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AN EVALUATION OF TRIAL-BASED FUNCTIONAL ANALYSES OF INAPPROPRIATE MEALTIME BEHAVIOR

by

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the University of Nebraska Graduate College
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AN EVALUATION OF TRIAL-BASED FUNCTIONAL ANALYSES OF INAPPROPRIATE MEALTIME BEHAVIOR

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University of Nebraska, 2021

Supervisor: Bethany A. Hansen, Ph.D.

Functional analyses allow clinicians to develop treatment targeting the variables maintaining a child's inappropriate mealtime behavior (Bachmeyer et al., 2019). Extended functional analyses can be inefficient, potentially delaying the onset of treatment. Researchers have suggested a trial-based functional analysis can increase assessment efficiency (Saini, Fisher, et al., 2019). This study compared trial-based functional analyses to extended functional analyses to determine the variables maintaining inappropriate mealtime behavior. We compared the efficiency and acceptability and evaluated treatments informed by the analyses. Exact correspondence between analyses was low (29%); however, most treatments indicated by the trial-based functional analyses (71%) resulted in improvements in the child's target behaviors. The trial-based functional analysis required 71% less time than the extended functional analysis, and caregivers found analyses equally acceptable. Future researchers should continue refining trial-based functional analysis procedures to provide an efficient assessment that leads to efficacious treatment.

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EO	establishing operation
LCL	lower criterion line
UCL	upper criterion line
EE	escape extinction
AE	attention extinction

INTRODUCTION

Approximately 1 in 4 typically developing children and 8 in 10 children with a developmental disability have feeding difficulties (Benjasuwantep et al., 2013; Field et al., 2003). When caregivers present food or drinks, children with feeding difficulties often display inappropriate mealtime behavior, such as turning their head or batting at the spoon, and how a caregiver responds may worsen the feeding problem (Piazza et al., 2003a). For example, giving the child breaks from eating following refusal may cause the child to refuse more often. Decreasing inappropriate mealtime behavior is often an initial treatment goal and necessary to observe increases in bite or drink acceptance. Assessment and treatment procedures conceptually based in applied behavior analysis, such as functional analyses and escape extinction, have the most empirical support for treating feeding difficulties (Volkert & Piazza, 2012).

Functional Analysis

Functional analyses involve the systematic presentation of environmental variables that are putative reinforcers for the problem behavior (Iwata et al., 1982/1994). Researchers have modified traditional analog functional analyses to test the effects of relevant consequences for a child's inappropriate mealtime behavior (Bachmeyer et al., 2009; Girolami & Scotti, 2001; Najdowski et al., 2003; Piazza et al., 2003a). Recent reviews of published functional analyses with children with pediatric feeding disorders have found escape (i.e., breaks from eating) maintains inappropriate mealtime behavior, exclusively or in part, in 81%-100% of cases (Hodges et al., 2020; Saini, Jessel, et al., 2019; Saini, Kadey, et al., 2019). The high likelihood of identifying an escape function has led some researchers to suggest that functional analyses for inappropriate mealtime behavior may be unnecessary (e.g., Saini, Jessel, et al., 2019). However, treatments that do not address all maintaining variables may not lead to clinically significant

improvements in inappropriate mealtime behavior and acceptance of bites or drinks (e.g., Bachmeyer et al., 2019). For example, Bachmeyer et al. (2019) showed it was necessary to treat both escape and attention functions to achieve clinically acceptable levels of inappropriate mealtime behavior and acceptance.

Since the initial application of functional analysis procedures to inappropriate mealtime behavior (Girolami & Scotti, 2001), various researchers have evaluated modifications. Piazza et al. (2003a) conducted extended functional analyses to determine whether consequences that caregivers typically delivered following inappropriate mealtime behavior functioned as reinforcers. Najdowski et al. (2003, 2008) varied the functional analysis procedures by using different bite-presentation and prompting procedures (e.g., presented food on table). In 2019, Bachmeyer et al. compared the Najdowski et al. procedures with the extended functional analysis procedures used by Piazza et al. More specifically, Bachmeyer et al. compared analyses with and without discriminative stimuli and bite-presentation modifications and determined that presenting bites close to the child's lips with consistent vocal instructions across all conditions most reliably identified functions.

Although extended functional analyses can accurately identify reinforcers, the majority of practitioners report they do not use functional analyses due to limited space or time and overall limited acceptance of the procedure (Oliver et al., 2015; Roscoe et al., 2015). Specific to inappropriate mealtime behavior, researchers have reported that the total time required to run the analysis is one of the largest barriers (e.g., Hodges et al., 2020). In a review of functional analyses among children with feeding disorders, Saini, Kadey, et al. (2019) found published functional analyses took an average of 290 min (range 55-850 min) based on the reported data. To investigate the efficiency further, the first author reviewed clinical cases from 2017 to 2019 from an intensive day-

treatment program for children with feeding disorders to determine the duration of functional analyses. Across 63 datasets, analyses took an average of 147 min (median, 119; range, 47-741). To address this limitation, researchers should evaluate more efficient functional analysis procedures, such as trial-based functional analyses.

Trial-Based Functional Analysis

During trial-based functional analyses, specific environmental events (e.g., demands) are presented in discrete trials, and those trials are integrated into the child's typical environment (e.g., Sigafoos & Saggers, 1995). Sigafoos and Saggers (1995) conducted a seminal study evaluating trial-based functional analyses of children's aggression in a classroom. Each trial consisted of a test segment that was immediately followed by a control segment. The test segment involved delivery of the putative reinforcer immediately following the target behavior (e.g., aggression) and the control segment involved noncontingent delivery of and continuous access to the same putative reinforcer. Since this seminal article, studies have evaluated procedural variations, such as Bloom et al. (2011), who determined the control segment immediately preceding the test segment limited carryover and that measuring the latency to problem behavior is another way to observe differentiation between conditions.

Trial-based functional analyses have many potential advantages that warrant further consideration. Given the few resources required and the short segmented trials, these analyses can be easily integrated into more natural settings, such as homes or schools, and with caregivers or teachers implementing the procedures. Previous researchers taught special education teachers to implement these procedures in as few as 60 min (Lambert et al., 2012). Even though training may require some initial time upfront, researchers have suggested that trial-based functional analyses can maximize

efficiency and may be amenable to less intensive forms of data collection (Saini, Fisher, et al., 2019).

Functional Analysis Comparison

Hodges et al. (2018) compared a trial-based functional analysis to the extended functional analysis procedures that were used by Najdowski et al. (2003) for inappropriate mealtime behavior and found partial correspondence between the two procedures (i.e., functions matched for two of the three that were assessed). Though Hodges et al. found partial correspondence and the treatment based on the trial-based functional analysis produced desired effects, several procedural limitations make it challenging to draw conclusions. First, Hodges et al. compared trial-based functional analysis procedures to those used by Najdowski et al., in which feeders did not include relevant discriminative stimuli across conditions (Bachmeyer et al., 2019). Second, Hodges et al. counterbalanced the order of analyses; for this reason, exposure to the extended functional analysis may have affected responding in the trial-based functional analysis for one participant (i.e., greater exposure to contingencies; Bloom et al., 2011). Last, the structure of the trial-based functional analysis may have tested for the effects of combined instead of isolated variables as the attention and tangible test trials ended after the first instance of inappropriate mealtime behavior (i.e., inappropriate mealtime behavior during the attention and tangible test trials also resulted in escape). Therefore, additional research is necessary to continue refining trial-based functional analysis procedures and determine whether this approach is appropriate for assessing the variables that maintain inappropriate mealtime behavior.

Purpose of the Current Study

The purpose of the current study was to evaluate the efficacy of a trial-based functional analysis for identifying the variables that maintain inappropriate mealtime behavior. This study compared results from trial-based functional analyses and extended functional analyses, assessed efficiency and caregiver acceptability, and conducted a treatment evaluation to compare the efficacy of indicated treatments.

CHAPTER 1: METHOD

Participants

Participants were four children who were admitted to an intensive day-treatment program in a pediatric feeding disorders clinic. Participants were children who (a) were between 3 and 8 years of age, (b) were safe oral feeders, and (c) engaged in inappropriate mealtime behavior (defined below) during preliminary meal observations with solids, liquids, or both. In addition, the child's caregiver must have identified that a primary goal of treatment was to reduce inappropriate mealtime behavior during meals with solids, liquids, or both. Before the study, children participated in an interdisciplinary intake evaluation with a gastroenterologist, swallow-safety expert (i.e., Speech-Language Pathologist), dietician, and licensed psychologist to rule out ongoing medical concerns that may have contributed to the feeding problems, ensure the children were safe oral feeders, analyze nutrition deficiencies, and identify environmental variables (e.g., caregiver attention) that might have contributed to the maintenance of feeding difficulties. The program's dietitian used each child's age and sex to select the appropriate Centers for Disease Control and Prevention (2010) growth chart on which to plot height, weight, and body-mass index. The program's dietician determined the percentage of calorie and fluid needs the child met at the time of the intake evaluation

based on three-day food records completed by caregivers. Table 1 describes participant demographics and nutritional information.

				% Needs Met by Mouth		Nutritional Deficits
Name	Age	Sex	Diagnoses	Calories	Fluid	
Kaylee	3	Female	Failure to thrive, history of vomiting	91	80	Folic acid, chromium, potassium, vitamins D and E
Callie	3	Female	Gastroesophageal reflux disease, failure to thrive, constipation	112	44	none
Hank	3	Male	Short gut syndrome, failure to thrive	101	64	Potassium and vitamins D and E
Vick	8	Male	Cardiofaciocutaneous syndrome, developmental delay, constipation	3	3	none

Table 1: Participant demographics and nutritional information.

Setting and Materials

Sessions took place in 4-m by 4-m therapy rooms that were equipped with one-way observation panels and sound-monitoring equipment. Session rooms contained a table, a chair for the feeder, and developmental- or weight-appropriate seating for the child (e.g., highchair, booster seat). The session room also contained necessary meal-related items, such as food scales, bowls, utensils, colored placemats, and a timer. The colored placemats were used as discriminative stimuli that were associated with each condition of the functional analyses and treatment evaluation.

Feeders conducted three 40-min meals and two 30-min meals with at least a 40-min break between meals. Feeders conducted multiple presentations, trials, or five-bite sessions in meals with solids and multiple presentations, trials, or five-drink sessions in meals with liquids. Observers and feeders allowed approximately 1 min between presentations, trials, or sessions to prepare for the next (e.g., reset data-collection program). The number of presentations, trials, or sessions per meal varied based on the child's behavior.

For treatment evaluations involving solids, caregivers selected 16 foods, four from each major food group (i.e., proteins, grains, vegetables, fruits) to introduce during treatment. The treatment team advised caregivers to select foods that the family encountered and consumed regularly while being responsive to special diets, nutritional needs, and cultural considerations. The treatment team selected four of those foods to use during the functional analyses and treatment evaluations that were the focus of the current study. Based on the child's age and skill level, the treatment team selected the initial bolus size and utensil. Feeders presented bites on a rubber-coated baby spoon for Kaylee and Callie (approximately 1 ml), a level, large Maroon spoonful for Hank

(approximately 3-4 ml), and a level, small Maroon spoonful for Vick (approximately 2-3 ml).

For treatment evaluations involving liquids, caregivers selected a calorically dense, nutritionally complete drink (e.g., milk, formula) to introduce during treatment. The treatment team used this liquid during the functional analyses and treatment evaluation. Each drink was 2 ml and was presented in a pink Nosey cut-out cup. Consumption of liquids was not targeted for Kaylee.

Feeders and Observers

Feeders and observers had bachelor's, master's, or doctoral degrees in behavior analysis, psychology, or a related field. Training for feeders included didactic modules with posttests, competency training for food preparation, and behavioral skills training (i.e., verbal instructions, modeling, and role-play; Parsons et al., 2012) with in-vivo feedback to competency for assessment and treatment procedures.

Observers participated in intensive training on data collection procedures that included a review of operational definitions with a Board Certified Behavior Analyst (BCBA), collecting data on videos of previously recorded feeding sessions, and collecting data during real-time sessions. Observers assessed their agreement with a BCBA, and after reaching 80% agreement for at least three consecutive sessions during real-time sessions, observers collected data for the study. Observers collected data in an Excel spreadsheet or using DataPal 1.0 data-recording software (i.e., a beta version of BDataPro; Bullock et al., 2017).

Dependent Variables, Procedural Integrity, and Interobserver Agreement

Dependent Variables

Observers collected data on the frequency of inappropriate mealtime during the presentation assessment, extended functional analysis, and treatment evaluation and on the latency to inappropriate mealtime behavior during the trial-based functional analysis. Observers recorded *inappropriate mealtime behavior* each time the food, drink, or utensil was within the child's reach, and the child's (a) mouth turned 45 degrees or moved 5 cm in any direction except toward the utensil; (b) hand, arm, or anything in their hand touched the food, drink, utensil, or feeder's arm; or (c) hand, arm, or anything in their hand (except the utensil) contacted their lips. Observers determined the latency to inappropriate mealtime behavior by recording the amount of time that elapsed from when the feeder presented the utensil to the target location and provided the vocal instruction, "take a bite (drink)," to the first instance of inappropriate mealtime behavior. Observers also recorded the duration of *session time* that the food, drink, or utensil was within the child's reach during the extended functional analysis and treatment evaluation to calculate the rate of inappropriate mealtime behavior. DataPal 1.0 calculated the rate of inappropriate mealtime behavior by dividing the frequency of inappropriate mealtime behavior by the session time.

Observers recorded the frequency of active acceptance during the treatment evaluation. Observers recorded *active acceptance* each time the child (a) opened their mouth without crying or (b) opened their mouth while crying and moved toward the utensil, and the feeder deposited the entire bite (drink) within 5 s from when the utensil touched the child's lips. DataPal 1.0 calculated the percentage of presentations with active acceptance by dividing the number of presentations with active acceptance by the number of bites (drinks) presented and converting the ratio to a percentage.

Procedural Integrity

Observers measured procedural integrity during the presentation assessment, trial-based functional analysis, extended functional analysis, and treatment evaluation. The observer recorded *correct procedure* if the feeder implemented all components of the protocol within 3 s of the programmed implementation during each bite (drink). Observers did not record correct procedure if the feeder did not perform a component or performed a component incorrectly. For the presentation assessment, observers recorded correct procedure if the feeder: (a) presented the bite (drink) to the target location, (b) kept the bite (drink) at the target location, (c) withheld attention, and (d) removed the bite (drink) when 30 s elapsed. The first author calculated the percentage of presentations with correct procedure by dividing the number of presentations with correct procedure by the total number of presentations and converting the ratio to a percentage. Observers recorded correct procedure during the presentation assessment for an average of 96% of presentations (range, 75%-100%). Average correct procedure during the presentation assessment was 95% (range, 75%-100%).

For the functional analyses, observers recorded correct procedure if the feeder: (a) presented the bite (drink) to the target location; (b) kept the bite (drink) at the target location; (c) refrained from providing continuous attention during the escape-control, escape-test, and attention-test conditions of the trial-based functional analysis and the escape and attention conditions of the extended functional analysis; (d) provided attention continuously during the attention-control conditions of the trial-based functional analysis and during the control conditions of the extended functional analysis; (e) provided free access to a tangible item in the control condition of the extended functional analysis; and (f) delivered programmed consequences within 3 s of inappropriate mealtime behavior. For the trial-based functional analysis, the percentage of trials with correct procedure was calculated in the same manner as the presentation assessment.

Observers recorded correct procedure during the trial-based functional analyses for an average of 93% of trials (range, 75%-100%). Average correct procedure during the trial-based functional analysis was 96% (range, 90%-100%). For the extended functional analysis, DataPal 1.0 calculated the percentage of presentations with correct procedure by dividing the number of presentations with correct procedure by the total number of presentations in the session, and converting the ratio to a percentage. Observers recorded correct procedure during the extended functional analyses for 100% of sessions. Average correct procedure during the extended functional analysis was 99% (range, 96%-100%).

For the treatment evaluation, observers recorded correct procedure if the feeder: (a) presented the bite (drink) to the child's lips while delivering the instruction, "take a bite (drink)," (b) delivered programmed consequences within 3 s of inappropriate mealtime behavior, (c) withheld attention in attention-extinction conditions, (d) provided praise for active acceptance, (e) checked the child's mouth 30 s after the bite (drink) was deposited to determine if the bite (drink) was swallowed, (f) provided praise following mouth clean (i.e., no food or liquid larger than the size of a pea in the child's mouth) or reminded the child to swallow, and (g) presented the next bite (drink) within 5 s of the scheduled presentation interval. For the treatment evaluation, the percentage of presentations with correct procedure was calculated the same as the extended functional analysis. Observers recorded correct procedure during the treatment evaluation for an average of 100% of sessions (range, 97%-100%). Average correct procedure during the trial-based functional analysis was 99% (range, 99%-100%).

During the treatment evaluation, observers recorded the duration of *correct utensil placement*. Across baseline and treatment conditions, the observer recorded correct utensil placement when the feeder: (a) presented the utensil to the child's lips at

the scheduled interval and (b) removed the utensil after the bite (drink) entered the mouth. The observer recorded correct utensil placement during escape baseline conditions if the feeder removed the utensil after inappropriate mealtime behavior. The observer recorded correct utensil placement during escape extinction conditions when the feeder: (a) held the utensil at the child's lips if they did not meet the criterion for active acceptance until they could deposit the bite (drink) into the mouth or 10 min elapsed from session initiation; (b) moved the utensil to the side of the child's mouth if the child coughed, gagged, or vomited; and (c) re-deposited expelled bites (drinks) within 3 s of previously accepted food or liquid exiting the child's mouth. DataPal 1.0 calculated the percentage of the session with correct utensil placement by dividing the amount of time with correct utensil placement by total time (i.e., time the utensil was within and outside of child's reach during session) and converting the ratio to a percentage. Observers recorded correct utensil placement for an average of 99% of sessions (range, 97%-100%). Average correct utensil placement during the treatment evaluation was 99% (range, 98%-100%). Correct utensil placement decreased below acceptable levels (i.e., 80%) during Kaylee's solids and Vick's solids treatment evaluations. Therefore, a second feeder assisted the primary feeder with keeping the utensil at the child's lips (described below).

Interobserver Agreement

A second observer independently recorded inappropriate mealtime behavior for an average of 90% (range, 33%-100%) of presentations across children during the presentation assessment. A second observer recorded correct procedure for 81% (range, 33%-100%) of presentations and 70% (range, 37%-100%) of trials across children during the presentation assessment and trial-based functional analysis, respectively. The first author calculated total agreement coefficients for inappropriate

mealtime behavior from the presentation assessment and correct procedure from the presentation assessment and trial-based functional analysis by dividing the number of presentations or trials both observers scored the presence or absence of inappropriate mealtime behavior by the total number of presentations or trials and converting the ratio to a percentage. Mean agreement for inappropriate mealtime behavior during the presentation assessment was 97% (range, 80%-100%). Mean agreement for correct procedure was 98% (range, 85%-100%) and 95% (range, 83%-100%) during the presentation assessment and trial-based functional analysis, respectively.

A second observer independently recorded inappropriate mealtime behavior for 80% (range, 53%-100%) of trials during the trial-based functional analysis across children. The first author calculated total agreement coefficients for latency to inappropriate mealtime behavior from the trial-based functional analysis by dividing the shorter latency from the trial by the longer latency from the trial and converting the ratio to a percentage (Thomason-Sassi et al., 2011). If both observers scored the same latency to inappropriate mealtime behavior, the first author determined agreement was 100% for that trial. Mean agreement for inappropriate mealtime behavior during the trial-based functional analysis was 89% (range, 82% to 96%).

A second observer recorded inappropriate mealtime behavior for 74% (range, 33%-100%) and 57% (range, 33%-80%) of sessions during the extended functional analysis and treatment evaluation, respectively. DataPal Reli 1.0 software calculated mean-count-per interval agreement coefficients for inappropriate mealtime behavior from the extended functional analysis and treatment evaluation. The software partitioned sessions into 10-s intervals, divided the smaller frequency of inappropriate mealtime behavior by the larger frequency in each interval, and converted the ratio to a percentage. The software averaged the percentage across intervals to get an agreement

coefficient for each session. Mean agreement for inappropriate mealtime behavior was 88% (range, 83%-93%) and 95% (range, 87%-99%) during the extended functional analysis and treatment evaluation, respectively.

A second observer recorded correct procedure for 74% (range, 33%-100%) of sessions during the extended functional analysis and active acceptance and correct procedure for 57% (range, 33%-80%) of sessions during the treatment evaluation. DataPal Reli 1.0 software calculated total agreement coefficients for correct procedure from the extended functional analysis and active acceptance and correct procedure from the treatment evaluation. The software divided the number of intervals with agreement (i.e., the observers recorded the occurrence or nonoccurrence of the behavior) by the total number of intervals and converted the ratio to a percentage of agreement for each session. Mean agreement for correct procedure was 94% (range, 90%-98%) and 95% (range, 91%-97%) during the extended functional analysis and treatment evaluation, respectively. Mean agreement for active acceptance during the treatment evaluation was 96% (range, 90%-100%).

A second observer recorded correct utensil placement for 57% (range, 33%-80%) of sessions during the treatment evaluation. DataPal Reli 1.0 software calculated mean-duration-per-interval agreement coefficients for correct utensil placement. The software divided the smaller duration of correct utensil placement by the larger duration in each 10-s interval and converted the ratio to a percentage for each session. The software averaged the percentage across intervals to get agreement coefficients. Mean agreement for correct utensil placement during the treatment evaluation was 98% (range, 95%-100%).

Experimental Sequence

Before this study, the feeder conducted a paired-stimulus preference assessment to identify moderate- and high-preferred items for use in the trial-based and extended functional analyses, respectively (Fisher et al., 1992). The feeder first conducted a presentation assessment for solids, liquids, or both, followed by the trial-based functional analysis and then the extended functional analysis. If analyses were warranted for both solids and liquids, the extended functional analyses were not initiated until completion of the presentation assessments and trial-based functional analyses to reduce carryover.

Procedures

Presentation Assessment

We designed the presentation assessment to determine establishing operation (EO)-present and EO-absent target locations to inform the test and control conditions of the trial-based and extended functional analyses, respectively. Bloom et al. (2011) stated that antecedent events can exert more control over responding in the trial-based functional analysis than the extended functional analysis, given the relevant consequences are delivered only once per trial compared to the extended functional analysis in which consequences may be delivered multiple times per session. The presentation assessment ensured relevant discriminative stimuli were present across conditions while arranging the relevant motivating operations. We hypothesized that utensils presented closer to the child would result in a stronger EO to engage in inappropriate mealtime behavior to access escape or attention compared to utensils presented farther from the child.

The feeder randomized the following target locations: at lips, 2.5 cm from lips, midline (i.e., halfway between lips and table), on the table in front of the child, and on the table at the edge of the child's reach. The exact measurements of these locations varied

slightly based on the child's size and seating arrangement. The order of locations was randomized within a series (i.e., one presentation at each location). The feeder presented a bite (drink) to the target location, provided the vocal instruction, "take a bite (drink)," and held the utensil at the target location for 30 seconds. The feeder did not provide attention nor facilitate bite (drink) deposit if the child moved toward the utensil. The observer recorded the presence or absence of inappropriate mealtime behavior and calculated the percentage of trials with inappropriate mealtime behavior at each location. Feeders conducted series until the first author confirmed that inappropriate mealtime behavior was stable at each location.

The target location for control conditions (EO absent) across both analyses was the location that had the lowest likelihood of evoking inappropriate mealtime behavior. For escape and attention test conditions, the target location (EO present) was the location farthest from the child that evoked inappropriate mealtime behavior in 100% of trials but still closer to the child than the EO-absent location. If inappropriate mealtime behavior occurred at all target locations, the first author used the EO-present location in front of the child on the table, and the EO-absent location on the table at the edge of the child's reach.

Trial-Based Functional Analysis

The feeder implemented a trial-based functional analysis to evaluate escape and attention as reinforcers for inappropriate mealtime behavior, as these were the consequences observed or reported to be delivered by caregivers. The feeder randomly determined the first putative reinforcer to evaluate and conducted trials evaluating only that putative reinforcer until the ongoing visual-inspection criteria (explained below) identified a function or indicated a lack of differentiation between test and control conditions.

Before each trial, the feeder placed a colored placemat on the table in front of the child and described the rules for the trial. The feeder used colored placemats associated with each test condition (e.g., orange for escape trials), and the stimuli were present throughout trials. Trials consisted of a 30-s control condition, followed by a 30-s test condition (Bloom et al., 2011). Each trial was separated by a two-min break during which the feeder interacted with the child, and the child remained seated and had access to three moderate-preferred toys to simulate the child's typical environment.

During test and control conditions of the trial-based functional analysis, observers recorded the latency to inappropriate mealtime behavior. If inappropriate mealtime behavior did not occur during the trial, observers entered a latency of 30 s into the spreadsheet.

Escape. During the control condition of escape trials, the feeder presented bites (drinks) to the EO-absent location and delivered the vocal instruction, "take a bite (drink)." The feeder did not provide attention for inappropriate mealtime behavior. After 30 s, the feeder began the escape test condition, moved the utensil to the EO-present location, and repeated the vocal instruction. Immediately following the first instance of inappropriate mealtime behavior, the feeder removed the utensil from the child's reach and restarted the timer for 30 seconds, and after 30 s, the trial ended.

Attention. During the control condition of attention trials, the feeder presented bites (drinks) to the EO-absent location and provided the vocal instruction, "take a bite (drink)." The feeder provided continuous attention consisting of topics unrelated to the meal (e.g., singing). After 30 s, the feeder began the attention test condition and moved the utensil to the EO-present location, repeated the vocal instruction, and stopped providing attention. Immediately following the first instance of inappropriate mealtime behavior, the feeder provided attention that was similar to the attention caregivers

provided in preliminary meal observations and restarted the timer for 30 seconds. To ensure attention was similar, the feeder used a checklist during preliminary meal observations to record how the caregiver responded (e.g., statements of comfort, reprimands) and the tone (e.g., flat, animated). The utensil remained where the feeder initially presented it. After 30 s, the trial ended.

Extended Functional Analysis

The feeder conducted the same test conditions during the extended functional analysis as the trial-based functional analysis (i.e., escape and attention). The feeder implemented extended functional analyses using a pairwise design (e.g., Bachmeyer et al., 2009) and the same procedures described by Kirkwood et al. (2020), with the exception of target locations for bites (drinks). The feeder randomly determined the first putative reinforcer to evaluate in the first phase. Within each phase, the feeder randomized the order of test and control conditions and conducted pairs of five-bite (drink) sessions.

Before each session, the feeder placed a colored placemat on the table in front of the child and stated the rules. The feeder presented bites (drinks) to the EO-present (escape and attention) or EO-absent (control) location, provided a vocal instruction, “take a bite (drink),” and started a timer for 30 seconds. After 30 s, the feeder removed the utensil and began the next trial.

Escape. If the child engaged in inappropriate mealtime behavior, the feeder removed the utensil and restarted the timer for 30 seconds. The feeder did not interact with the child.

Attention. If the child engaged in inappropriate mealtime behavior, the feeder provided attention for 30 seconds. During this time, the utensil remained where it was

initially presented. The feeder provided similar attention to that delivered during the trial-based functional analysis.

Control. Before each session, the feeder presented three of the child's high-preferred items and instructed the child to select one. The feeder gave the selected item to the child, removed the others, and provided free access to the item throughout the session. The feeder did not provide differential consequences for inappropriate mealtime behavior and provided noncontingent attention on topics unrelated to the meal. If the child engaged in inappropriate mealtime behavior, the feeder kept the utensil where it was initially presented.

Data Analysis

The observer analyzed the results from the trial-based and extended functional analyses using ongoing visual-inspection criteria (Saini et al., 2018). Ongoing visual inspection uses modified visual-inspection criteria that Roane et al. (2013) developed to increase inter-rater agreement. Briggs et al. (in preparation) modified the visual-inspection criteria for use with latency-based functional analyses, and we used those modifications in the current study to analyze responding in the trial-based functional analyses. For the trial-based functional analysis, the first author identified a *function* when the number of test condition data points that fell below the lower criterion line (LCL; i.e., one standard deviation below the mean) minus the number of test condition data points that fell above the upper criterion line (UCL; i.e., one standard deviation above the mean) was greater than or equal to the number of trials divided by two. For the extended functional analysis, the first author identified a *function* when the number of test condition data points that fell above the UCL minus the number of test condition data points that fell below the LCL was greater than or equal to the number of test conditions divided by two.

Efficiency. From all analyses, the first author calculated the total time until maintaining variables were identified or the data were identified as undifferentiated to determine the *efficiency* of analyses. To calculate the total time for the presentation assessment, the first author multiplied the number of trials by 30 s and divided by 60 to obtain the total number of minutes. To calculate the total time for the trial-based functional analysis, the first author multiplied the number of trials by 30 s for control conditions. The first author then summed the latency to inappropriate mealtime behavior across trials plus the number of trials times 30 s to obtain the number of seconds of test conditions. The first author summed the time across conditions and divided by 60 to determine the length of the analysis in minutes. To calculate the total time for the extended functional analysis, observers recorded the total duration using DataPal 1.0. The total time during the extended functional analysis included the amount of time that the utensil was within and outside the child's reach.

Treatment Evaluation

Following the trial-based and extended functional analyses, we evaluated indicated treatments. If both analyses identified the same maintaining variables, we evaluated the indicated treatment. If the analyses did not match (e.g., trial-based indicated an escape function and extended indicated an attention function), we compared indicated treatments to determine which produced clinically significant changes in the child's behavior. If either the trial-based or extended functional analysis was undifferentiated, we evaluated the indicated treatment from the analysis that was differentiated. If both analyses were undifferentiated, we conducted an extended baseline to evaluate child responding without treatment.

Experimental Design. We evaluated the efficacy of the indicated treatment using a reversal design consisting of function-based baseline and function-based

treatment phases. If the functional analyses indicated different treatments, we embedded an alternating treatments design into the baseline and treatment phases. Vick's solids and liquids treatment evaluations included additional reversals to compare treatments in isolation.

General Procedures. Feeders presented solids exclusively in some meals and liquids exclusively in others. Feeders used the same session structure as the extended functional analysis (e.g., five bite [drink] presentations, vocal instruction, "take a bite [drink]"). If the child met the criteria for active acceptance, the feeder deposited the bite (drink) into the child's mouth, provided praise, and removed the utensil. If the feeder did not deposit the bite (drink), the utensil was removed after 30 seconds. If the feeder deposited the entire bite (drink) into the child's mouth, the feeder checked the child's mouth 30 s later to determine if they had swallowed. If there was no food (liquid) larger than a pea in their mouth after 30 s (not due to the food [liquid] exiting the mouth), the feeder provided praise. If there was food (liquid) larger than a pea in the child's mouth, the feeder told the child to swallow and moved to the next bite (drink). If there was food (liquid) larger than a pea in the child's mouth after the fifth trial, the feeder continued to check the child's mouth every 30 s until there was none or until the 10-min session cap was reached, at which point the feeder wiped food (liquid) out of the child's mouth using a Toothette oral swab. The feeder did not provide differential consequences for expulsion, coughing, gagging, or vomiting.

Baseline. The feeder presented the bite (drink) to the child's lips as described in the treatment evaluation general procedures. If the feeder did not deposit the bite (drink), the utensil remained where it was initially presented for 30 seconds. The feeder followed the extended functional analysis procedures (described above) for the identified function(s). For example, if feeders identified an escape function in both the trial-based

and extended functional analyses, feeders removed the bite or drink for 30 s following the first instance of inappropriate mealtime behavior.

If no function was identified, the feeder followed the general procedures and presented bites (drinks) every 30 seconds. After we observed stable levels of active acceptance and inappropriate mealtime behavior during baseline, we made one change at a time to systematically increase the response effort associated with bite or drink acceptance (e.g., presenting larger boluses) to identify evocative conditions that might lead to higher levels of inappropriate mealtime behavior.

Treatment. If escape and attention were identified as maintaining variables for inappropriate mealtime behavior, feeders implemented escape and attention extinction. If escape (not attention) was identified as the maintaining variable, escape extinction was implemented and feeders continued to provide attention following inappropriate mealtime behavior. If attention (not escape) was identified as the maintaining variable, attention extinction was implemented and feeders continued to provide escape following inappropriate mealtime behavior.

Escape and Attention Extinction (EE AE). The feeder followed the treatment evaluation general procedures with the following additions. The feeder kept the utensil touching the child's lips until the child opened their mouth. If the child did not actively accept the bite (drink) within 5 s of presentation, the feeder deposited the bite (drink) in the child’s mouth at the first opportunity. The feeder did not provide attention following inappropriate mealtime behavior. The feeder used the utensil to collect expelled food or liquid as quickly as possible and placed it back in the child's mouth. If the child coughed or gagged, the feeder moved the utensil to the child’s cheek until the coughing or gagging stopped before returning the utensil to the child’s lips. If the child vomited, the feeder wiped away the vomit from the child’s face and the table before returning the

utensil to the child's lips. If a second feeder was needed due to a decrease in correct utensil placement, the second feeder stood behind the child facing the child's back and placed their arms over the child's shoulders. The second feeder's arms hovered 15 cm above and parallel to the child's torso when the bite (drink) was within the child's reach. The second feeder blocked the child's attempts to bring their hands to the utensil or turn their head (Piazza et al., 2003b).

Escape Extinction with Attention (EE Attn). The feeder followed the escape and attention extinction procedures with the following modifications. Immediately following inappropriate mealtime behavior, the feeder provided brief attention (3 to 5 s) that was similar to the attention that caregivers provided in preliminary meal observations.

Attention Extinction with Escape (AE Esc). The feeder followed the treatment evaluation general procedures with the following additions. Immediately following inappropriate mealtime behavior, the feeder removed the utensil for 30 s and withheld attention. If the child did not engage in inappropriate mealtime behavior, the utensil remained where it initially touched the child's lips for 30 seconds.

Caregiver Acceptability

After the trial-based and extended functional analyses, the first author gave caregivers a questionnaire to determine the acceptability of the procedures. The questionnaire was a modified version of the Treatment Acceptability Rating Form–Revised that Langthorne and McGill (2011) adapted for use with functional analyses. The questionnaire was modified to specify "inappropriate mealtime behavior" instead of "challenging behavior." The questionnaire contained nine statements and instructed caregivers to indicate their level of agreement using a Likert scale that ranged from 1

(strongly disagree) to 5 (strongly agree). The questionnaire included statements on the acceptability of the functional analysis, the child's perceived discomfort during the functional analysis, and the caregiver's perception of the effectiveness of the functional analysis. The first author determined acceptability ratings by calculating the average rating and range of scores for each statement on the questionnaire across caregivers.

CHAPTER 2: RESULTS

During Kaylee's solids presentation assessment, she engaged in inappropriate mealtime behavior during 100% of trials when the bite was presented at the lips, 2.5 cm from the lips, midline, and on the table in front of her. She engaged in inappropriate mealtime behavior during 67% of trials when the bite was presented on the table at the edge of her reach. Therefore, the first author identified the EO-present location as on the table in front of her and the EO-absent location as on the table at the edge of her reach.

Figure 1 displays the results of Kaylee's solids functional analyses and treatment evaluation. During the trial-based functional analysis (first pane), the latency to inappropriate mealtime behavior was lower in the attention (*M* = 0.7 s; range, 0.3-1.5 s) and escape (*M* = 0.9 s; range, 0.8-1 s) test conditions relative to the attention (*M* = 8 s; range, 1-30 s) and escape (*M* = 1 s) control conditions. The first trial was not analyzed using ongoing visual inspection due to an integrity error (i.e., the bite was presented to the incorrect location). The trial-based functional analysis identified escape and attention as maintaining variables. During the extended functional analysis (second pane), Kaylee engaged in inappropriate mealtime behavior at a higher rate in the escape (*M* = 20; range, 8-27) and attention (*M* = 5; range, 3-7) conditions relative to the control condition (*M* = 0.2; range, 0-0.8). The extended functional analysis identified escape and attention as maintaining variables.

Both solids functional analyses identified the same maintaining variables for Kaylee; therefore, feeders implemented escape and attention extinction. Rate of inappropriate mealtime behavior and active acceptance during the treatment evaluation are displayed in the third and fourth panes of Figure 1, respectively. Inappropriate mealtime behavior per min was high and increasing (*M* = 27; range, 0-76) and active acceptance was at 0% during the escape and attention baseline phases. Inappropriate mealtime behavior per min was low and decreasing (*M* = 4; range, 0-24) and active acceptance was variable and increasing (*M* = 35%; range, 0%-100%) during escape and attention extinction phases.

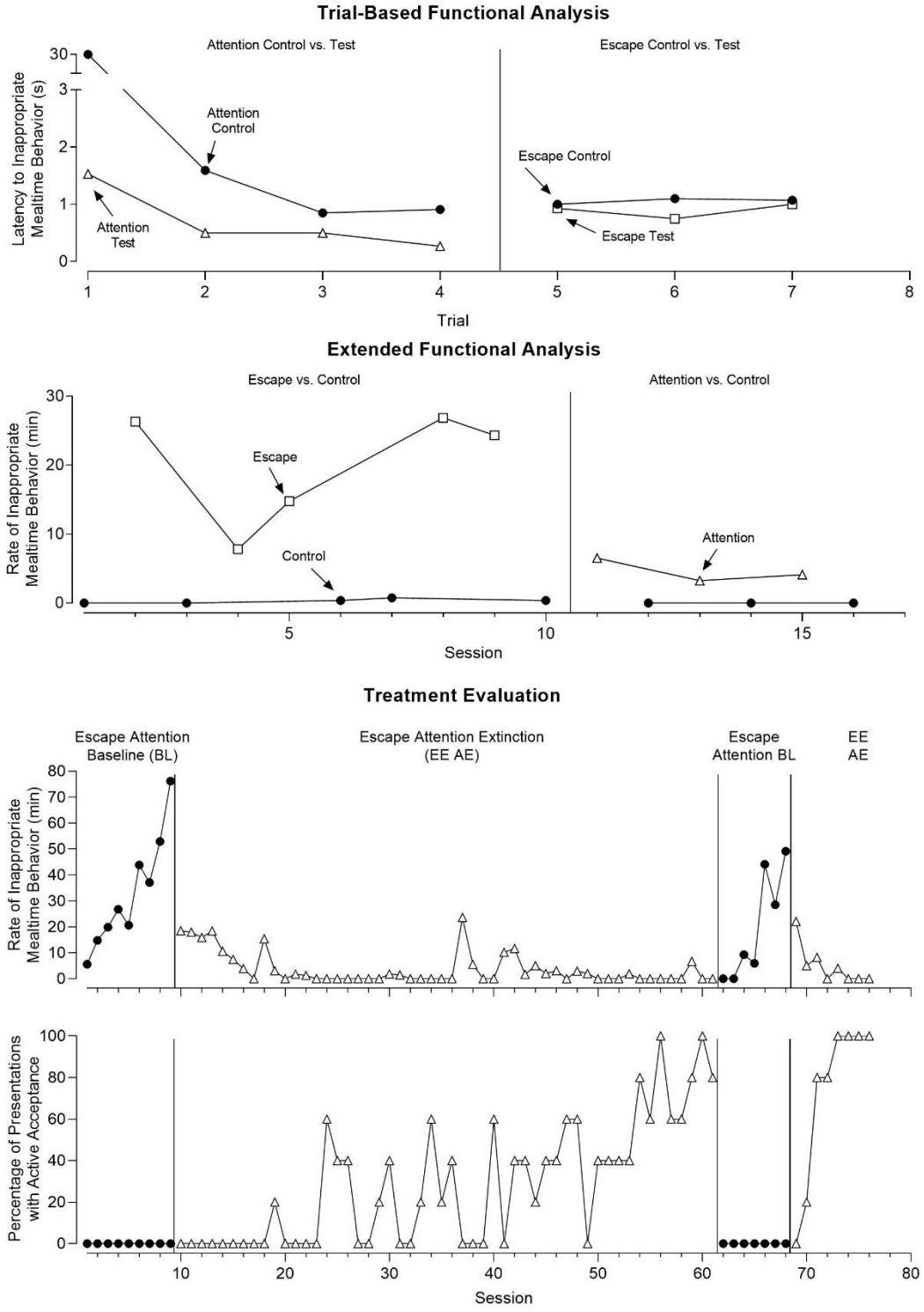

Figure 1: Kaylee's solids functional analyses and treatment evaluation.

During Callie's liquids presentation assessment, she engaged in inappropriate mealtime behavior during 100% of trials when the drink was presented 2.5 cm from the lips and on the table in front of her, 75% of trials when the drink was presented on the table at the edge of her reach, 50% of trials when the drink was presented to midline, and 25% of trials when the drink was presented at the lips. Therefore, the first author identified the EO-present location as 2.5 cm from the lips and the EO-absent location as midline.

Figure 2 displays the results of Callie's liquids functional analyses and treatment evaluation. During the trial-based functional analysis (first pane), the latency to inappropriate mealtime behavior was at similar levels in the escape test (*M* = 24 s; range, 5-30 s) and escape control (*M* = 28 s; range, 5-30 s) conditions, and variable in the attention test (*M* = 20; range, 3-30) and attention control (*M* = 19 s; range, 5-30 s) conditions. The trial-based functional analysis did not identify a maintaining variable. During the extended functional analysis (second pane), Callie engaged in inappropriate mealtime behavior at a higher rate in the control condition (*M* = 5; range, 0-12) relative to the attention (*M* = 1; range, 0-3) and escape (*M* = 0.4; range, 0-2) conditions. The extended functional analysis did not identify a maintaining variable.

Given no identified functions, the feeder conducted baseline procedures and did not respond differentially to inappropriate mealtime behavior. The feeder increased the bolus size and drink presentation rate (as indicated by the arrows in Figure 2). The size of the drink was increased from 2 ml to 4 ml, 6 ml, and 8 ml at sessions 17, 38, and 45, respectively. Also, the rate of drink presentations was increased so there was 15 s (instead of 30 s) between drinks starting with session 31. Rate of inappropriate mealtime behavior and active acceptance are depicted in the third and fourth panes of Figure 2,

respectively. Inappropriate mealtime behavior per min was low (*M* = 0.3; range, 0-4) and active acceptance was variable and high (*M* = 84%; range, 20%-100%) during baseline.

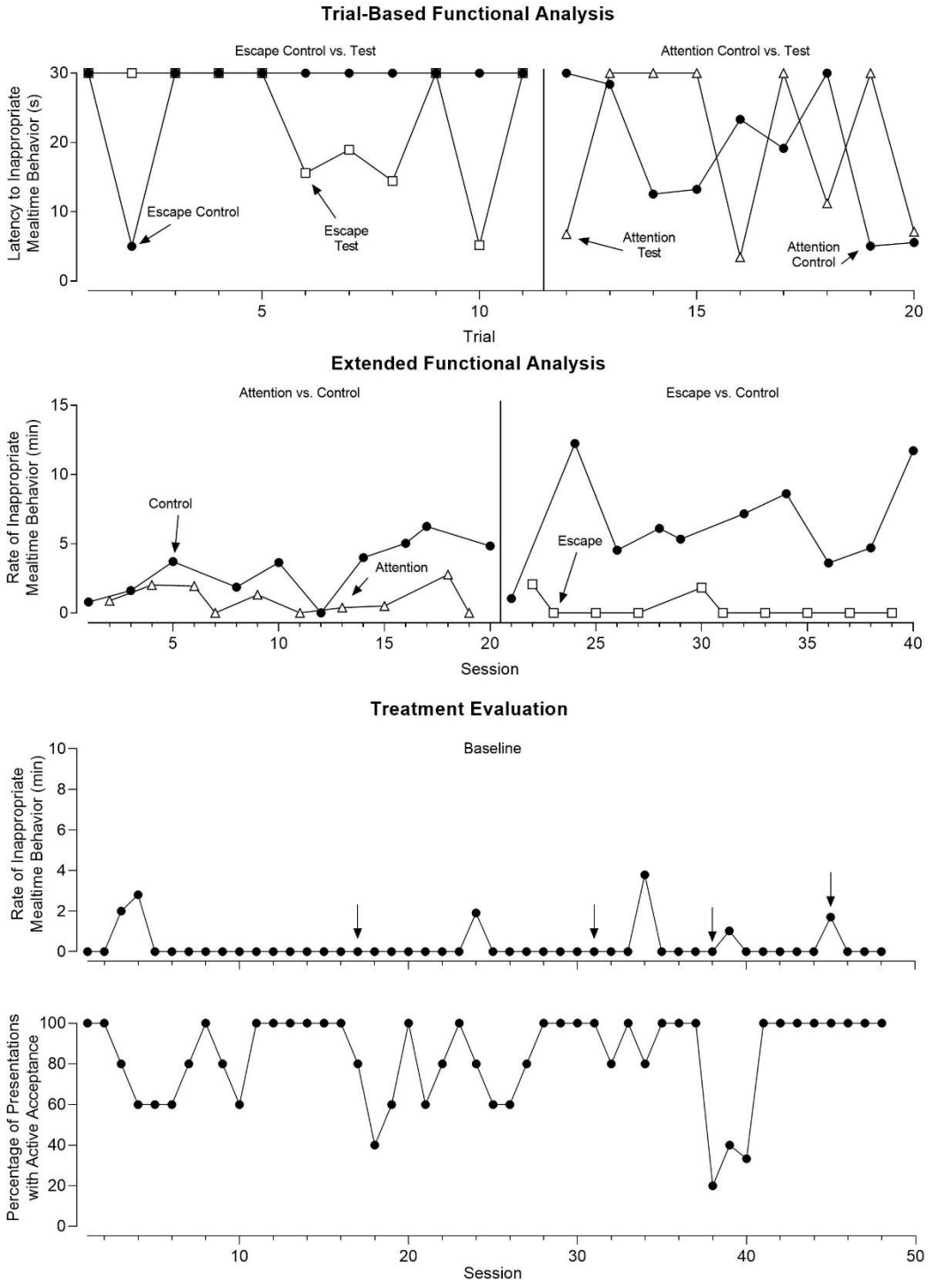

Figure 2: Callie's liquid functional analyses and treatment evaluation. Arrows indicate the session that rate or bolus increases occurred.

During Callie's solids presentation assessment, she engaged in inappropriate mealtime behavior during 100% of trials when the bite was presented at her lips and at midline, 66% of trials when the bite was presented on the table at the edge of her reach, and 33% of trials when the bite was presented 2.5 cm from the lips and on the table in front of her. Therefore, the first author identified the EO-present location as at lips and the EO-absent location as 2.5 cm from the lips.

Figure 3 displays the results of Callie's solids functional analyses and treatment evaluation. During Callie's trial-based functional analysis (first pane), the latency to inappropriate mealtime behavior was lower in the escape (*M* = 4 s; range, 1-16 s) and attention (*M* = 6 s; range, 3-10 s) test conditions relative to the escape (*M* = 12 s; range, 3-30 s) and attention (*M* = 17 s; range, 10-30 s) control conditions. The trial-based functional analysis identified escape and attention as maintaining variables. During Callie's extended functional analysis (second pane), she engaged in inappropriate mealtime behavior at a higher rate in the escape condition (*M* = 21; range, 4-34) relative to the attention (*M* = 6; range, 0.4-8) and control (*M* = 10; range, 2-17) conditions. The extended functional analysis identified escape as the maintaining variable.

Callie's solids functional analyses indicated different treatments; therefore, feeders compared escape and attention extinction to escape extinction with attention for inappropriate mealtime behavior. During baseline, rate of inappropriate mealtime behavior (third pane) was high and variable during the escape and attention baseline (*M* = 27; range, 15-35) and the escape baseline (*M* = 27; range, 22-29). During baseline, the percentage of trials with active acceptance (fourth pane) was 0% across conditions. After beginning the treatment comparison, inappropriate mealtime behavior decreased and remained low during escape and attention extinction (*M* = 2; range, 0-15) and escape extinction with attention for inappropriate mealtime behavior (*M* = 0.7; range, 0-

4). Active acceptance did not increase during escape and attention extinction (*M* = 10%; range, 0%-33%) or escape extinction with attention for inappropriate mealtime behavior (*M* = 3%; range, 0%-33%). Due to an increase in vomiting, Callie's treatment progression shifted, and she was no longer appropriate for the study.

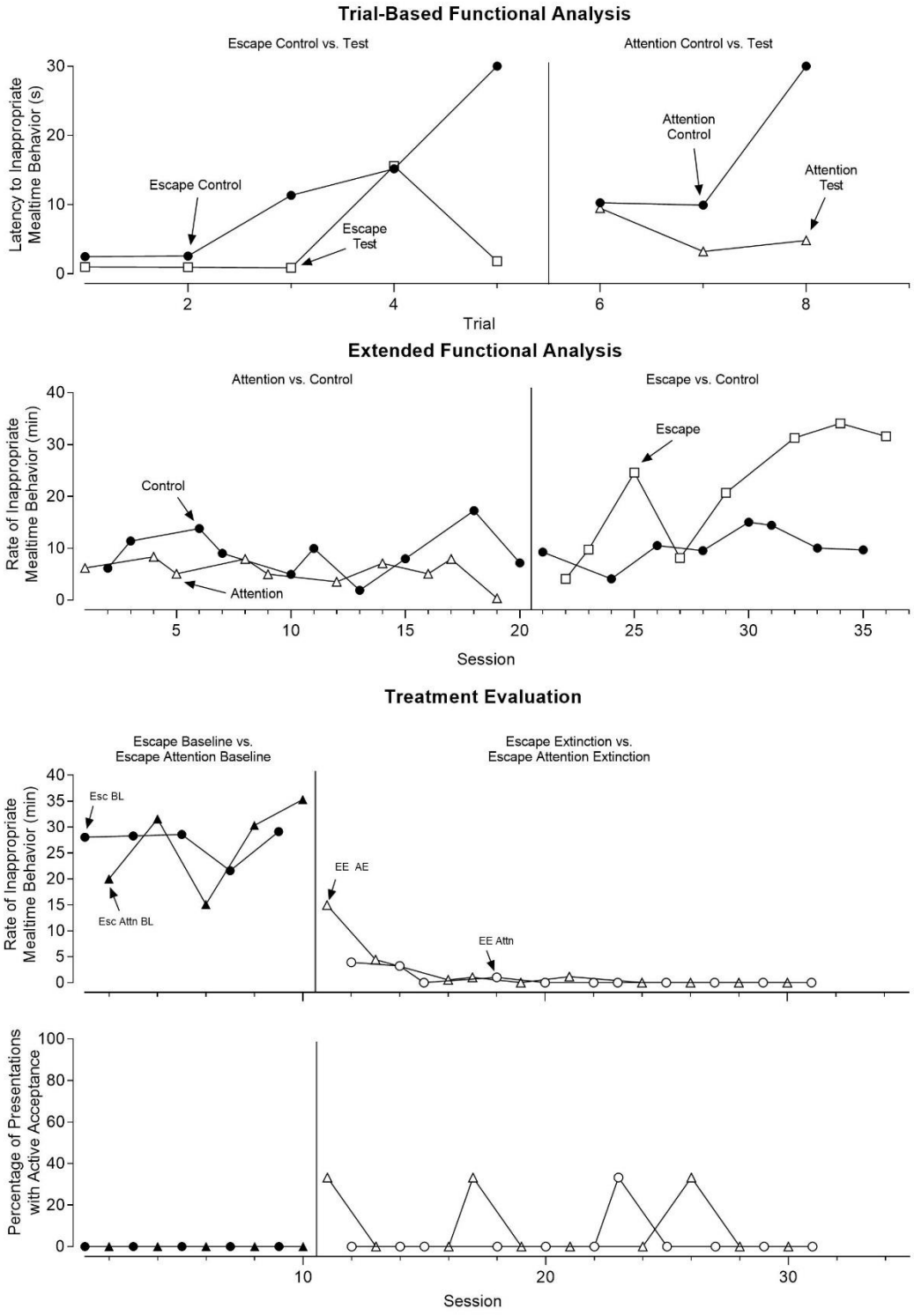

Figure 3: Callie's solids functional analyses and treatment evaluation.

During Hank's solids presentation assessment, he engaged in inappropriate mealtime behavior during 100% of trials when the bite was presented 2.5 cm from the lips, at midline, and on the table in front of him, 66% of trials when the bite was presented at the lips, and 33% of trials when the bite was presented on the table at the edge of his reach. Therefore, the first author identified the EO-present location as on the table in front of him and the EO-absent location as on the table at the edge of his reach.

Figure 4 displays the results of Hank's solids functional analyses and treatment evaluation. During Hank's trial-based functional analysis (first pane), the latency to inappropriate mealtime behavior was low in the attention test condition (*M* = 4 s; range, 0.5-30 s) and variable in the attention control condition (*M* = 12 s; range, 0.4-30 s). The latency to inappropriate mealtime behavior was lower in the escape test condition (*M* = 6 s; range, 0.9-30 s) relative to the escape control condition (*M* = 16 s; range, 2-30 s). The trial-based functional analysis identified escape as the maintaining variable. During Hank's extended functional analysis (second pane), he engaged in inappropriate mealtime behavior at a higher rate in the attention (*M* = 7; range, 5-13) and escape (*M* = 17; range, 11-23) conditions relative to the control condition (*M* = 0.9; range, 0-4). The feeder conducted a second attention-versus-control phase due to an error in implementing the ongoing visual-inspection criteria. That is, the feeder transitioned to a new phase before the ongoing visual-inspection criteria confirmed an attention function. The extended functional analysis identified escape and attention as maintaining variables.

Hank's solids functional analyses indicated different treatments; therefore, feeders compared escape extinction with attention for inappropriate mealtime behavior to escape and attention extinction. Rate of inappropriate mealtime behavior (third pane) was high and variable during the initial escape baseline (*M* = 27; range, 21-32) and

escape and attention baseline (*M* = 26; range, 19-29). The percentage of trials with active acceptance (fourth pane) was 0% during the initial escape baseline and escape and attention baseline. After beginning the treatment comparison, inappropriate mealtime behavior decreased and remained low during escape extinction with attention for inappropriate mealtime behavior (*M* = 2; range, 0-16) and escape and attention extinction (*M* = 2; range, 0-5). Active acceptance increased during escape extinction with attention for inappropriate mealtime behavior (*M* = 74%; range, 0%-100%) and escape and attention extinction (*M* = 76%; range, 20%-100%). After returning to the baseline phase, Hank's inappropriate mealtime behavior remained low during the escape baseline (*M* = 0.5; range, 0-11) and the escape and attention baseline (*M* = 0.5; range, 0-12). Also, active acceptance remained high during the escape baseline (*M* = 97%; range, 40%-100%) and the escape and attention baseline (*M* = 98%; range, 60%-100%). Only after increasing the rate of bite presentations, adding novel foods, changing the meal setting, and adding caregivers and siblings to the room (as indicated by arrows in Figure 4) did inappropriate mealtime behavior and active acceptance return to initial baseline levels. Specifically, the bite presentation rate was increased to every 15 s (instead of 30 s) and then every 5 s at sessions 48 and 78, respectively; novel foods were introduced at session 60; the caregiver began feeding at session 98; the meal occurred outside at a picnic bench at session 118; and the sibling was in the meal area at session 132. After initiating the comparison again for Hank, inappropriate mealtime behavior was variable and low during escape extinction with attention for inappropriate mealtime behavior (*M* = 3; range, 0-10) and escape and attention extinction (*M* = 4; range, 0-13). Active acceptance increased during escape extinction with attention for inappropriate mealtime behavior (*M* = 92%; range, 40%-100%) and escape and attention extinction (*M* = 94%; range, 60%-100%).

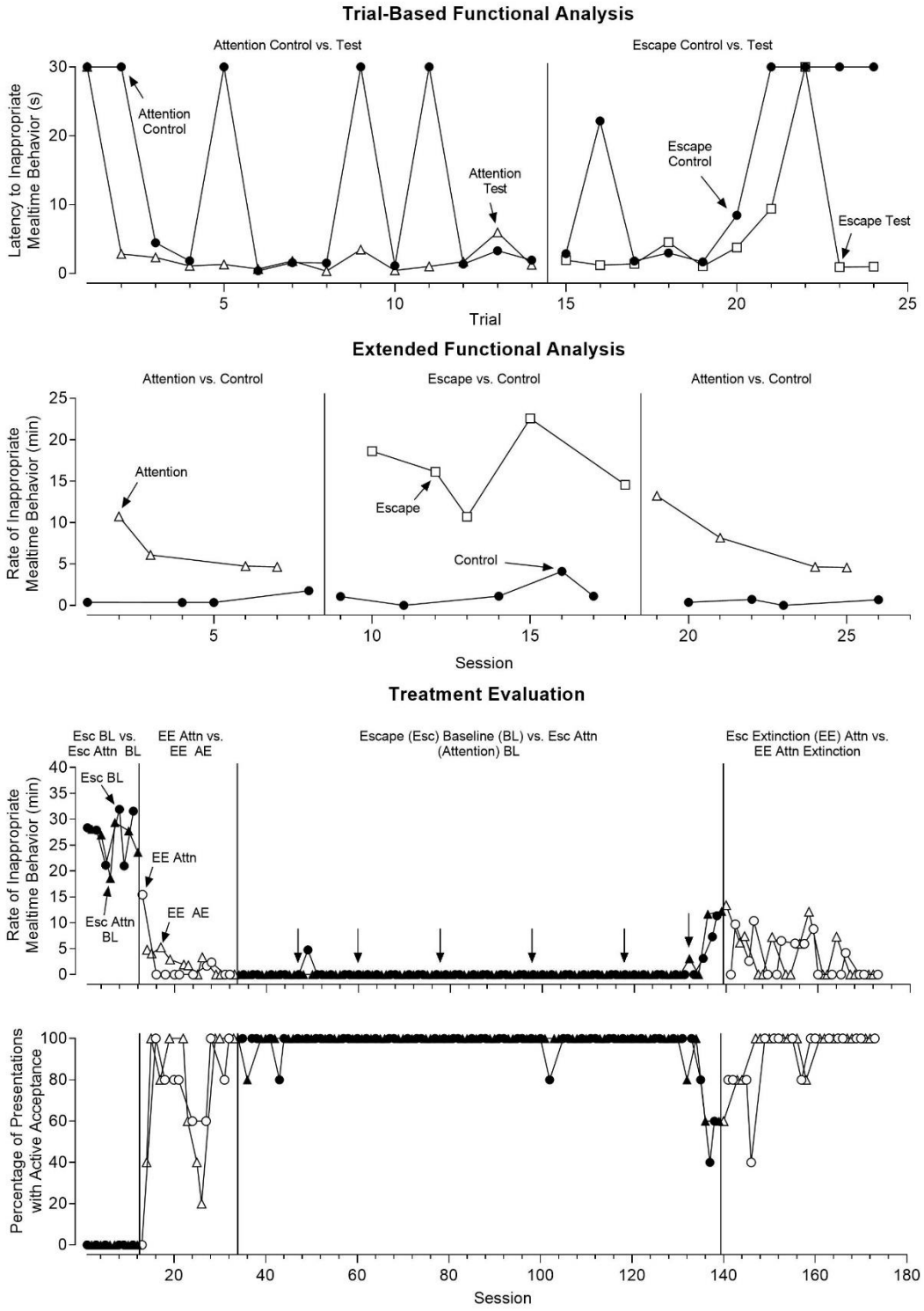

Figure 4: Hank's solids functional analyses and treatment evaluation. Arrows indicate the session that rate, bolus, feeder, or variety changes occurred.

During Vick's solids presentation assessment, he engaged in inappropriate mealtime behavior during 100% of trials when the bite was presented at the lips, 2.5 cm from the lips, at midline, on the table in front of him, and on the table at the edge of his reach. Therefore, the first author identified the EO-present location as on the table in front of him and the EO-absent location as on the table at the edge of his reach.

Figure 5 displays the results of the functional analyses and treatment evaluation for Vick's solids. During the trial-based functional analysis (first pane), the latency to inappropriate mealtime behavior was lower in the attention test condition (*M* = 0.8 s; range, 0.3-2 s) relative to the attention control condition (*M* = 2 s; range, 0.6-9 s). The latency to inappropriate mealtime behavior was low in the escape test condition (*M* = 0.5 s; range, 0.2-1.4 s) and variable in the escape control condition (*M* = 3 s; range, 0.4-18 s). The trial-based functional analysis identified attention as the maintaining variable. During the extended functional analysis (second pane), Vick engaged in inappropriate mealtime behavior at a higher rate in the attention (*M* = 20; range, 18-24) and escape (*M* = 40; range, 27-49) conditions relative to the control condition (*M* = 3; range, 0.7-5). The extended functional analysis identified escape and attention as maintaining variables.

Vick's solids functional analyses indicated different treatments; therefore, feeders compared attention extinction with escape for inappropriate mealtime behavior to escape and attention extinction. Rate of inappropriate mealtime behavior and active acceptance during the treatment evaluation are depicted in the third and fourth panes of Figure 5, respectively. During the baseline phases, inappropriate mealtime behavior per min was high and variable during the attention baseline (*M* = 16; range, 11-23) and the escape and attention baseline (*M* = 34; range, 10-52). Also, active acceptance was low and variable during the attention baseline (*M* = 13%; range, 0-80%) and the escape and attention baseline (*M* = 17%; range, 0-100%). During the treatment comparison phases,

inappropriate mealtime behavior per min was low and variable during attention extinction with escape for inappropriate mealtime behavior (*M* = 3; range, 0-19) and escape and attention extinction (*M* = 6; range, 0-14). Active acceptance was high and variable during attention extinction with escape for inappropriate mealtime behavior (*M* = 82%; range, 20%-100%) and during escape and attention extinction (*M* = 86%; range, 0%-100%). When conducting treatment in isolated phases, inappropriate mealtime behavior was lower (*M* = 0.6; range, 0-6) and active acceptance was higher (*M* = 89%; range, 60%-100%) during the attention extinction with escape phases compared to inappropriate mealtime behavior (*M* = 5; range, 1-11) and active acceptance (*M* = 79%; range, 20%-100%) during the escape and attention extinction phase.

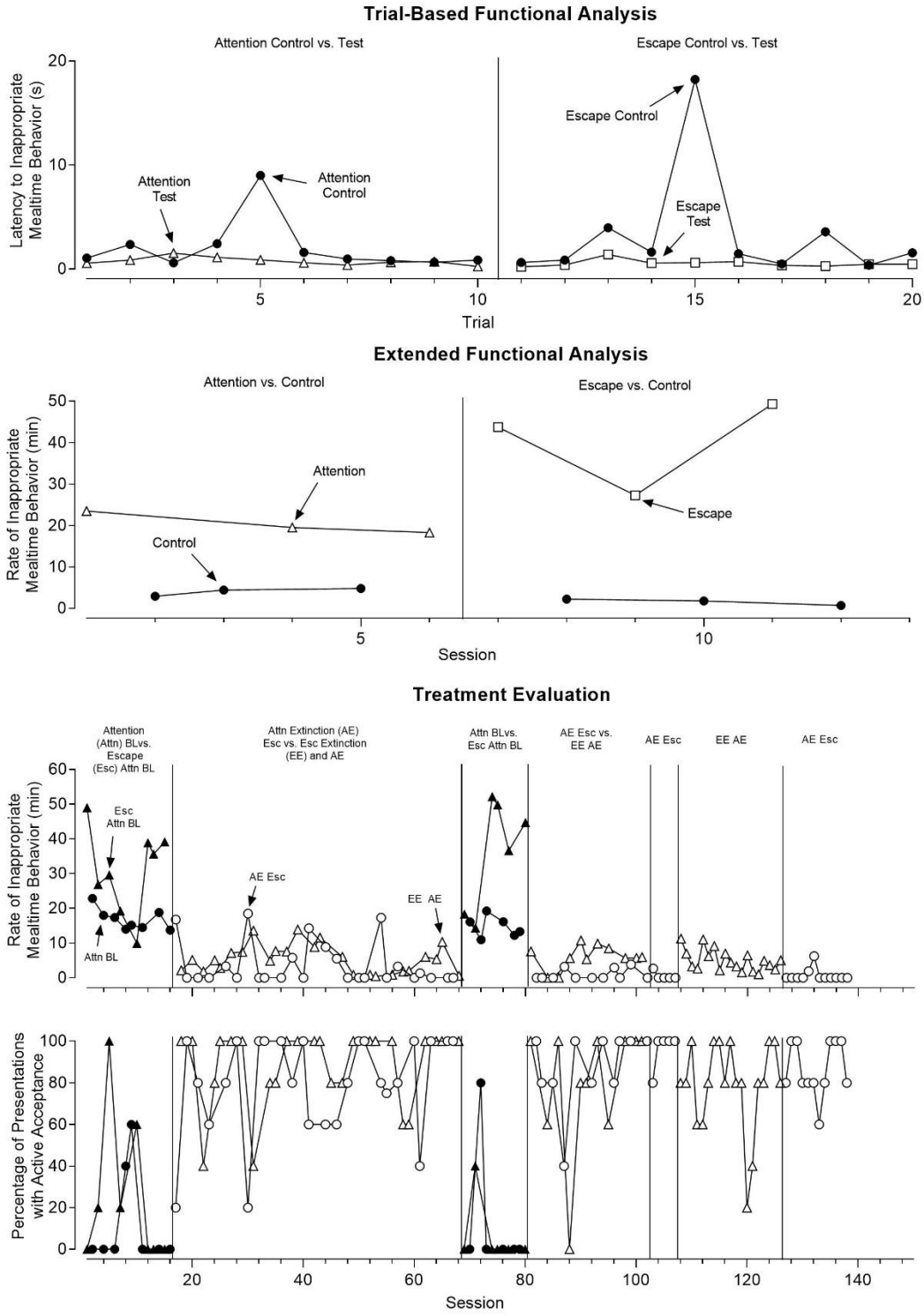

Figure 5: Vick's solids functional analyses and treatment evaluation.

During Vick's liquids presentation assessment, he engaged in inappropriate mealtime behavior during 100% of trials when the drink was presented at the lips, 2.5 cm from the lips, at midline, on the table in front of him, and on the table at the edge of his reach. Therefore, the first author identified the EO-present location as on the table in front of him and the EO-absent location as on the table at the edge of his reach.

Figure 6 displays the results of Vick's liquids functional analyses and treatment evaluation. During the trial-based functional analysis (first pane), the latency to inappropriate mealtime behavior was lower in the attention test condition (*M* = 2 s; range, 0.6-7 s) relative to the attention control condition (*M* = 3 s; range, 1-5 s). The latency to inappropriate mealtime behavior was low in the escape test (*M* = 0.8 s; range, 0.3-1.5 s) and escape control (*M* = 3 s; range, 0.4-13 s) conditions. The trial-based functional analysis identified attention as the maintaining variable. During the extended functional analysis (second pane), Vick engaged in inappropriate mealtime behavior at a higher rate in the attention (*M* = 20; range, 15-25) and escape (*M* = 30; range, 26-33) conditions relative to the control condition (*M* = 0.9; range, 0-3). The extended functional analysis identified escape and attention as maintaining variables.

Vick's liquids functional analyses indicated different treatments; therefore, feeders compared attention extinction with escape for inappropriate mealtime behavior to escape and attention extinction. Rate of inappropriate mealtime behavior and active acceptance during the treatment evaluation are displayed in the third and fourth panes of Figure 6, respectively. During the baseline phases, inappropriate mealtime behavior per min was high and variable during the attention baseline (*M* = 14; range, 8-17) and the escape and attention baseline (*M* = 29; range, 6-55). Active acceptance was low during the attention baseline (*M* = 2%; range, 0%-20%) and the escape and attention baseline (*M* = 3%; range, 0%-20%). During the treatment comparison phases, inappropriate

mealtime behavior per min was low and variable during attention extinction with escape for inappropriate mealtime behavior (*M* = 9; range, 0-32) and escape and attention extinction (*M* = 9; range, 1-20). Also, active acceptance was high and variable during attention extinction with escape for inappropriate mealtime behavior (*M* = 41%; range, 0%-100%) and during escape and attention extinction (*M* = 65%; range, 0%-100%). When conducting treatment in isolated phases, rate of inappropriate mealtime behavior was similar during the escape and attention extinction phases (*M* = 7; range, 1.5-12) compared to rate of inappropriate mealtime behavior during attention extinction with escape for inappropriate mealtime behavior (*M* = 10; range, 0-22). Active acceptance was higher during escape and attention extinction (*M* = 89%; range, 40%-100%) compared to active acceptance during attention extinction with escape for inappropriate mealtime behavior (*M* = 51%; range, 0%-100%).

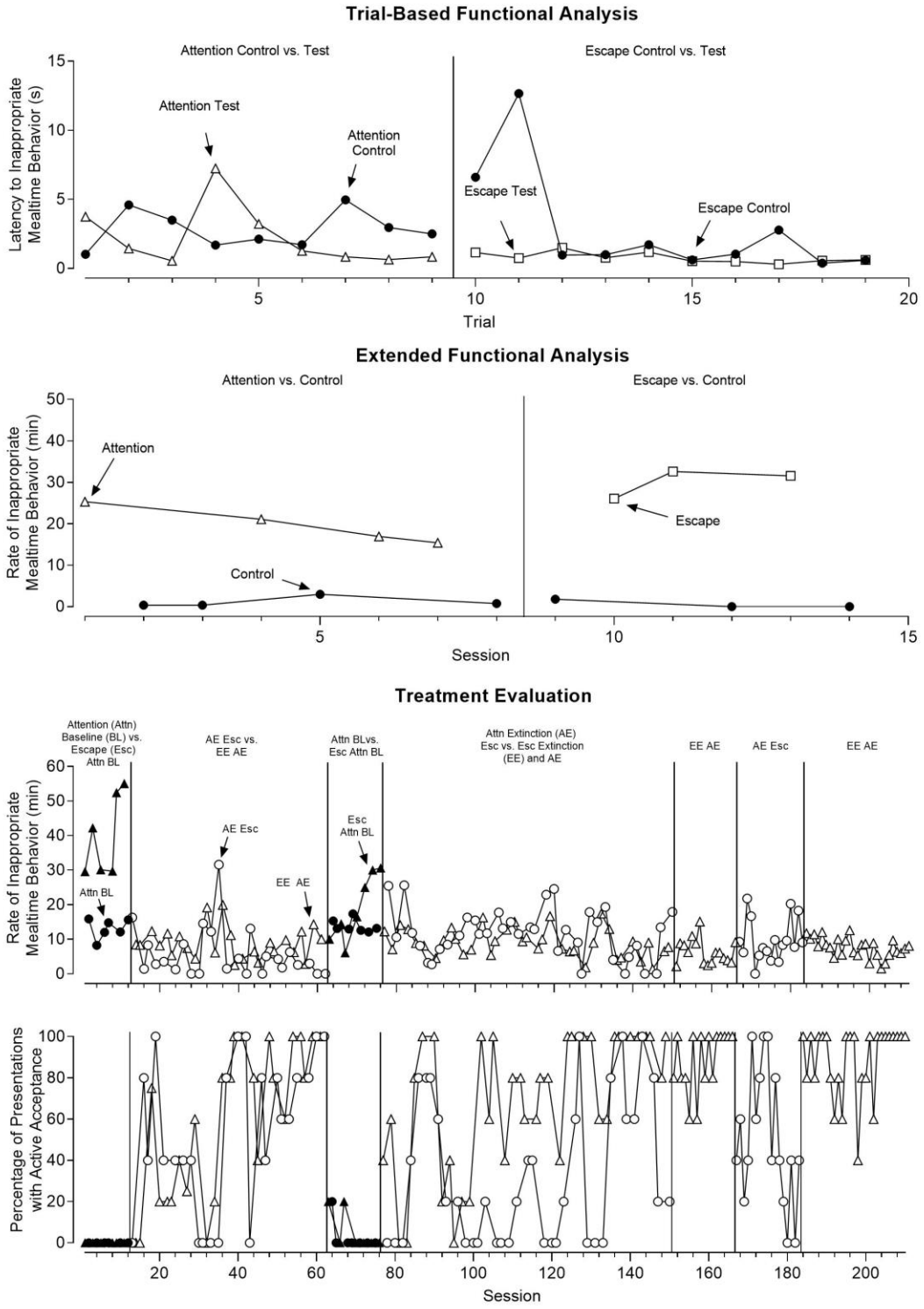

Figure 6: Vick's liquids functional analyses and treatment evaluation.

During Hank's liquids presentation assessment, he engaged in inappropriate mealtime behavior during 100% of trials when the drink was presented 2.5 cm from the lips and on the table in front of him and 75% of trials when the drink was presented to the lips, at midline, and on the table at the edge of his reach. Therefore, the first author identified the EO-present location as 2.5 cm from his lips and the EO-absent location as at midline.

Figure 7 displays the results of Hank's liquids functional analyses and treatment evaluation. During the trial-based functional analysis (first pane), the latency to inappropriate mealtime behavior was variable in the attention test (*M* = 14 s; range, 2-30 s) and attention control (*M* = 12 s; range, 2-30 s) conditions. The latency to inappropriate mealtime behavior was lower in the escape control condition (*M* = 6 s; range, 1-30 s) relative to the escape test condition (*M* = 11 s; range, 1-30 s). The trial-based functional analysis did not identify a maintaining variable of inappropriate mealtime behavior. During the extended functional analysis (second pane), Hank engaged in inappropriate mealtime behavior at a higher rate in the attention (*M* = 64; range, 38-112) and escape (*M* = 14; range, 5-25) conditions relative to the control condition (*M* = 3; range, 0.7-6). The extended functional analysis identified escape and attention as maintaining variables.

For Hank, feeders did not identify a function during the trial-based functional analysis and identified escape and attention functions during the extended functional analysis; therefore, escape and attention extinction were evaluated as the indicated treatments. Rate of inappropriate mealtime behavior and active acceptance during the treatment evaluation are displayed in the third and fourth panes of Figure 7, respectively. Inappropriate mealtime behavior per min (*M* = 15; range, 0-55) and active acceptance (*M* = 56%; range, 0-100%) were variable during baseline. Inappropriate mealtime

behavior per min was low (*M* = 2; range, 0-17) and active acceptance was high and increasing (*M* = 85%; range, 60%-100%) during escape and attention extinction phases.

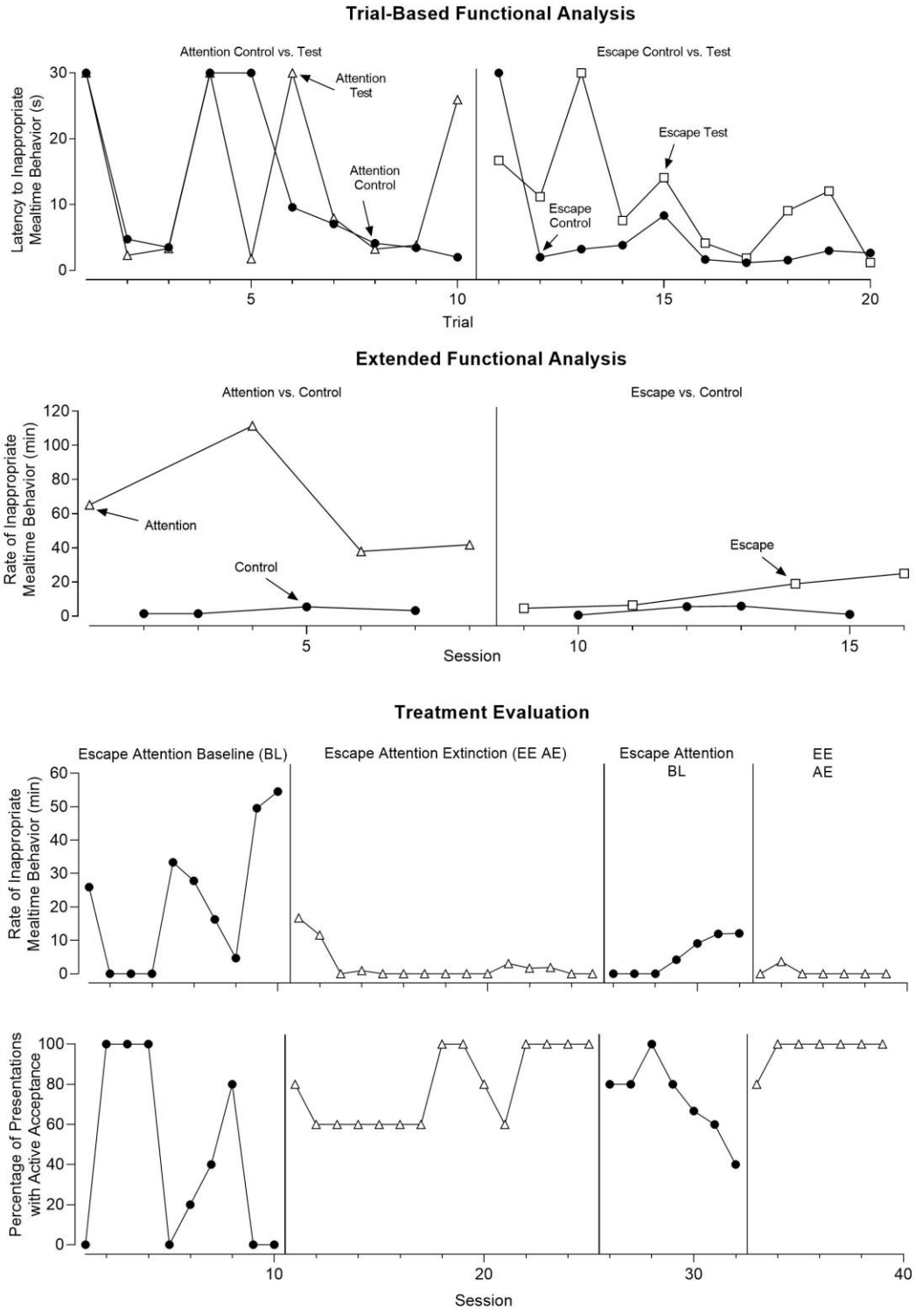

Figure 7: Hank's liquids functional analyses and treatment evaluation.

Table 2 depicts a summary of the results across children, including the functions identified from the trial-based and extended functional analyses and the outcomes of indicated treatments. Across children, two pairs of functional analyses (29%) had exact agreement, four pairs of functional analyses (57%) had partial agreement, and one pair of functional analyses (14%) did not correspond. Five of the seven treatments (71%) indicated by the trial-based functional analysis produced reductions in inappropriate mealtime behavior. Six of the seven treatments (86%) indicated by the extended functional analysis produced reductions inappropriate mealtime behavior.

Participant	Context	Trial-Based	Extended	Match	Trial-Based Treatment Efficacy	Extended Treatment Efficacy
Kaylee	solids	escape, attention	escape, attention	yes	yes	yes
Callie	solids	escape, attention	escape	partial	yes [a]	yes [a]
	liquids	none	none	yes	yes	yes
Hank	solids	escape	escape, attention	partial	yes	yes
	liquids	none	escape, attention	no	no	yes
Vick	solids	attention	escape, attention	partial	yes	no
	liquids	attention	escape, attention	partial	no	yes
				29%	71%	86%

Table 2: Summary of results.

Analysis Efficiency

The presentation assessment took an average of 8.6 min (range, 7.5-10 min). The trial-based and extended functional analyses took an average of 19 min (range, 8-27 min) and 83 min (range, 39-171 min), respectively. The trial-based functional analysis resulted in a 71% decrease in time required to conduct the analysis (range, 48%-93%) compared to the extended functional analysis.

Caregiver Acceptability

All caregivers rated the trial-based and extended functional analyses as acceptable (*M* = 4; range, 4-5) and reported they would be willing to use the analyses again with their child (*M* = 4; range, 4-5). For the trial-based functional analysis, 75% of caregivers believed their child did not experience discomfort (*M* = 2; range, 1-4), whereas 50% of caregivers believed their child did not experience discomfort during the extended functional analyses (*M* = 2.5; range, 1-4). Overall, all caregivers had a positive reaction to the trial-based and extended functional analyses (*M* = 4; range, 4-5) and generally rated the analyses similarly.

CHAPTER 3: DISCUSSION

In the current study, we evaluated trial-based functional analysis procedures for inappropriate mealtime behavior by comparing the findings to results from the extended functional analysis. We also assessed the efficiency and caregiver acceptability of both procedures and conducted a treatment evaluation to determine whether the functional analyses identified treatments that produced reductions in inappropriate mealtime behavior and improvements in active acceptance.

We found exact correspondence between the functional analyses to be low; however, the majority of functions identified from trial-based functional analyses

matched at least one function of the extended functional analyses. In addition, the majority of treatments indicated by the trial-based and extended functional analyses resulted in improvements in the child's target behaviors. The trial-based functional analysis consistently required less time than the extended functional analysis, and caregivers found both analyses to be acceptable.

For children whose functional analyses indicated different treatments, the comparison of treatments provided more information as to whether the trial-based and extended functional analyses resulted in false-positive or false-negative findings. When a functional analysis identifies a maintaining variable that may not function as a reinforcer, this is referred to as a false-positive finding (Tiger & Effertz, 2020). Callie's solids trial-based functional analysis may have produced a false-positive finding by identifying an attention function, as escape extinction with and without attention extinction resulted in decreases in inappropriate mealtime behavior. When attention functions are identified, the literature shows mixed findings; that is, some researchers have obtained clinically significant improvements in inappropriate mealtime behavior and acceptance without attention extinction (e.g., Bachmeyer et al., 2009), whereas others found it to be a necessary component (Bachmeyer et al., 2019). Therefore, it is difficult to determine whether there was a false-positive finding or an attention function that did not require direct treatment.

When a functional analysis does not identify a maintaining variable when in fact, a maintaining variable exists, this is referred to as a false-negative finding (Tiger & Effertz, 2020). Hank's liquids trial-based functional analysis produced a false-negative finding as no functions were identified, but escape and attention extinction were necessary to produce clinically significant changes in inappropriate mealtime behavior and active acceptance. Further, Vick's liquids trial-based functional analysis may have

produced a false-negative finding by identifying only an attention function, given that both escape and attention extinction were necessary to reduce inappropriate mealtime behavior and increase active acceptance.

This study replicated Hodges et al. (2018), who conducted a preliminary evaluation of trial-based functional analyses of inappropriate mealtime behavior and compared the findings to those from extended functional analyses. Similar to Hodges et al., we demonstrated that the findings from the trial-based functional analyses indicated treatments that produced the desired changes in the child's inappropriate and appropriate mealtime behaviors.

The current study extends Hodges et al. (2018) in a number of important ways. First, Hodges et al. compared trial-based functional analyses to extended functional analyses using the procedures outlined by Najdowski et al. (2003), which may not have presented the relevant discriminative stimuli across test and control conditions to evoke or suppress inappropriate mealtime behavior, respectively. In the current study, we used procedures similar to Bachmeyer et al. (2009) for the extended functional analysis because they have been shown to more reliably identify attention functions through the use of discriminative stimuli (Bachmeyer et al., 2019). Furthermore, we did not counterbalance the order of the functional analyses, which contrasts from Hodges et al. Some researchers have suggested that a fixed order of analyses is important when comparing trial-based functional analyses to extended functional analyses to ensure the participant does not have prior exposure to the session contingencies (e.g., Bloom et al., 2011), and other researchers have randomized or counterbalanced the order of functional analyses (e.g., LaRue et al., 2010). Given the inconsistencies across studies, future researchers should continue to investigate whether fixed or counterbalanced ordering is necessary. Last, Hodges et al. may have tested for combined putative

reinforcers in some test conditions as attention and tangible trials ended after the putative reinforcer was delivered. We tested for putative reinforcers in isolation to increase the accuracy of the trial-based functional analysis (i.e., the trial did not end after the first instance of inappropriate mealtime behavior). Continuing the trial after the first instance of inappropriate mealtime behavior is different from most trial-based functional analyses (e.g., Sigafoos & Saggers, 1995), but was important when extending trial-based functional analyses to inappropriate mealtime behavior. Due to the functional analysis occurring in the context of the meal, ending the trial involved the removal of food or liquid or the child leaving the meal area (i.e., escape). If attention test conditions also resulted in escape from the bite or drink, identification of an attention function may have produced a false-positive finding, resulting in the inclusion of unnecessary treatment components.

The treatment evaluation in the current study represents another important extension of previous literature on trial-based functional analyses by comparing indicated treatments when results differed from extended functional analyses. Previous studies have either compared the functional analyses (e.g., Bloom et al., 2011; LaRue et al., 2010) or only implemented the treatment suggested by the trial-based functional analysis (e.g., Hodges et al., 2018; Lambert et al., 2012). Even though the extended functional analysis is used regularly and has empirical support (e.g., Bachmeyer et al., 2019), there is discussion as to whether the extended functional analysis should be treated as the “gold standard” assessment from which to determine the validity of other assessments (Tiger & Effertz, 2020). Ultimately, the usefulness of a functional analysis is determined by its ability to indicate a treatment that produces the desired changes in the target behavior

Similar to other studies evaluating the maintaining variables of inappropriate mealtime behavior, we found a lower percentage of children's inappropriate mealtime behavior was maintained by only escape (14% from trial-based and extended functional analyses) or escape and attention (29% from trial-based and 71% from extended functional analyses). This contrasts to previous studies, which identified escape or escape and attention to maintain inappropriate mealtime behavior in 81%-100% of cases (Hodges et al., 2020; Saini, Jessel, et al., 2019; Saini, Kadey, et al., 2019). Unlike previous studies, which found attention to be the sole maintaining variable in 0%-2% of cases (Hodges et al., 2020; Saini, Jessel, et al., 2019; Saini, Kadey, et al., 2019), the trial-based functional analysis in this study found attention to be the sole maintaining variable for 29% of cases.

Unlike most trial-based functional analysis studies that analyzed aggregated occurrence data (e.g., Bloom et al., 2011), we analyzed latency data from the trial-based functional analysis similar to LaRue et al. (2010). The use of latency data as opposed to occurrence data was particularly important for a trial-based functional analysis of inappropriate mealtime behavior as we predicted the child would engage in inappropriate mealtime behavior in every condition, which would have made it unlikely to observe differentiation. In addition, analyzing latency data from the trial-based functional analysis allowed us to use ongoing visual-inspection criteria in a similar manner as the extended functional analysis.

This is the first study that we know of to use ongoing visual-inspection criteria during functional analyses of inappropriate mealtime behavior. It was important to use structured criteria to determine differentiation during the functional analyses consistently, given that a goal was to compare efficiency of the two functional analyses. Visual inspection could have introduced subjectivity that may have altered the efficiency

findings, as previous researchers found low agreement when raters used visual inspection (e.g., Hagopian et al., 1997). In situations where ongoing visual-inspection criteria did not identify a function, it is possible that variability in the control condition increased the standard deviation making the upper and lower criterion lines too wide to identify a function (Guerrero et al., under review). This may have been the case during Vick's solids and liquids trial-based functional analyses during which the latency to inappropriate mealtime behavior was much higher in one trial of each escape phase than in other trials of that phase. Similar to the special rules for trends developed by Hagopian et al. (1997), future researchers should develop special rules for when there is variability or outlier data points in the control condition that may inflate the standard deviation.

The change in presentation locations across test and control conditions is a deviation from the typical procedures used for extended functional analyses of inappropriate mealtime behavior in which feeders present the utensil to the same locations across conditions (e.g., Bachmeyer et al., 2009). We changed the target locations to create a difference in the antecedents across conditions, given the reliance on antecedent control during trial-based functional analyses (Bloom et al., 2011). It is possible that using EO-present and EO-absent target locations increased the efficiency of the extended functional analysis from previous studies by introducing antecedent control. In the current study, feeders required an average of 83 min to complete the extended functional analyses, which was much shorter than the average duration of extended functional analyses in our review of clinical cases and the Saini, Kadey, et al. (2019) review of the literature (147 min and 290 min, respectively). It could be helpful for future researchers to use the presentation assessment to improve the efficiency of the

extended functional analysis while trial-based functional analysis procedures continue to be refined.

Given the preliminary nature of this study, several limitations and areas of future research were identified. One limitation is that the difference in motivating operations between test and control conditions (i.e., EO-present and EO-absent target locations) may not have been substantial for some children. During the presentation assessment, the majority of children engaged in inappropriate mealtime behavior when utensils were presented at most locations. It is possible that an establishing operation to engage in inappropriate mealtime behavior to access escape or attention was present when the utensil, food, or liquid was in the room for some children. Future researchers should consider other assessments to determine EO-present and EO-absent conditions for the functional analyses that may be more salient (e.g., nonpreferred and preferred food).

Another limitation of the current study is that there may have been carryover between indicated treatments that prevented us from evaluating the impact of each treatment individually. For example, experience with escape extinction may carry over to the next session where escape extinction is absent. Further, it is less clear whether there was carryover when evaluating attention extinction. When comparing treatments with and without escape or attention extinction, researchers should consider using different designs to decrease the possibility of carryover between conditions (e.g., reversal design).

Overall, the current study provides preliminary evidence that a trial-based functional analysis can identify maintaining variables of inappropriate mealtime behavior and inform efficacious treatments. However, further evaluation is necessary to refine the procedures and assess the validity of the results, as there is the potential for false-positive or false-negative findings, which could lead to the implementation of

unnecessary or ineffective treatments. Additional research is needed before the trial-based functional analysis can serve as an alternative to the extended functional analysis. The extended functional analysis remains the assessment with the most empirical support in identifying functions of inappropriate mealtime behavior and indicating an effective treatment reliably (e.g., Bachmeyer et al., 2019). Due to the time-saving benefits of the trial-based functional analysis, further investigation is warranted as the analysis could provide clinicians with a more practical assessment tool that may be more feasible to implement in the child's typical setting and by caregivers or teachers who typically feed the child.

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