Items that asked parents to rate the quality of their children’s diet were also eliminated. Although it is important to understand the impact of problematic eating behaviors, the Pedi-EAT is not designed to measure the adequacy of diet. Separate assessments of motor skill and diet would augment the Pedi-EAT in future studies to increase understanding of factors that contribute to or are associated with problematic eating behaviors of children.

Parents of children with feeding difficulties confirmed the relevance and comprehensiveness of the items, and parents of children without eating difficulties assisted in the phrasing of items so that items were understandable to them as well. By having parents complete the Pedi-EAT in Phase IV, we learned that the directions were not clear enough and that a wider range of response options was necessary. Parents suggested that the response options be repeated at the top of each page and that in the directions we underline the phrase “at this time” to highlight that the instrument is asking about current behaviors.

**Limitations**

The process of establishing content validity of the Pedi-EAT had several limitations. The secondary data source of interviews accessed to generate items in Phase I (focus group and individual interviews) represented a single group of children with Down syndrome. Field, Garland, and Williams (2003) found that, within a sample of children referred for feeding problems (n = 349), those with Down syndrome had more oral motor delays—as evidenced by problems with chewing, moving the tongue, and lip closure—and were more selective of the type of foods eaten. The items derived from the Phase I interviews may have oversampled in these areas. Most of the participants rated their children as having moderate feeding difficulty. Although this response indicates most would likely be able to describe a number of problematic eating behaviors, the range of behaviors may have been limited. However, the items from the parent interviews were augmented by two other sources and constituted only a subset of the total number of items. A second limitation was the representativeness of the expert sample for Phase II. All invited experts had extensive research and/or clinical experience, but the majority of those invited were speech pathologists. Because we do not know the disciplines of the participants, there is potential for selection bias and overrepresentation of this area of expertise. A third limitation was the representativeness of the samples of parents who participated in the cognitive interviews. Although the samples represented parents of children with a diverse range of eating behaviors, the majority were White, lived in two-parent households, and had a family income greater than $50,000 per year. Eating behaviors of concern to low-income, non-White, single-parent families may be underrepresented; the understanding of the items may be inadequately tested within these groups. Finally, the Pedi-EAT has been validated with families of children through the age of 10, and this sets the upper age limit. However, because some children with developmental disabilities continue to make progress toward optimization of motor capabilities and lessening of difficult behaviors into their second decade or longer (Buckley, Bird, Sacks, & Archer, 2006), the instrument may be appropriate for a higher age.

**Future Development of the Pedi-EAT**

The next step in the development of the Pedi-EAT is to determine its factor structure and to assess reliability (internal consistency) on the basis of data obtained from a large, heterogeneous sample of parents of children with and without feeding difficulties. Construct validity and test–retest reliability should also be evaluated. Once the factor structure has been defined (and items eliminated that do not sufficiently load or cross-load too closely), cutoffs will need to be established for children of various ages at risk for feeding problems.

**Conclusion**

We developed the Pedi-EAT within the framework of dynamic systems theory using a systematic process of
instrument development and validation. The design of the Pedi-EAT as a parent-report instrument is one of its strengths as parents interact with their children during mealtime across different settings and during different times of the day, qualifying them to report on their children’s typical eating behaviors. To our knowledge, this is the first measure of problematic eating behaviors in children that has taken a systematic, quantitative approach to expert content validation as well as a systematic, qualitative approach to evaluating content validity with parents. The Pedi-EAT has content validity with future users and respondents of the instrument: experiential, clinical, and research experts. The research team plans further psychometric evaluation of the instrument.

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