



A Summary of the Effectiveness of Treatments for Pediatric Feeding Disorders

Cathleen C. Piazza

University of Nebraska Medical Center's Munroe-Meyer Institute



UNMC Munroe-Meyer Institute

## Pediatric Feeding Disorders

- ❑ Identified when a child fails to consume a sufficient variety or quantity of food to maintain nutritional status



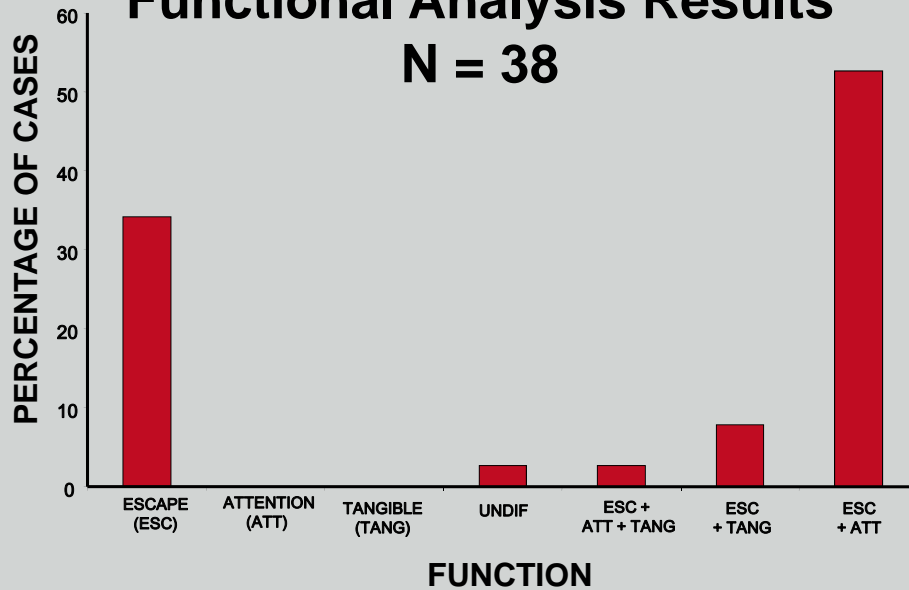
## Functional Analysis of Pediatric Feeding Disorders

- ❑ **Piazza, Fisher, et al. (2003) conducted functional analyses of inappropriate mealtime behavior of 15 children diagnosed with pediatric feeding disorders.**
  - ❑ 67% of participants displayed high levels of inappropriate mealtime behavior in one or more test conditions.
  - ❑ 90% of participants whose functional analyses were differentiated displayed sensitivity to negative reinforcement.
  - ❑ 80% of participants whose functional analyses were differentiated displayed sensitivity to multiple reinforcing contingencies.



## Functional Analysis Results

N = 38

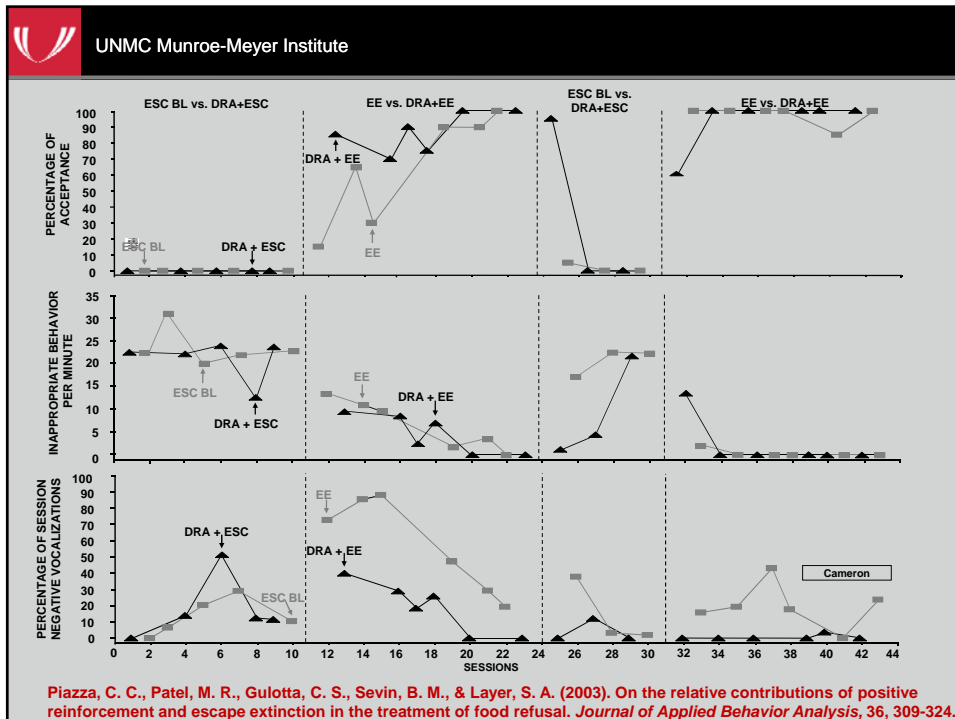




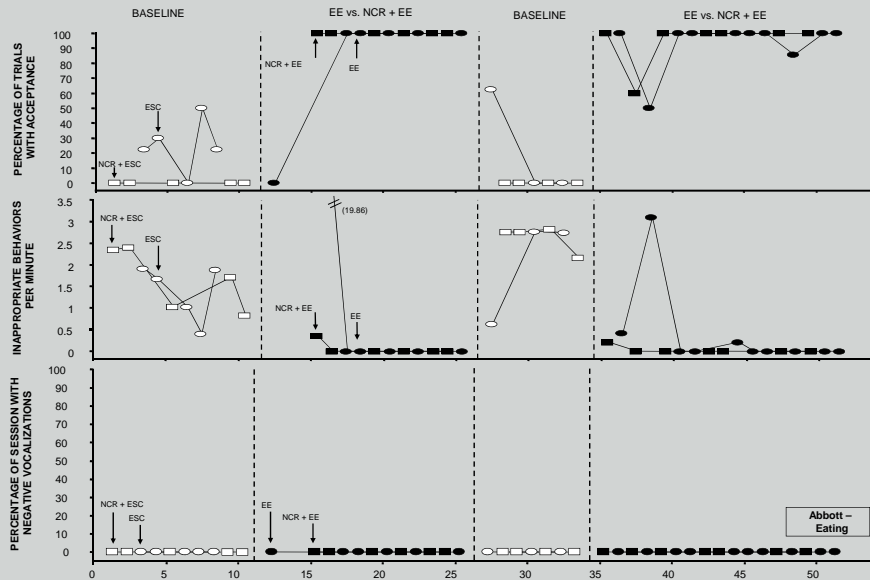
## Functional Analysis of Pediatric Feeding Disorders

### The findings suggest that:

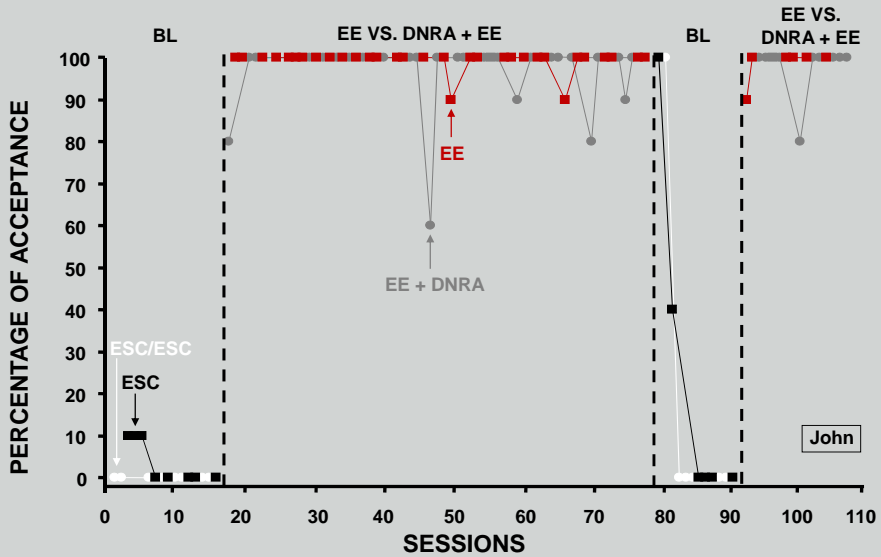
- ❑ Negative reinforcement appears to play a primary role in the maintenance of feeding problems.
- ❑ Children with feeding problems may be sensitive to other reinforcement contingencies.



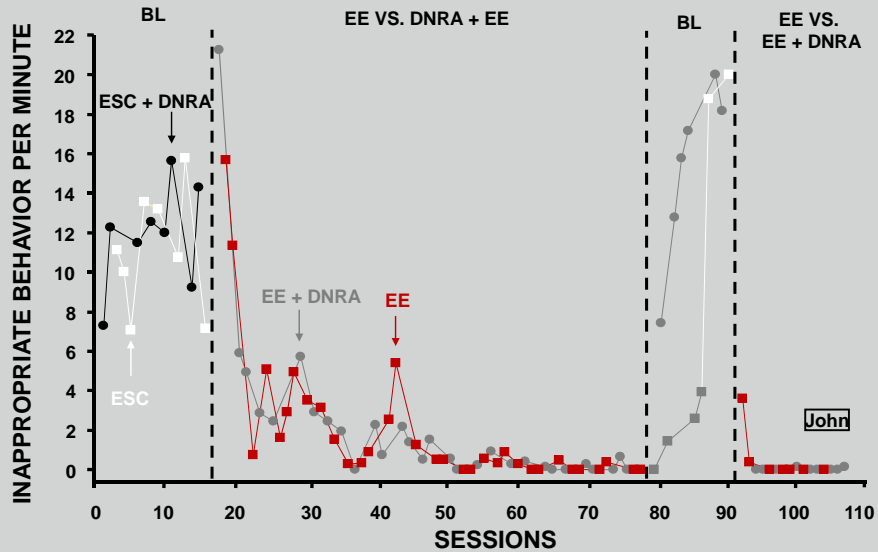
Piazza, C. C., Patel, M. R., Gulotta, C. S., Sevin, B. M., & Layer, S. A. (2003). On the relative contributions of positive reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis*, 36, 309-324.



Reed, G. K., Piazza, C. C., Patel, M. R., Layer, S. A., Bachmeyer, M. H., Bethke, S. D., & Gutshal, K. A. (2004). On the relative contributions of noncontingent reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis, 37*, 27-41.



LaRue, R. H., Stewart, V., Piazza, C. C., & Volkert, V. M. (in press). Escape as reinforcement and escape extinction in the treatment of feeding problems *Journal of Applied Behavior Analysis*.



LaRue, R. H., Stewart, V., Piazza, C. C., & Volkert, V. M. (in press). Escape as reinforcement and escape extinction in the treatment of feeding problems *Journal of Applied Behavior Analysis*.



## Treatment of Pediatric Feeding Disorders

- ❑ **Escape extinction (EE) may be a necessary component of treatment.**

LaRue, R. H., Stewart, V., Piazza, C. C., & Volkert, V. M. (in press). Escape as reinforcement and escape extinction in the treatment of feeding problems *Journal of Applied Behavior Analysis*.

Piazza, C. C., Patel, M. R., Gulotta, C. S., Sevin, B. S., & Layer, S. A. (2003). On the relative contribution of positive reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis*, 36, 309-324.

Reed, G. K., Piazza, C. C., Patel, M. R., Layer, S. A., Bachmeyer, M. H., Bethke, S. D., & Gutshall, K. A. (2004). On the relative contribution of noncontingent reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis*, 37, 27-41.



## Treatment of Pediatric Feeding Disorders

- ❑ **Positive reinforcement in conjunction with EE resulted in lower levels of negative vocalizations or inappropriate behavior for some children.**

Piazza, C. C., Patel, M. R., Gulotta, C. S., Sevin, B. S., & Layer, S. A. (2003). On the relative contribution of positive reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis*, 36, 309-324.

Reed, G. K., Piazza, C. C., Patel, M. R., Layer, S. A., Bachmeyer, M. H., Bethke, S. D., & Gutshall, K. A. (2004). On the relative contribution of noncontingent reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis*, 37, 27-41.



## Treatment of Pediatric Feeding Disorders

- ❑ **Negative reinforcement for mouth clean in conjunction with EE did not result in lower levels of negative vocalizations or inappropriate behavior.**

LaRue, R. H., Stewart, V., Piazza, C. C., & Volkert, V. M. (in press). Escape as reinforcement and escape extinction in the treatment of feeding problems *Journal of Applied Behavior Analysis*.



## Pediatric Feeding Disorders

- Feeding disorders may be characterized by one or more of the following:**
  - Symptoms associated with **nutritional status** (e.g., Failure to Thrive)
  - Symptoms related to **oral motor** aspects of eating (e.g., oral motor dysfunction)
  - Inappropriate behavior** during meals (e.g., tantrums)



## Pediatric Feeding Disorders

- Feeding consists of a complex chain of behaviors.**
- Problems may occur anywhere in the chain:**
  - Acceptance
  - Swallowing
  - Inappropriate mealtime behavior

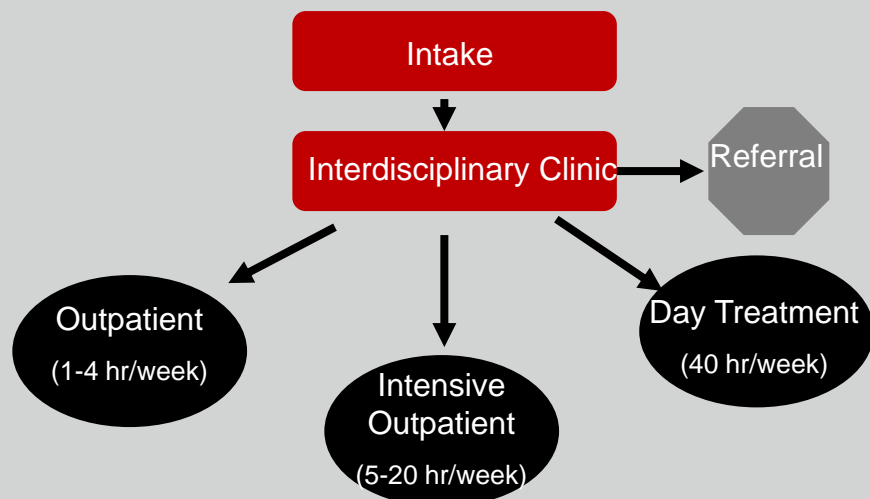


## Purpose

- ❑ To determine how often EE either alone or in combination with reinforcement for appropriate behavior (i.e., DRA, NCR, DNRA) was effective as treatment (referred to as EE/EE+Sr+Sr-).
- ❑ To determine what the effectiveness of adjunctive and/or alternative treatments when EE/EE+Sr+/Sr- was not effective treatment.

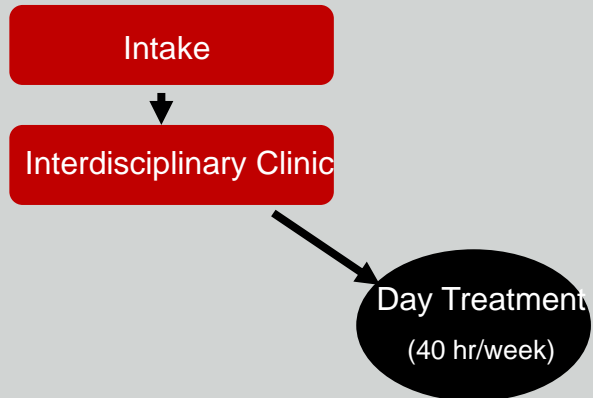


## PEDIATRIC FEEDING DISORDERS PROGRAM





## PEDIATRIC FEEDING DISORDERS PROGRAM



## PEDIATRIC FEEDING DISORDERS PROGRAM



Interdisciplinary

Medicine, Nursing, Nutrition, Occupational Therapy, Psychology,  
Social Work, Speech Therapy



## Method

- Analyzed 133 data sets of children receiving intensive day treatment for pediatric feeding disorder
- Included all data sets from completed evaluations during study period
- Some children supplied multiple data sets (e.g., liquids treatment, solids treatment)



## Participants

- N = 92 children
- Admitted between 1999 and 2005 to a day treatment program for treatment of a feeding disorders
- M* age = 39 months
- Gender: 64% male, 36% female
- 53% had developmental delays; 47% had typical cognitive development



### General Admission Criteria

- Height or weight below the 5<sup>th</sup> percentile
- G-tube dependence
- Failure to advance to an age-appropriate texture or variety of foods
- High levels of inappropriate mealtime behavior
- Not responsive to outpatient therapy



#### FEEDING GOALS: Jenny Smith

Date: 4-26-07

##### Increase Total Intake by Mouth

Admission: <u>0%</u>	Current: <u>25%</u>	Discharge: <u>100%</u>
----------------------	---------------------	------------------------

##### Increase Acceptance of 8 novel foods

Admission: <u>0%</u>	Current: <u>50%</u>	Discharge: <u>80%-100%</u>
----------------------	---------------------	----------------------------

##### Decrease Inappropriate Mealtime Behavior

Admission: <u>15.6 per minute</u>	Current: <u>5.2 per minute</u>	Discharge: <u>at or below 1 per minute</u>
-----------------------------------	--------------------------------	--

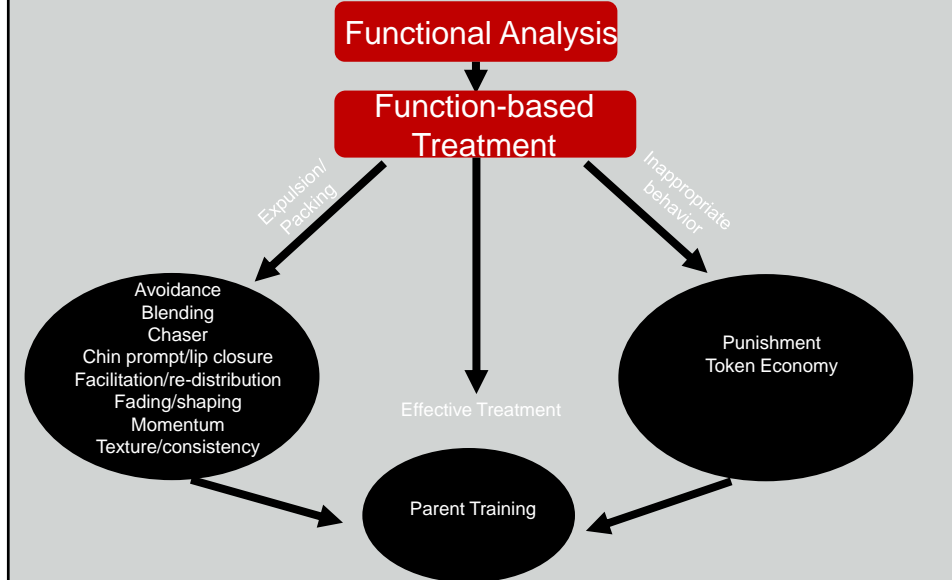
##### Decrease Tube Feeding

Admission: <u>100%</u>	Current: <u>50%</u>	Discharge: <u>0%</u>
------------------------	---------------------	----------------------

**Measurable goals are set for each patient**



## General Treatment Progression



## Treatment of Pediatric Feeding Disorders

### □ Dependent Variables

- acceptance – child actively leans forward toward the presentation or opens the mouth without negative vocalizations or inappropriate mealtime behavior, allowing the entire bite (eating) or any liquid (drinking) to be deposited within 5 s of the presentation
- mouth clean – no visible food or drink larger than the size of a pea in the child's mouth 30 s after the bite enters the child's mouth
- inappropriate mealtime behavior - head turn, bat, and block



## Criteria for Treatment Effectiveness

- Acceptance = 80% or greater**
- Mouth clean = 80% or greater**
- Inappropriate mealtime behavior**
  - Less than 1 per minute**
  - 80% reduction relative to baseline**



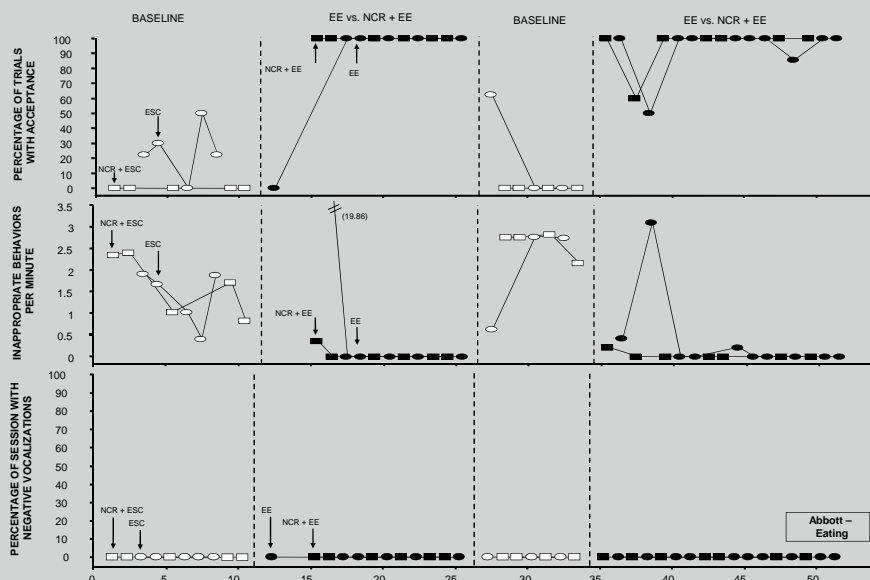
## Procedures Categories

- EE or EE+Sr+/Sr-**
  - Nonremoval of the spoon
  - Physical (jaw) prompt
  - Differential Reinforcement of Alternative Behavior (DRA)
  - Noncontingent Reinforcement (NCR)
  - Differential negative reinforcement (DNRA)
- Adjunctive Procedures**
  - Avoidance
  - Chaser
  - Chin prompt and lip closure training
  - Fading
  - Momentum (high-probability instructional sequence)
  - Punishment (response cost, hands down)
  - Swallow facilitation and re-distribution
  - Texture or consistency manipulations
  - Token Economy
- Alternative Procedures**



## EE or EE+SrSr-

- ❑ **Nonremoval of the spoon** – feeder keeps spoon or cup at child’s lips and deposits bite or drink at first opportunity
- ❑ **Physical (jaw) prompt** – feeder applies gentle pressure to mandible to open mouth then deposits bite
- ❑ **Differential Reinforcement of Alternative Behavior (DRA)** – feeder delivers a preferred item or activity following appropriate behavior (e.g., mouth clean)
- ❑ **Noncontingent Reinforcement (NCR)** – feeder interacts with child throughout the session in presence of preferred items or activities
- ❑ **Differential negative reinforcement of Alternative Behavior (DNRA)** – feeder delays presentation of bite following appropriate behavior (e.g., mouth clean)



Reed, G. K., Piazza, C. C., Patel, M. R., Layer, S. A., Bachmeyer, M. H., Bethke, S. D., & Gutshal, K. A. (2004). On the relative contributions of noncontingent reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis, 37*, 27-41.



## Effectiveness of EE or EE+Sr+/Sr-

N = 68 data sets

Means

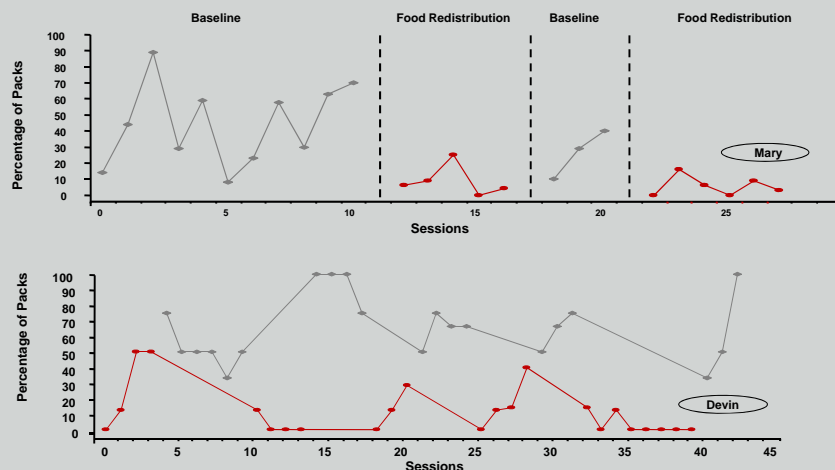
ACC, MC, IB	ACC	MC	IB
84%	91%	97%	96%

EE or EE+Sr+/Sr- was an effective treatment for 43% of children.



## Swallow Facilitation/Re-distribution

- ❑ **Swallow Facilitation** – feeder applies gentle pressure to tongue by depressing a nuk brush or flipped spoon on the tongue
  - ❑ Dempsey, J., Piazza, C. C., Groff, R. A., & Kozisek, J. M. (in press). A flipped spoon and chin prompt to increase mouth clean. *Journal of Applied Behavior Analysis*.
  - ❑ Volkert, V. M., Vaz, P. C. M., Piazza, C. C., Frese, J., & Barnett, L. (in press). Using a flipped spoon to decrease packing in children with feeding disorders. *Journal of Applied Behavior Analysis*.
  - ❑ Rivas, K. R., Piazza, C. C., Kadey, H. J., Volkert, V. M., & Stewart, V. (2011). Sequential treatment of a feeding problem using a pacifier and flipped spoon. *Journal of Applied Behavior Analysis*, 44, 318-391.
- ❑ **Re-distribution** – feeder removes packed food from the child's mouth and places it back on the tongue
  - ❑ Gulotta, C. S., Piazza, C. C., Patel, M. R., & Layer, S. A. (2005). Using food redistribution to reduce packing in children with severe food refusal. *Journal of Applied Behavior Analysis*, 38, 39-50.



Gulotta, C. S., Piazza, C. C., Patel, M. R., & Layer, S. A. (2005). Using food redistribution to reduce packing in children with severe food refusal. *Journal of Applied Behavior Analysis*, 38, 39-50.



Facilitation/Re-distribution			
N = 16 data sets			
Means			
ACC, MC, IB	ACC	MC	IB
69%	94%	75%	88%



# Fading

## □ Fading

### □ Blending

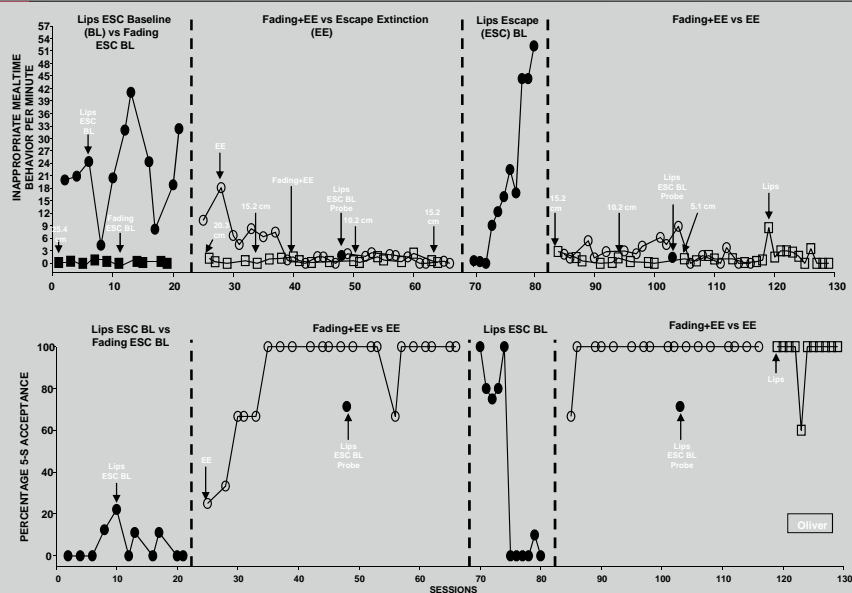
- Mueller, M. M., Piazza, C. C., Patel, M. R., Kelley, M. E., & Pruett, A. (2004). Increasing variety of foods consumed by blending nonpreferred foods into preferred foods. *Journal of Applied Behavior Analysis, 37*, 159-170.

### □ Spoon distance

- Rivas, K. D., Piazza, C. C., Patel, M. R., & Bachmeyer, M. H. (2010). Spoon distance fading with and without escape extinction as treatment for food refusal. *Journal of Applied Behavior Analysis, 43*, 673-683.

### □ Spoon to cup

- Groff, R. A., Piazza, C. C., Zeleny, J. R., & Dempsey, J. R. (in press). Spoon-to-cup fading as treatment for cup drinking in a child with intestinal failure. *Journal of Applied Behavior Analysis*.



Rivas, K. D., Piazza, C. C., Patel, M. R., & Bachmeyer, M. H. (2010). Spoon distance fading with and without escape extinction as treatment for food refusal. *Journal of Applied Behavior Analysis, 43*, 673-683



## Fading

N = 12 data sets

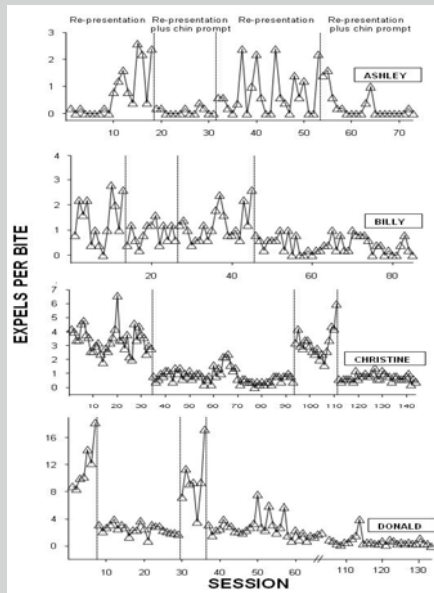
Means

ACC, MC, IB	ACC	MC	IB
75%	100%	92%	75%



## Chin Prompt

- ❑ **Chin prompt** – feeder places thumb under child's lower lip and forefinger under child's chin while placing gentle upward pressure after depositing the presentation
  - ❑ Wilkins, J. W., Piazza, C. C., Groff, R. A., & Vaz, P. C. M. (2011). Chin prompt plus re-presentation as treatment for expulsion in children with feeding disorders. *Journal of Applied Behavior Analysis*, 44, 513-522.



Wilkins, J. W., Piazza, C. C., Groff, R. A., & Vaz, P. C. M. (in press). Chin prompt plus re-representation as treatment for expulsion in children with feeding disorders. *Journal of Applied Behavior Analysis*.



### Chin prompt/Lip closure

N = 10 data sets

Means

ACC, MC, IB	ACC	MC	IB
50%	80%	60%	90%



## Chaser

- ❑ **Chaser** – feeder presents a solid or liquid that the child swallows reliably following depositing a solid or liquid the child does not swallow reliably
- ❑ Vaz, P. C. M., Piazza, C. C., Stewart, V., Volkert, V. M., Groff, R. A., & Patel, M. R. (in press). Using a chaser to decrease packing in children with feeding disorders. *Journal of Applied Behavior Analysis*.





## Chaser

N = 9 data sets

Means

ACC, MC, IB	ACC	MC	IB
89%	100%	100%	89%



## Momentum

- ❑ **Momentum** – feeder presents three high-probability requests prior to presentation of one low probability feeding-related request
  - ❑ Patel, M. R., Reed, G. K., Piazza, C. C., Mueller, M., Bachmeyer, M. H., & Layer, S. A. (2007). Use of a high-probability instructional sequence to increase compliance to feeding demands in the absence of escape extinction. *Behavioral Interventions*, 22(4), 305-310.
  - ❑ Patel, M. R., Reed, G. K., Piazza, C. C., Bachmeyer, M. H., Layer, S. A., & Pabico, R. S. (2006). An evaluation of a high probability request sequences to increase acceptance of food and decrease inappropriate behavior in children with pediatric feeding disorders. *Research in Developmental Disabilities*, 27, 430-442.
  - ❑ Dawson, J. E., Piazza, C. C., Sevin, B. M., Gulotta, C. S., Lerman, D., & Kelley, M. L. (2003). Use of the high-probability instructional sequence and escape extinction in a child with food refusal. *Journal of Applied Behavior Analysis*, 36, 105-108.



## Momentum

N = 7 data sets

Means

ACC, MC, IB	ACC	MC	IB
57%	71%	86%	57%



## Punishment

### Punishment

- Hands down – feeder hold's child's hand on the tray or table down for a fixed period of time following inappropriate behavior
- Response cost – feeder terminates access to reinforcement following inappropriate behavior



## Punishment

N = 5 data sets

Means

ACC, MC, IB	ACC	MC	IB
60%	100%	80%	80%



## Tokens

- ❑ **Tokens** – feeder delivers tokens for appropriate behavior during the meal; child may exchange tokens after meal for back-up reinforcement



## Tokens

N = 5 data sets

Means

ACC, MC, IB	ACC	MC	IB
60%	80%	80%	60%



## Alternative other

N = 5 data sets

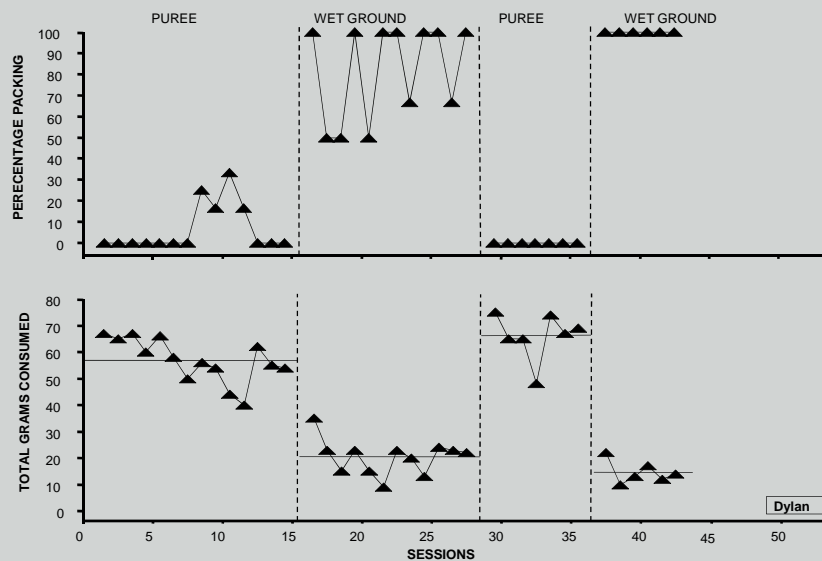
Means

ACC, MC, IB	ACC	MC	IB
80%	80%	100%	100%



## Texture or Consistency Manipulation

- ❑ **Texture** – feeder reduces the texture of presented food (e.g., from wet ground to puree)
  - ❑ Patel, M. R., Piazza, C. C., Layer, S. A., Coleman, R., & Swartzwelder, D. M. (2005). A systematic evaluation of food textures to decrease packing and increase oral intake in children with pediatric feeding disorders. *Journal of Applied Behavior Analysis, 38*, 89-100.
  - ❑ Patel, M. R., Piazza, C. C., Layer, S. A., Coleman, R., & Swartzwelder, D. M. (2005). Systematic evaluation of food textures to decrease packing and increase oral intake in children with pediatric feeding disorders. *Journal of Applied Behavior Analysis, 38*, 89-100.
- ❑ **Consistency** - feeder alters the consistency of liquid (e.g., from thin to thick)



Patel, M. R., Piazza, C. C., Layer, S. A., Coleman, R., & Swartzwelder, D. M. (2005). A systematic evaluation of food textures to decrease packing and increase oral intake in children with pediatric feeding disorders. *Journal of Applied Behavior Analysis, 38*, 89-100.



## Texture/consistency manipulation

N = 3 data sets

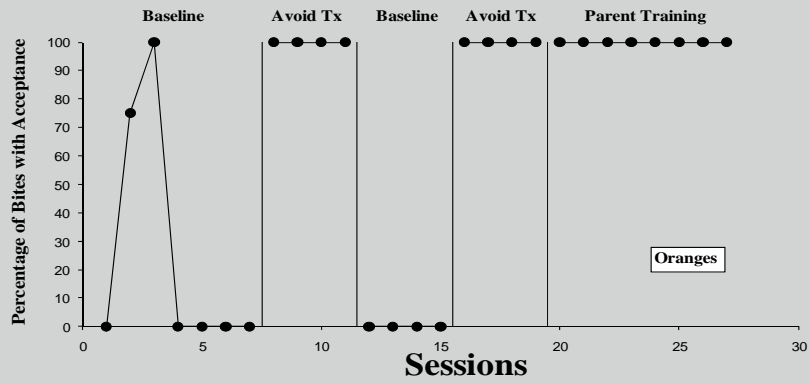
Means

ACC, MC, IB	ACC	MC	IB
67%	100%	67%	100%



## Avoidance

- ❑ **Avoidance** – the feeder presents the child with a lower preference food contingent on food refusal (usually as a component of a self-feeding protocol)
  - ❑ Vaz, P. C. M., Volkert, V. M., & Piazza, C. C. (in press). Using negative reinforcement to increase self-feeding in a child with food selectivity. *Journal of Applied Behavior Analysis*.



Vaz, P. C. M., Volkert, V. M., & Piazza, C. C. (in press). Using negative reinforcement to increase self-feeding in a child with food selectivity. *Journal of Applied Behavior Analysis*.



## Avoidance

N = 2 data sets

Means

ACC, MC, IB	ACC	MC	IB
100%	100%	100%	100%



### Comparison of All Procedures

	ACC,MC,IB	ACC	MC	IB
Avoidance	100%	100%	100%	100%
Chaser	89%	100%	100%	89%
EE or EE+Sr+/Sr-	84%	91%	97%	96%
Alternative	80%	80%	100%	100%
Fade	75%	100%	92%	75%
Swallow Fac /Re-dist	69%	94%	75%	88%
Texture/consist	67%	100%	67%	100%
Punishment	60%	100%	80%	80%
Tokens	60%	80%	80%	60%
Momentum	57%	71%	86%	57%
Chin prompt/Lip	50%	80%	60%	90%



## Summary

- EE or EE+Sr+/Sr- was an effective treatment for 43% of the interventions.
- Although EE may be a necessary treatment, it may not be sufficient for many children with severe feeding problems.



## Summary

- We used other procedures in addition to EE for 53% of the interventions.
- We did not use EE for 4% of the interventions.



## Summary

- The procedure with the highest degree of effectiveness was avoidance.
- However, we only exposed a few children to this procedure.



## Summary

- ❑ **The procedure with the lowest degree of effectiveness was chin prompt or lip closure training.**



## Limitations

- ❑ **The data are limited because:**
  - ❑ We analyzed them according to whether the child met their final treatment goals using stringent criteria.
  - ❑ We did not ensure that there was a demonstration of functional control for individual treatments.
  - ❑ In some cases, we did not isolate the effects of any one treatment component when the treatment included multiple components.
  - ❑ The number of children exposed to each treatment was unequal across procedures.



## Limitations

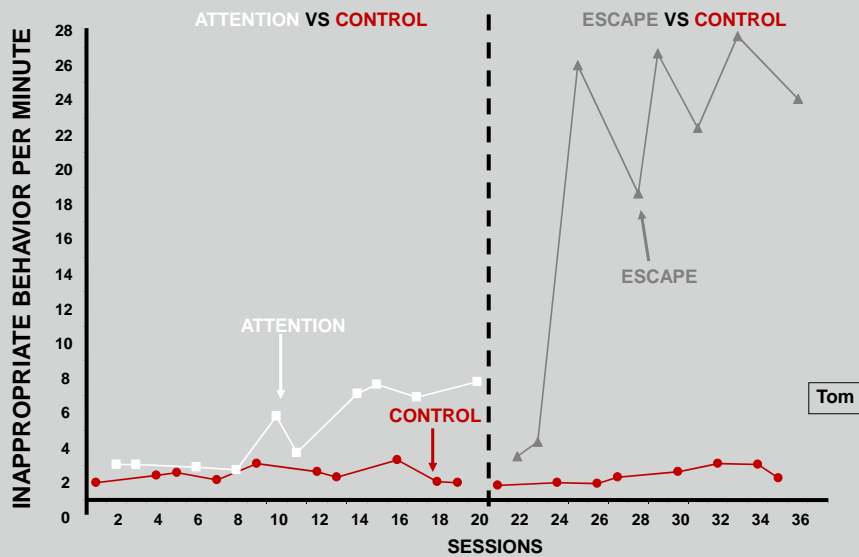
- ❑ **All of the procedures were effective some of the time; however, it is not clear which procedures should be used in which order when EE is not sufficient.**





### Functional Analysis

Condition	Consequence for Inappropriate Behavior	Bite Presentation
ESCAPE	20 s to 30 s of escape	removed for 20 s
ATTENTION	20 s to 30 s of attention	remained at midline
TANGIBLE	20 s to 30 s of access tangible	remained at midline
CONTROL	no differential consequence	remained at midline



Bachmeyer, M. H., Piazza, C. C., Fredrick, L. D., Reed, G. K., Rivas, K. D., & Kadey, H. J. (2009). Functional analysis and treatment of multiply controlled inappropriate mealtime behavior. *Journal of Applied Behavior Analysis, 42*, 641-658.