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IMPROVING IDENTIFICATION OF PEDIATRIC FEEDING DYSFUNCTION
AMONG REGISTERED DIETITIAN NUTRITIONISTS

by

April Litchford

A dissertation submitted in partial fulfillment
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Nutrition Science

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2019

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ABSTRACT

Improving Identification of Pediatric Feeding Dysfunction Among Registered Dietitian

Nutritionists

by

April Litchford, Doctorate of Nutrition Science

Utah State University, 2019

Major Professor: Dr. Heidi Wengreen
Department: Nutrition, Dietetics, and Food Science

The main purpose of this dissertation was to increase the literacy of Registered Dietitian Nutritionists (RDNs) concerning child feeding dysfunction. Particular attention was given to how feeding dysfunction is identified by RDNs, feeding screening tools that are available for practical use, and the outcome of using a feeding screening tool in a pediatric population.

An online survey was conducted to assess the practices of RDNs that work in the pediatric population. The survey gathered information about the practitioners' perceived prevalence, methods used to identify possible feeding problems, and procedures for diagnosis and treatment.

A systematic review of current literature was conducted to identify screening tools capable of producing valid and sensitive classification of feeding dysfunction in children. One tool, the Montreal Children's Hospital Feeding Scale (MCH), was selected to be tested in an early intervention (EI) program. This study gathered qualitative information from service coordinators to determine best procedures for implementing feeding screening in the program. It also gathered quantitative data from parents of children birth to 3 years of age through completion of feeding screening.

Three hundred forty-one RDNs from 41 states within the United States responded to the survey.

Results of the survey suggested the need for standardized screening, diagnostic, and treatment

protocols among pediatric RDNs. These adjustments would enable RDNs to improve feeding abilities in more patients earlier in child development. The systematic literature review identified 36 unique screening tools capable of identifying children at risk for feeding dysfunction. Implementation of feeding screening in an early intervention program was successful in identifying more children at feeding risk. Referral rates to the RDN increased 3 fold and time to treatment decreased by 160 days after feeding screening was conducted.

Overall, the studies completed in this dissertation have the potential to better inform the RDN population and provide practical information and procedures to increase feeding screening among pediatric patients.

(149 pages)

PUBLIC ABSTRACT

Improving Identification of Pediatric Feeding Dysfunction Among Registered Dietitian

Nutritionists

by

April Litchford

All Registered Dietitian Nutritionists (RDN) undergo extensive training to develop the ability to improve dietary intake among individuals of all ages. Treating children (0-18 years of age) is often challenging and requires specialized training. One area that is particularly challenging is identifying children that may not be able to eat appropriately to sustain rapid growth and development. An online survey of RDNs that work specifically with children was conducted to better understand how RDNs are identifying and treating children with feeding problems. From the survey we learned that the methods and procedures used by RDNs for identifying and treating children with feeding problems are variable. A review of current literature identified many tools capable of identifying children at risk for feeding problems. One of these tools was chosen and tested in a population of children 0-3 years of age who were clients of an early intervention program. Use of this tool, the Montreal Children's Hospital Feeding Scale, increased the number of children that were identified as having feeding dysfunction and who received nutrition services. Implementing feeding dysfunction screening into children's health care settings would improve the quality of care a child receives and help to improve their overall nutrition status.

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Lastly, I would like to give a special thank you to my amazing husband and children. I consider myself one of the most blessed woman on earth to be the companion to my husband. His love and support have never wavered, even when tested by advanced biochemistry. He is my ultimate champion who always makes me feel like I could do anything. And my amazing five! You are the pieces that make up my heart. Finishing this dissertation brings great satisfaction, but you will always be my greatest achievement!

April Litchford

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CHAPTER 1

INCREASING AWARENESS AND IDENTIFICATION OF PEDIATRIC
FEEDING DISORDERS AMONG REGISTERED DIETITIAN NUTRITIONISTS

By April Litchford

ABSTRACT

Feeding dysfunction is commonly recognized in young children; however, some of these common problems have the potential to become major issues that limit the amount and variety of foods children can or will eat. In some cases, this feeding dysfunction can become a more serious problem that can lead to delay in other developmental areas and has the potential to impact the long-term health of the child. Registered Dietitian Nutritionists (RDN) often lack sufficient knowledge and training to identify feeding dysfunction in children. In order to better understand the current practices of RDNs in connection to child feeding, an online survey was conducted to gather information about RDN practice procedures in pediatric populations. The survey was designed to gather information about current practices RDNs use to identify children with feeding dysfunction and treatments or therapies they may use to mediate symptoms of these disorders. A literature review was conducted to identify screening tools that have been developed to aid in screening for and identifying feeding dysfunction in children. Through the literature review we were able to identify an appropriate tool, the Montreal Children's Hospital Feeding Scale, to identify feeding dysfunction in an early intervention program. Implementation of this tool showed that it is capable of identifying feeding dysfunction in

the target population which effectively increased the RDN referral rate and reduced overall time to treatment.

Problem Statement

As children grow and develop they often exhibit behaviors that can interfere with eating an adequate diet.¹ A vast majority of these behaviors will resolve as the child grows and matures, but there are instances when a child does not outgrow problematic behavior.² Often the behaviors exhibited by the child are indicative of physical dysfunction in the systems used for intake and digestion of food. In other situations, learned behaviors create psychological barriers that influence eating patterns.² In severe cases the behavior/symptoms may create a situation that hinders the child's ability to consume the types and amounts of food needed to grow and develop.

Feeding dysfunction that exists in the pediatric population are wide and varied. Also, many children with feeding dysfunction have comorbid conditions that complicate treatment options.¹ As a result, the range of healthcare professionals that treat feeding disorders is broad and includes several disciplines.³ Despite extensive training, many RDNs that treat pediatric patients have limited knowledge concerning the range of feeding dysfunction that occurs in this population. This limits their ability to identify dysfunction and provide information about available treatments and the consequences of untreated feeding dysfunction.³ The goal of this dissertation is to improve the ability of RDNs to identify feeding dysfunction in any pediatric population by: increasing knowledge about the need to screen pediatric patients, identifying screening tools that are available, and

conducting preliminary research to determine the effectiveness of implementing feeding screening protocols.

LITERATURE REVIEW

Prevalence of feeding disorders

Feeding and/or nutritional delays are relatively common in infancy and can occur in up to 45% of typically developing infants.^{1,4} Some form of feeding difficulty is also seen in 40% of toddlers and early school age children.⁵ About 5%-10% of the pediatric population are diagnosed with severe feeding disorders that require medical intervention.⁴ The majority of feeding issues experienced by the pediatric population are mild and will generally resolve with time. However, about 3-10% of young children will develop chronic feeding issues that result in slowed development and medical complications.⁵ When feeding difficulties contribute to other morbidities or delays they are called feeding disorders because the nature of the symptoms becomes chronic and more severe.⁵ The prevalence of feeding issues are more common in children that have documented developmental disabilities, about 80% of this population deals with a feeding disorder of some sort.¹ Certain sub-groups of children with disabilities have even higher prevalence of feeding disorders. For example, the rate of children with autism spectrum disorder (ASD) experiencing significant feeding dysfunction is 89%.⁵ While these numbers and statistics seem high, there is concern that prevalence of feeding disorders in children is often underreported.

One challenge that occurs when attempting to determine a true prevalence of

feeding disorders in this population is defining them. There is little evidence based guidance on what is considered a significant feeding disorder and which feeding difficulties have the tendency to become feeding disorders.¹ Broad definition of feeding difficulties occur because of the complex nature of these difficulties.³ The etiology of each patient is unique in the scope of the problem and depth of treatment needed to address the feeding concerns.^{1,3} One specific reason classification is so difficult is due to the way these children are assessed. Weight loss or failure to maintain weight is the most common determinant of nutritional risk in a child.^{1,3} Children with feeding difficulties may eat extremely poor diets that affect their overall physiology but still maintain or gain weight.¹³ While weight is a convenient way to measure the developmental progress of a child, it may hinder diagnosis of an actual condition due to this type of discrepancy.³ There are also other factors that challenge the diagnostic process including mother/caregiver attitudes during feedings, presence of other morbid conditions, behavioral conditions that interrupt feeding, and psychological conditions.^{1,3,5} Depending on the extent of the health concerns facing an affected child, feeding difficulties can range from simple aversion to certain types of foods, to an inability to feed on their own.⁶

More than 50% of mothers with young children report that their child has some type of feeding difficulty.³ The feeding difficulties reported range in severity from mild “picky eating” to severe food aversion and refusal. Investigators identify three general classifications of feeding issues among children: eating too little, eating a restricted number of foods, and displaying a fear of eating.³ The reason behind these feeding issues is often hard to define as biological, behavioral, and social factors often contribute to the overall feeding disorder.^{2,7} One study found that in a population of children with

physical limitations that directly affected their ability to eat, 85% exhibited some type of behavior that further hindered the process of eating. The discipline of psychology defines feeding as a “behavior that is conditioned and maintained by environmental and social forces”.⁷ Many studies have reported that problematic interactions between parent and child commonly contribute to feeding problems in children.⁷⁻⁹ Behavioral interventions may be necessary to truly address all components of feeding issues in children.⁷

Another problem with diagnosis of feeding dysfunction in the pediatric population stems from how the feeding issues are defined. The psychiatric and medical diagnoses currently used cover a wide spectrum of symptoms from eating too little to eating a severely limited variety of foods.⁵ This causes serious problems in diagnosing the etiology for each individual child. Without firm diagnoses there is limited ability to recommend or develop proper feeding therapies that will help the child get adequate nutritional intake.⁵ Also, some of the causative factors for feeding dysfunction can be organic in nature or non-organic. Non-organic causes may include psychological problems that occur because of family disruption, injury, or other traumatic events.⁵

Types/Causes of Feeding Dysfunction

Pediatric organic feeding dysfunction stems from a number of different etiologies. In infants the physical limitation is often related to difficulty or inability to suck, swallow, or breathe correctly. All three of these actions must occur in an ordered pattern to ensure the infant is getting enough nutrition for normal growth and development.^{2,10} Difficulties with infant suck can cause serious problems with the amount of nutritional intake, and can

potentially contribute to delayed global development since suck is the initial way a child explores their environment.¹⁰ Any problem in the systems involved in the feeding process (gastrointestinal, cardiorespiratory, swallowing) can cause an infant to refuse to suck and potentially develop abnormalities to their sucking mechanisms. This makes the etiology of sucking dysfunction difficult to diagnose. However, there are a few general categories of etiology. The first category concerns anatomic problems including cleft lip/palate, micrognathia, Pierre-Robinson malformation sequence, macroglossia, and masses in the tongue.¹⁰ The second category is poor muscular control; this is generally a secondary symptom of a some type of neurologic deficit. Some of these deficits include: asphyxia, cranial hemorrhages, Down Syndrome, and Cerebral Palsy. The last category is oral pain, an infant feeling pain anywhere in the oral area may begin to refuse feedings in order to avoid pain from sucking. Some reasons for oral pain could include oral infections, lesions, or oral trauma/lacerations.¹⁰

Swallowing difficulties are classified into two general categories; anatomic and neuromuscular abnormalities. Anatomic abnormalities would include conditions such as cleft lip/palette, laryngeal clefts, esophageal lesions, dysmotility, micrognathia, tracheoesophageal fistulas, vascular rings, trauma, and presence of foreign bodies.¹⁰ These abnormalities are present because of damage or failure of development in functional areas where swallowing takes place. Other abnormalities occur due to abnormal or delayed development of neurologic processes and muscle function. These neuromuscular abnormalities can occur due to: prematurity, brain damage from anoxic encephalopathy, congenital infections (CMV), acquired infections (AIDS), hydrocephalus, vascular accident, or cerebral palsy.¹⁰ Other diseases that may affect muscle function include:

Werdnig-Hoffman disease, Prader-Willi syndrome, chromosomal defects, and cranial nerve palsies.¹⁰

Dysphagia is a common diagnosis of swallowing dysfunction. In the pediatric population about half a million children are diagnosed with dysphagia annually.^{11,12} Dysphagia is actually a symptom of a breakdown in the feeding/swallowing process. The etiology can be widely varied in these patients, but the consequence of pediatric dysphagia can be detrimental to growth and development.¹¹ A child with any type of feeding or swallowing dysfunction is at risk for aspiration-induced lung disease, under nutrition or malnutrition, and developmental deficits. Also, pre-term infants have a higher incidence of feeding dysfunction, 40% experience some level of feeding/swallowing dysfunction.¹¹

Other populations with increased incidence of dysphagia or swallowing/feeding problems are those with neurologic disorders.¹³ Currently, 80% of patients with a neurologic disorder are diagnosed with some level of dysphagia.¹⁴ Often the dysphagia is a result of general muscle weakness, but children with neurologic disorders require a more thorough examination than children with normal development. This is due, in part, to a high percentage of children with more than one place of dysfunction in the feeding/swallowing mechanisms.¹³

Logically, a breakdown of function at any point in the swallowing process would create problems with eating an adequate amount of calories and nutrients. But many practitioners don't realize that a breakdown in respiratory function can have detrimental effects similar to those caused by swallowing issues.¹⁰ It is critical that the breathing processes be functional and adequate to provide enough oxygen during eating. Lowered

oxygen intake can cause a child to become fatigued quickly which reduces the amount of nutrition they are capable of taking in.¹⁰

A decrease in oxygen intake can be especially concerning in infants. Infants begin life breathing through their nose. They can switch to breathing by mouth, but this is often not an adequate way to provide enough oxygen to the body.¹⁰ Premature infants have a more difficult time switching to mouth breathing if there is something that restricts nasal breathing. Their ability to breathe by mouth increases as they get older, but this can be a serious issue for babies born too early.¹⁰ Breakdown in respiratory function can occur in any of the six anatomic compartments of the respiratory system including: central nervous system, upper airways, lower airways, lung parenchyma, the pleurae, and the thoracic cavity.¹⁰ Dysfunction that hinders nutrient intake is not isolated to the organic failures discussed above.

Organic failures in the gastrointestinal tract (GI) are common among children and are often diagnosed in infancy. However, the symptoms experienced by these failures often follow infants into later childhood.¹² Some common GI conditions include: acute diarrhea/vomiting, food allergies, gastroesophageal reflux disease (GERD), chronic constipation, lactose intolerance, and Celiac Disease.^{10,14–16} The symptoms of these conditions can discourage a child from eating because they anticipate pain or discomfort from the experience.^{2,15} This can exacerbate feeding disorders since behaviors developed as a result of the symptoms of these physical limitations often continue even after the condition has been resolved.¹⁵

Organic failures in other systems can have the same effect on a child's ability to develop normal feeding behaviors capable of supporting growth and development.¹⁶

Chronic diseases like chronic kidney disease or type 2 diabetes require multiple diet manipulations as part of treatment. These manipulations often result in behavior adaptations to eating and food choices that can create problematic habits as the child develops.¹⁶ For example, abnormalities of the heart create serious intake issues for pediatric cardiac patients. Many of these patients are classified as failure to thrive (FTT) because they are experiencing poor age appropriate growth, development, and weight gain.¹⁷ Pediatric cardiac patients often struggle to intake adequate energy due to poor feeding skills, and oftentimes tire quickly due to inadequate ability to oxygenate.¹⁶ Poor oral intake of cardiac patients is further exacerbated by increased metabolic demands due to the nature of the condition.¹⁶

Organic failures secondary to other conditions, such as disability, can also create serious imbalances in the type and amount of nutrients children are capable of eating. Children with neurological disabilities tend to suffer from the consequences of malnutrition.^{12,18} Often the malnutrition is a secondary symptom to a larger problem. For example, 92% of children with cerebral palsy (CP) have organic failures in their GI tract and 60% of these children also suffer from swallowing problems.¹⁹ This creates problematic consequences as 46%-90% of CP cases suffer from malnutrition.¹² Failures in body systems that facilitate eating naturally limit the amount and quality of foods consumed by this population. It is estimated that at least 1/3 of all neurologically impaired children suffer from undernutrition with many of these suffering from serious consequences of malnutrition.¹⁸ The extent of the malnutrition observed includes calorie-protein and specific micronutrient deficiencies. Deficits in calories and protein can limit a child's linear growth where micronutrients can affect social, cognitive, and behavioral

development outcomes.¹² Deficiencies that occur due to a child's inability to eat an adequate amount can be further exacerbated by increased nutrient needs, especially caloric needs, for children with certain disability types.¹²

While these estimates help us to understand how many children may be affected by malnutrition, they do not take into consideration the severity of the disability a child may suffer from. The incidence and severity of malnutrition increases with an increase in the severity of the neurological disability the child suffers from.¹⁸ There are many reasons why children of this population struggle to consume adequate nutrition to promote health and normal growth. Many professionals believe that damage to the central nervous system directly effects the processes of eating and digestion as the enteric nervous system has more neurons than the spinal column.¹⁸ This is especially concerning in children that have severe restriction in gross motor function.¹⁸ These children have difficulty performing basic feeding functions like getting the food to their mouths or chewing and swallowing adequately. There is also a concern that these children suffer from conditions such as GERD, dysphagia, and constipation which increases the likelihood of lowered nutritional intake.¹⁸

In past years it was generally accepted that malnutrition among neurologically impaired children was an unavoidable consequence of their condition.¹⁸ This is no longer supported by research or followed by providers that treat this population. Undernutrition in these children is preventable, if it is corrected early.¹⁸ Serious attention should be paid to function and efficiency of the gastro-intestinal tract as disorders here can compound poor intake.¹⁹ Efforts to evaluate and treat individual feeding disorders have resulted in

improved nutritional status, reduction in hospital stays, and overall improvement in quality of life.¹⁸

Depending on the severity of the organic etiology, nutrition support often becomes essential in chronic cases of feeding disorders and undernutrition.¹² This type of feeding can help restore linear growth, normalize weight, decrease irritability and spasticity, encourage wound healing, and reduce hospitalizations. The use of nutrition support has saved the lives of many children over the past few decades. This allows children, and their families, to have a better quality of life and aids children in reaching optimal growth. However, use of feeding tubes as a long-term eating solution has not been extensively studied.²⁰ Also, there is little known about possible implications that may result from “tube dependency.” The biggest complication associated with tube dependency is the development of problematic feeding behaviors such as; gagging, choking, withdrawal from food, and an extreme reluctance related to eating or drinking called oral aversion.²⁰ Research suggests that children with severe feeding difficulties likely suffer from oral aversion in the first two years of life. Also, families desire a more normalistic feeding routine for their child as soon as possible.¹⁹ Programs to wean children from tube dependency require in-depth, multi-disciplinary team approaches. Children must be carefully monitored to ensure rate of weight loss is controlled and that the child is gaining adequate skills to self-feed.²⁰ Also, in cases of severe oral aversion, specialized feeding therapies may be indicated to help children learn how to eat properly.²⁰ Often feeding aversions are the result of symptoms experienced because of organic diseases/limitations but aversions and other problematic behaviors can occur without any clear etiology.

Non-organic Feeding Disorder (NOFD) is a formal diagnostic term that identifies patients with problematic feeding behaviors, in the absence of organic causes.¹⁷ The types of behaviors included in the definition include; food aversion, food refusal, selective eating, and low food intake. These all occur in the absence of a diagnosed organic disease/limitation that directly affects the eating process.¹⁷ While true NOFD diagnosis can occur, often children develop feeding disorders because of an organic etiology that persists even when the organic disease/limitation is corrected. One study reported that 70% of the children in the control group, diagnosed with NOFD, had suffered previously from an organic disease/limitation that contributed to their current feeding disorder.¹⁵

The common occurrence of comorbid conditions in the pediatric population makes the diagnosis of NOFD eating disorders more difficult. Many pediatric practitioners don't know how to treat feeding disorders that lack an organic etiology.¹⁵ Many children diagnosed with NOFD struggle to gain and maintain weight which causes conditions of FTT.¹⁷

NOFD eating disorders generally have strong behavior components that seriously hinder the feeding process. Autism Spectrum Disorder (ASD), is a specific neurological disability where children experience endemic feeding disorders with strong behavioral components.²¹ A recent meta-analysis explored research concerning the prevalence of feeding disorders in children in ASD as compared to typically developing children.²¹ The study concluded that children with ASD are 5 times as likely to have feeding disorders than are children without ASD. Children with ASD are also more likely to have lower calcium and protein intakes than their peers.²¹ This study also found that despite an increase in literacy concerning feeding problems in children with ASD, there are relatively few studies

on feeding dysfunction that can be generalized for this population. This is thought to be due in part to the fact that children with ASD meet weight and growth parameters regularly.²¹ This is concerning because typical physical growth could be masking underlying nutrient deficiencies. One reason that may explain this phenomenon is the tendency of children with ASD to have severely restricted diets.^{21,22} Many meals are composed of high glycemic foods that tend to be high in fat, sugar and sodium.²³ They will eat large volumes of foods they enjoy, while eliminating other foods and even whole food groups from their diet.²¹

Many parents of children with ASD report severe selectivity in their child's diet, with as few as 5 acceptable foods.²² Severely restricted diets cannot provide adequate nutrition for comprehensive health. Sensitivity to smell, texture, color and temperature of foods are a few reasons why children with ASD are more likely to suffer from severe food selectivity.²² There are few studies that study the eating behaviors of children with ASD as compared to typically developing children. One study reported that 75% of the children with ASD in their study were significantly more likely to only accept low-texture foods. Also, the ASD children only ate 1/3 of the variety of foods that their typically developing peers did.²² There was also a significant degree of food selectivity reported in children with ASD. Children with ASD ate less across all food groups than did their peers.²² Other studies based on parent report of child food acceptance, reported reduced food acceptance of less than 20 foods among children with ASD.²²

Food selectivity is a major concern because it can lead to nutrition insufficiency. Despite this concern, very few studies have been conducted that compare the severity of food selectivity to nutritional adequacy.²² The few that have been conducted reported

mixed results which make the findings difficult to generalize. One study reported no difference in levels of nutrients eaten between children with ASD and typical children. Where another study reported a slight difference in nutrient intake between these two populations. A different study found that all children of the age range included in the study had vitamin and mineral deficient food intakes.²²

Attempts to define the etiology behind the food selectivity seen in children with ASD has led researchers to formulate several theories. One theory is that these behaviors are maintained, in part, by environmental factors that enforce these behaviors.²³ Children will exhibit behaviors that are unpleasant or unacceptable in order to escape a specific situation. Often caregivers will remove cups or spoons because they seem to be the cause of the behavior. Also, children are often given foods they prefer in order to avoid episodes of poor behavior.²³ These coping techniques used by caregivers reinforce poor behavior and negatively strengthen the occurrence and severity of the behavior exhibited.²³

Another theory is that sensory sensitivity creates a state of sensory defensiveness, the over-reaction to certain touch sensations.²² It is common for children on the ASD spectrum to have problems with tactile defensiveness, which is the inability to tolerate materials touching their skin. A wool blanket is an example of a material that is not tolerated well by these children.²² The domains studied that were significantly different in autistic subjects as compared to typical children were those of touch and smell/taste. Because the presence of sensory issues is so high in children with ASD, many researchers have argued that sensory processing should be part of the diagnostic criteria for ASD.²² This tendency for sensory defensiveness leads to the conclusion that oral defensiveness is a logical symptom of general sensory issues seen in ASD children. One common

manifestation of oral defensiveness, is that many children with ASD refuse to brush their teeth. Another example is that they often avoid foods with certain textures or mixed textures.²²

One study showed the link between tactile defensiveness and the eating habits of children who did not have autism. Children with tactile defensiveness were compared to children without sensory problems and were found to have a significantly lower rate of foods acceptance. They would refuse foods of certain textures and gag or bite their cheek when they were presented with foods that they were averse to.²² They also only accepted half as many vegetables as their peers. This suggests that sensory sensitivity has more to do with food aversion than ASD does.²² Olfactory sensitivity may also play a key role in the extent of the food aversion seen in children. A highly responsive sense of smell can increase discomfort in certain environments, like a cafeteria, and hinder the amount and types of foods that are accepted.²² It is also possible that the contrast of textures is what causes serious aversion to certain foods. For example, crunchy celery in creamy tuna salad may be too large of a contrast to be tolerated. Also, food aversions could lead to behavior problems in children that cannot express their distaste of certain foods.²²

The reason children develop problematic feeding behaviors cannot always be specifically defined. Some behavioral experts have hypothesized that a general approach to parenting and parent feeding styles can have significant impact on how children eat and grow.²⁴ Feeding styles are considered to be a balance between how responsive a parent is and the demands issued by a child. This can also be considered in the reverse, as these styles would be dependent on how responsive the child is to the demands of the parent.²⁵ Four categories of common parenting styles have been identified as well as the effects

typically seen in child behavior. Uninvolved and indulgent parents set very low rules and allow children to dictate what, when, and how much they eat. Authoritarian and authoritative parents set more rules and expectations for their children especially at mealtimes.^{24,25} They usually have scheduled eating times and require their children to eat what is given to them with little room for choice.²⁴ A recent meta-analysis reviewed research associated with parenting styles and BMI in children. The study found positive correlation for certain parent behavior and higher BMI among children. This was especially prevalent among children with parents that used an indulgent and authoritative style of parenting.^{24,25} Both of these styles lack proper boundaries that allow children to self-regulate their food intake.

Parenting style is relevant to the discussion of eating disorders in pediatric patients because indulgent and controlling parenting styles are correlated with less self-regulation by children.²⁶ Pressure from parent/caregiver to eat can hinder a child's ability to recognize and respond to innate hunger cues causing dysregulation of eating behaviors. This could lead to selectivity in diet as a child grows or poor management of body weight that could lead to morbid conditions.^{26,27} Studies have shown that children of mothers that used pressure to get children to eat developed undesirable feeding practices.^{27,28} These findings are supported by the current body of literature concerning pressure-feeding and perceptions of pickiness.²⁸ According to the literature, the influence of caregiver strategies on children is most influential during the preschool years.²⁷ A recent study tested the level of controlling feeding strategies used by the main caregiver and the extent of undesirable eating patterns to determine correlation. The study found the following occurred in response to controlling feeding strategies: lower interest in healthy foods, pickiness,

emergence of dietary restraint, and lower diet quality.²⁷ While there was significance reported with this relationship, the variance was relatively small which suggests that there are other factors contributing to the effects besides the controlling strategies.²⁷

There is also, some evidence that suggests that authoritative style parenting may have the most positive effect on child eating. This parenting style demands less of children, while offering higher interest in the health and well-being of the child than other types of parenting.²⁹ Effective parenting skills include setting appropriate eating schedules, providing appropriate healthy food options, modeling healthy eating behavior, emphasizing appropriate portion sizes, and helping children recognize hunger and satiety cues.^{30,31} Also, responding to a child's needs promptly encourages attentiveness in the child and interest in feeding. This focus can help children learn what their internal cues of hunger and satiety are and how to recognize them.³¹ This will help children develop healthy eating behaviors that will follow them into adolescence and adulthood.

How are feeding delays/disorders identified?

In order to be effective in diagnosing feeding dysfunction, child feeding specialists need to have a good understanding of available tests and monitoring procedures used to determine feeding dysfunction.¹⁰ When beginning the diagnostic process, it is beneficial to consider the specific questions that need to be answered. This will ensure that the practitioner chooses the most appropriate tests that will provide adequate information to improve diagnostic conclusions.¹⁰ Monitoring physiologic functions will provide basic functional information that can eliminate certain etiologic

possibilities and help focus diagnostic efforts. A cardiorespiratory monitor can give a quick understanding of the infant's current status.¹⁰ It measures heart beat and respiratory processes and is capable of detecting small dips in infant heart rate that are not seen with other monitoring devices.¹⁰ Oximetry monitors provide a constant measure of the saturation of oxygen in an infant's blood. Using information gained from this monitor, a child's baseline oxygen saturation can be determined and dips in saturation can be measured. This information is especially valuable when monitoring saturation levels during feedings.¹⁰ A polysomnogram is a multi-channel machine that can monitor respiration, airflow, chest and diaphragm movement, oxygen and carbon dioxide levels, heart rate, and esophageal pressures simultaneously. Reports from this tool can report relationships between different variables which can help in understanding the extent of identified conditions.¹⁰

Other tests can be conducted that give a pictorial view of actual functions of specific anatomical processes. These processes use radiologic measures to diagnose functional disparities. A technetium scan looks for evidence of gastro-esophageal reflux and evaluates the basic functions of the stomach. An infant is fed a small amount of radio-active isotope mixed with milk. Scans of the stomach and esophagus are taken periodically to observe the actual function of the stomach and presence of reflux in the esophagus.¹⁰ A barium swallow is a test that also looks at anatomical function, but this one is concerned with potential issues with swallowing and is especially focused on the esophagus. Barium is placed in the esophagus, and then pictures are taken using a fluoroscopic camera in order to see the swallow in real time. This test is able to diagnose problems with esophageal motility and gastro-esophageal reflux. Another test, that is

very similar to a barium swallow, is a videofluoroscopic swallow study. It is commonly called a modified barium swallow and uses the same procedure described previously except that a moving-action camera is used to watch the swallow progress. This test is particularly concerned with the pharyngeal swallow and will indicate the occurrence of aspiration.^{10,11} Different types and consistencies of foods will be offered to patients during the test to determine which foods may be problematic.¹⁰ Diagnostic tests can provide valuable information that can aid in the process of making a comprehensive diagnosis, but a clinical evaluation is also necessary to ensure all points of concern are addressed.

Ideally a clinical evaluation should be conducted before a barium swallow is performed to eliminate unnecessary exposure to radiation. It is necessary for feeding specialists to have in-depth understanding of body systems in order to capably compare typical feeding behavior with atypical behavior.¹⁰ Expertise in this area will help clinicians focus on problem areas during a clinical evaluation. This is often difficult as there can be a wide range of appropriate benchmarks set for certain ages.¹¹ Most clinical evaluations are grouped into categories of observation. This helps to ensure the clinician is gathering a wide range of information that will aid in determining a true diagnosis. These categories may include the following: behavior and state, motoric control, response to tactile input, oral-motor control, suck-swallow-breathe triad, physiologic control, and general observations.¹⁰ Also, using a comprehensive category system like this ensures that key observations aren't missed during an evaluation.

Identifying problematic feeding behavior is challenging. The tests mentioned above only happen if there is a concern about a potential feeding disorder. Practitioners in

several different disciplines have developed screening tools that help them identify problematic feeding issues.³ In 1995 the Joint Commission mandated universal screening and assessment of all hospital patients, including pediatric patients, for malnutrition.³² The intent of this mandate was to identify as many patients as possible that may be malnourished, or at risk for malnourishment. This mandate led to the development of many different screenings tools; however, a universally accepted tool for feeding disorder screening has not been implemented.³² Practitioners are using validated and non-validated tools that fit the needs of their practice, but do not necessarily improve their ability to identify a large percentage of at risk patients.³²

Malnutrition is not the only concern of practitioners that treat this population. Often children will suffer from undernutrition due to illness, environmental or behavioral factors, injury, congenital anomalies, etc.³³ Currently a standardized method to recognize and diagnose pediatric malnutrition and undernutrition is lacking. This creates inconsistencies of routine nutritional assessments of high-risk children in facilities across the United States.³³ The Academy of Nutrition and Dietetics (AND) recommends the following indicators be used when assessing and diagnosing pediatric malnutrition and undernutrition: food and nutrient intake, assessment of protein and energy needs, growth factors, weight gain velocity, mid-upper arm circumference, hand grip strength, proxy measures for traditional anthropometrics, and indication of Tanner stages.³³ These are recommended as the beginning stages of developing protocols that will better identify patients of risk. Encouragement is given to practitioners to work together with other disciplines to create a tool that will better inform the practice of the team.³³ Developed screening tools, which will be discussed in the next section of this dissertation, have been

developed by practitioners from a wide range of disciplines. There is currently not a universal screening tool commonly used by RDNs to identify feeding issues/disorders in this population.³³

One general practitioner developed a classification system to help practitioners categorize behaviors and diagnoses into a system that would help them identify possible concerns in their patients.³ This system uses input from medical and psychological practitioners to form a comprehensive scale that will be generalizable for all children. Classification is assigned using comments collected from the parent and patient history.³ Patients are assigned to one of three principal behavior categories; limited appetite, selective intake, and fear of feeding. Each category is also assigned a scale of severity; this includes description from normal to severe.³ Components are integrated into this scale in order to understand how organic and behavioral problems are influencing the child's feeding. The classification system includes expanded definitions for each category to aid practitioners in making the most correct classifications.³ The goal of this screening tool is to expedite the diagnostic process in order to provide patients and their families with resources as quickly as possible to avoid potential delays in the child's growth and development.³

Another tool, simple pediatric nutrition screening tool (PNST), was developed as a way to screen pediatric patients in hospitals. Poor nutrition state can have negative consequences in this population ranging from a weak immune system to physical and cognitive developmental delays.³⁴ This tool was developed based on a screening tool used to determine malnutrition in adults, subjective global nutrition assessment (SGNA). There are several pediatric nutritional screening tools, but they are overly complicated and require

too much time and specialization to use them effectively in this setting where time to diagnosis is critical to outcomes.³⁴ The goal of this tool was to eliminate the need for anthropometric measurements and a scoring system. Removal of these two criteria would speed up the time to diagnosis and get the children the nutrition therapy they need to recover quickly.³⁴ Questions for the PNST were developed using information from current literature and input from experienced nurses and dietitians. Criteria used to develop questions included: ease of application to all patient situations, minimal space needed on admission form for questions, and questions could be answered with yes or no.³⁴ Four questions were ultimately selected, two affirmative responses indicated that the child was at nutrition risk and required further care. This tool was tested using the SGNA as the validation reference as this tool had already been through a validation process.³⁴ The PNST reported similar scores to what the SGNA identified, which indicates that this tool was determined to be successful in identifying nutrition risk in pediatric patients.³⁴

The two tools discussed above focus on the functional aspects of feeding and eating. While these factors are important and have direct causative influence on what or how much a child will eat, some practitioners believe that environmental influences may have strong impact on the behavior a child is exhibiting.³⁵ Two treatment approaches, Feeding Dynamics and Bio Behavioral, agree that the extent of feeding problems depends on the structure, consistency, and level of positive interaction a child experiences at mealtimes. These treatment techniques seek to enhance the ability of children to recognize hunger/satiety cues by decreasing the amount of external controls and limits that are set by caregivers.³⁵ These theories inspired the creation of a screening tool that measures parent report of strategies used during mealtimes for child feeding. The Feeding Strategies

Questionnaire (FSQ) was developed by a multidisciplinary team in order to generate items that addressed the Feeding Dynamics and Bio behavioral theories.³⁵ The team agreed on a 40-item questionnaire that measured the level of mealtime structure, parent regulation of intake, and child regulation of intake. The FSQ was validated for structure and content by patients/clients of a pediatric feeding specialty clinic and members of the surrounding community, 288 parent/caregivers, participated in the validation process.³⁵ The FSQ preliminary results suggest that mealtime structure is positively related to use of a regular meal schedule and inversely related to between meal grazing.³⁵ The results also define the validity to this questionnaire as a valuable diagnostic tool to help practitioners choose treatments/therapies that are most effective for this population.³⁵

Many other feeding assessment tools have been developed, but lack the validation and credibility of the FSQ. Also, many of these tools fail to cover the wide range of problematic behaviors observed in this population.³⁶ Several steps were employed to develop a more comprehensive screening tool that would aid in diagnosing and categorizing more patients. The first stage of development included focus groups and individual interviews in addition to a comprehensive literature review and review of existing assessment instruments (8 total).³⁶

Through these reviews and interviews the actual tool, Pediatric Eating Assessment Tool (Pedi-EAT), was developed and included a wide range of questions designed to address as many problematic behaviors as possible. Next Pedi-EAT was tested for validity by a panel of interdisciplinary clinical practitioners and researchers.³⁶ Each of the panelists ranked the content for clarity and relevance based on a pre-determined scale. Pedi-EAT was then analyzed for validity by parents of children with feeding disorders or some type

of feeding dysfunction through cognitive interviewing.³⁶ Cognitive interviewing is designed to determine how the person reading or hearing the questions interpret the meaning of the questions. Each question within Pedi-EAT was read out loud to the participant, the participant was then asked to state what the question meant. The participant was then asked whether the directions and responses to each question were clear and easy to understand.³⁶ These interviews were recorded and summarized in a matrix format by a team of investigators.

Once the interviews were completed, revisions were made to Pedi-EAT and a second test was conducted on the assessment instrument.³⁶ Investigators decided to include parents of children without feeding issues in this test in order to ensure understanding among a wide variety of individuals. Participants were asked to complete the Pedi-EAT before coming to the interview and to record any questions or comments they had while answering the questions. They then participated in an interview where probing questions were asked in an attempt to determine ease of completion, understanding of questions, and clarity of response options.³⁶ Probing questions were also asked to clarify participant responses on the Pedi-EAT. These interviews were recorded and summarized using a matrix by a team of investigators.³⁶

After analysis was completed, 44 items were added from the interviews. Also, 39 items were added from the literature review and 25 items were added from existing instruments.³⁶ This instrument was then successfully validated for content and ability to generate accurate information. However, it still needs to be tested by a large heterogeneous sample to determine internal validity and consistency.³⁶ While use of this tool has

produced some favorable results, it is long and complicated and would be difficult to implement in clinical settings.

There are many effective assessment tools that have been developed to determine levels of feeding disorders in adults, but these tools are not easily transferrable to the pediatric population. However, one study sought to alter a successful adult screening tool to be effective in the pediatric population.³⁷ The Screening Tool for Feeding Problems (STEP) was developed to determine feeding problems in adults with intellectual disabilities. The main target of the assessment was to determine; risk of aspiration, feeding skill deficit, food refusal and associated behavior problems, nutrition related behavior problems, and food selectivity.³⁷ In order to make the STEP more applicable to the pediatric population, researchers asked parents of children in the study to fill out the following: STEP questionnaire ranking each behavior by frequency exhibited, the Child Eating Behavior Questionnaire (CEBQ), a four item food texture scale, a food preference inventory, and the Parent Mealtime Action Scale (PMAS).³⁷

The study included 142 participants whose responses allowed researchers to build an assessment tool more applicable to the pediatric population. The final STEP-CHILD is a 15 item assessment that includes the following six subscales: chewing problems, rapid eating, food selectivity, vomiting, and stealing food.³⁷ The results of the survey were significant and showed a correlation between child and parent variables. It was especially sensitive to specific parent mealtime actions and poor dietary intakes observed in children.³⁷ This version of the STEP assessment proved capable of identifying children with problematic feeding issues and could be beneficial in getting more children to feeding treatment more efficiently.³⁷ However, there is concern that this assessment tool is too

focused on parent/caregiver feeding methods. There is concern that this limitation could cause practitioners to miss feeding disorders not connected to parent/caregiver interaction.

Because behavior has a strong correlation to feeding disorders much research has been conducted to discover the source of problematic behaviors that hinder the ability of children to eat. One well-supported hypothesis is that parental actions create, or influence, some of these undesirable behaviors.³⁸ The Parent Mealtime Action Scale (PMAS) was a measure developed to assess the different practices parents employ to encourage their children to eat. Parents provided information about their child's eating behaviors and how frequently they participated in certain behaviors.³⁸ The parents would rank their frequency of participation based on a 3-point scale, i.e. 1=never 2= sometimes 3=always. Behaviors measured ranged from snack limiting, to the amount of food offered, to the types of food offered.³⁸ Results of studies conducted using this scale suggested significant relationships between some of the subcategories of the scale and childhood feeding problems. For example, parents who used "permissive" parenting techniques that allowed children to choose what and when they ate were correlated with more limited dietary variety.³⁸ The data gathered provided insight into possible parenting behaviors that could contribute to feeding disorders.

However, the reliability and validity of the scale was questionable in some instances. Because of this a revised scale was developed. The PMAS-R uses a 9-point scale to rank parenting behaviors. This scale proved to be more reliable, in every instance, than the original scale and was determined to be more useful in its ability to generalize results to all child populations.³⁸ This is especially true in the case of parents that have children with special needs. The study conducted using PMAS-R suggested that parents

of children with special needs rarely participate in behaviors that influence children to develop long-term healthy diets.³⁸ This study also suggested that children with higher weight had parents who used less insistence on eating what they provided and allowed more child-selected meals. However, none of the results were overly conclusive and further research is needed to ensure consistency of results.³⁸

Existing therapies and treatments for feeding delays/problems

There are several documented therapies used to address feeding disorders among the pediatric population. Differential Reinforcement of Alternative (DRA) behaviors is a behavior based therapy that attempts to reinforce appropriate eating behaviors by ignoring undesirable behaviors and guiding patients toward desired feeding behaviors.⁵ This therapy is often coupled with escape extinction (EE) that seeks to eliminate avoidance behaviors exhibited by the child in order to improve food intake.⁵ Most of the therapies currently used to treat feeding disorders are behavior based programs. There is some interest in medical management techniques that might be successful in treating these disorders, but there is little evidence to support this idea.⁵ Other strategies focus on simultaneous/sequential presentation of preferred and non-preferred foods and stimulus fading.⁵ A recent analysis looked at the effectiveness of behavior based treatments. In all cases behavioral interventions resulted in improvements of quantity and variety of foods accepted by participants.⁵ This study also concluded that the use of EE was the best, statistically, in helping patients to overcome feeding issues.⁵

EE looks to address the negative reinforcement that occurs when a child refuses to eat or drink food that is offered to them. The child will cry, bat at the spoon, turn head, spit out food, etc. in order to avoid eating.³⁹ When these types of behaviors are allowed to stop or postpone the feeding the child is able to escape an unpleasant experience. This negatively reinforces the behavior and increases the likelihood that it will occur again.³⁹ One study concluded that negative reinforcement, in the form of escape, plays a major role in the maintenance of behaviors that are considered inappropriate during eating. EE uses strategies that remove the negative reinforcement for these behaviors.³⁹

Several studies have suggested the extinction of escape behaviors can increase overall food intake and decrease the incidence of problematic behaviors.^{39,40} The studies cited here are small studies that involved a limited number of participants; however, they provide some valuable information on the potential effectiveness of EE to improve overall food consumption. In many problematic feeding cases, intake only increases when the child comes into direct contact with the food and drink through EE. EE therapy persists in placing food or drink in the child's mouth despite acceptance from the child. If the child spits out the food, it is scooped up and placed back in the mouth.³⁹ Consistent re-introduction helps the child to accept foods that have been previously avoided by ignoring the problematic behavior and persisting in continuing the meal.³⁹⁻⁴¹

Two studies looked at the effects of EE and positive reinforcement.^{40,41} EE therapy was conducted with the subjects of these studies but they were also given some type of reward for compliance to therapist requests. Rewards were based on preference of the subject and could be a toy or removal from the room where feeding was occurring.^{40,41} Both studies set time limits to the feeding sessions and therapies were terminated when

time expired. Subjects were instructed to eat bites of food, if they did so, they were praised and were reminded they only had so many bites left to take. If the subject engaged in any escape behaviors (i.e., spitting out food, refusal, etc.) they were consistently reminded to eat a bite of food. Once the subject ate the prescribed amount of bites they were allowed to leave the eating area and or engage in preferred activities (i.e. playing with favorite toy).^{40,41} EE with positive reinforcement proved successful in all cases, but positive reinforcement without EE was not successful. Both studies concluded that positive reinforcement can enhance the overall amount of food accepted but that EE needed to be included for reduction of undesirable behaviors and increase of food intake.^{40,41} The studies provide good evidence that the use of EE is an acceptable therapy to address feeding concerns in children.

Another behavioral based therapy is commonly used as an alternative to EE. The sequential oral sensory (SOS) approach is a 12-week program that uses systematic desensitization, through play, to treat feeding disorders.²³ The program uses six steps to build acceptance for problematic foods. The therapist begins with visual acceptance and then gradually increases exposure to gain acceptance of smell, touch, taste, and eating.²³ The amount of empirical information surrounding this therapy is limited and would be difficult to generalize to a wide array of populations. However, this therapy is widely used in many clinics that conduct feeding therapy programs for the pediatric population.²³ A recent study conducted a comparison in order to determine the effectiveness of the SOS method to an applied behavioral analysis (ABA) method.

The ABA method is similar to EE but uses a consistent pattern of presenting food on a spoon to the child.²³ The spoon is presented close to the child's mouth and follows

head movement if child refuses food. The food will be continuously re-introduced for a specific duration of time until child accepts the food.²³ Study results indicate that the ABA method was more successful in expanding the amount of foods the children would accept. The SOS method produced little to no change in the ability of the children to accept the new foods offered to them.²³ However, the study did indicate that use of the SOS method may be a good way to prepare children to accept more foods through the ABA method. The two subjects that participated in the SOS method and the ABA method were able to accept other, previously unaccepted foods, without any intervention from ABA therapists.²³

Another approach used to help children overcome sensory processing problems is called sensory integration theory.⁴² This theory views problematic eating behavior as a symptom of how the central nervous system interacts to receive and organize information. This theory discounts the idea that eating problems are created and enforced by environmental factors.⁴² The therapy associated with this theory, sensory integration therapy (SI), targets the underlying sensory processing issue instead of focusing on behavior modification. The SI therapy applies changes to the sensory stimulation the child receives.⁴² This is usually done through music/rhythm activities, proprioceptive activities, heavy work, and sensory modulation techniques. These activities/therapies can be applied anywhere on the body, however children usually tolerate them better on their legs, feet, and back.⁴² This type of therapy is most often employed by occupational therapists (OT) to address a variety of sensory concerns and to treat feeding disorders.⁴²

A study looked at the difference in effectiveness between the SI and EE therapies in order to understand which method is more effective in helping children overcome eating

disorders.⁴² Two children participated in this study participating in both therapies systematically. Results of the study reported no significant improvement of food acceptance or grams consumed during the SI therapy sessions.⁴² SI therapy sessions were conducted for 10 minutes prior to feeding sessions. The children then directed the pattern of the feeding sessions through the use of escape. If a child exhibited inappropriate behavior during a feeding session, the spoon or cup was removed.⁴² This is in contrast to the use of EE therapy to eliminate inappropriate feeding behaviors. When EE was used, the frequency of inappropriate behavior decreased and the amount of food acceptance increased.⁴² While SI may have some practical application to treat sensory issues in children, there is very little empirical evidence that this therapy has the ability to treat feeding issues in children.⁴²

The therapies described above are part of the actual eating process, there are other therapies that look at antecedent interventions that could impact behavior during feeding.^{43,44} The antecedent intervention (AI) was defined as a procedure implemented before acceptance of a bite or drink. For example, a child will be presented with small portions of non-preferred foods and will be asked to do something. The suggestion given by the therapists can be high-p suggestion, meaning there is a high probability that the child will comply.⁴⁴ Or they can be low-p, which is a high likelihood that the child won't comply with the request. An example of a high-p request would be, "kiss the carrot" or "bite the carrot into two pieces". Examples of low-p requests would be, "eat the whole carrot" or "take a bite".⁴⁴

In order to understand the effectiveness of AI, a meta-analysis was conducted including studies that used AI alone, EE alone, and EE with AI.⁴³ The study found that in

67% of the subjects with food refusal, AI enhanced the effects of EE. Also, in 70% of cases with feeding related medical issues AI enhanced the effects of EE.⁴³ Another study looked at the effectiveness of AI alone as an effective treatment for feeding disorders.⁴⁴ Results of the study found that high-p instructions, in the absence of EE, were effective in increasing food consumption in two subjects. The use of low-p instructions did not significantly improve consumption and acceptance of target foods.⁴⁴ One explanation for why the high-p was successful and the low-p was not, is that high-p instructions are more physically based, often not addressing feeding at all. It is interesting that this type of procedure increases food compliance, where the direct low-p instructions maintain problematic behaviors.⁴⁴

The therapies listed above, and any other therapies employed to treat feeding disorders in children, should only be initiated through the actions of an interdisciplinary medical team.^{17,45} Many times feeding disorders are complicated by other morbid conditions or conditions that develop secondary to the feeding disorder. The use of an interdisciplinary team allows practitioners to coordinate care and build a comprehensive, unique, treatment plan for each patient.^{4,17,45} Using these types of teams also helps lower the risk that disciplines, acting independently, will overlook key etiologies or needs that will delay therapy progress or further exacerbate the current situation.⁴ Also, most of these children need to “catch up” in their growth and nutrition. Having several practitioners developing feeding plans to address this, and other issues, is the best way to help the patients rehabilitate.¹⁷

In one model implemented at a large children’s hospital, team members were organized into a feeding team. The team included the following disciplines: nurse

coordinator, RDN, speech language pathologist, OT, psychologist, pediatrician, and gastroenterologist.⁴⁵ Each practitioner was assigned specific roles to perform that would best meet patient needs. The teams were then expected to perform their responsibilities and collaborate with others in the team to make effective decisions for treatment and progression.

One especially beneficial consequence of these types of teams was the reduction of appointments patients and their families were required to keep. The evaluations at this clinic began with an intake survey being issued to the caregivers of the patient.⁴⁵ This survey gathered as much pertinent information as possible including: medical diagnosis, medical history, feeding history, current feeding status, and caregiver expectations. This was compiled by the nurse coordinator and presented to the remaining team members.⁴⁵ This streamlined the process of getting necessary information to all providers because the caregivers were only required to give information once instead of multiple times, as seen in traditional medical care for these patients. Once the background information was collected the team met collectively with the patient/caregiver(s).⁴⁵ The dietitian was in charge of gathering additional information from other team members as needed during the team discussion.

Once the initial discussion concluded, some of the providers were allowed to request further testing in order to determine exact skill/tolerance level of foods and feeding.⁴⁵ The team would then meet together again to review their initial impressions and recommendations for treatment. Once these evaluations and recommendations were complete the pediatrician reviewed all of the information after which all practitioners

would then meet together in “rounds” to discuss the case further. Recommendations were then made and follow up visits were scheduled for the patient as needed.⁴⁵

Other researchers analyzed the effectiveness of intensive feeding programs through a recent meta-analysis. Results of a meta-analysis that included 11 studies suggests the effectiveness of intensive feeding programs as part of frequent care from interdisciplinary teams.⁴⁶ Two of the studies included were randomized controlled trials, the other 9 were non-randomized chart reviews. The results of the analysis were encouraging, reporting success with weaning from tube feeds and significant improvement in oral consumption during meals.⁴⁶ Continued improvement of oral intake was also reported in a few included studies. During follow up visits significant increase in the volume of calories consumed by patients was measured. Study conclusions indicate that intensive feeding programs involving interdisciplinary teams are associated with improvement in food consumption after the interventions.⁴⁶

Another therapy model centered around interdisciplinary teams is called the Day Patient Treatment Program.⁴ This is an example of an intensive feeding program that feeds clients 4 meals a day, 5 days a week. The therapies are recommended and conducted by a team of practitioners including: gastroenterologist, nurse practitioner, behavioral psychologist, OT, speech language pathologist, RDN, social worker, and a case manager.⁴ The psychologist is considered the lead and is responsible for training and overseeing any behavioral therapies implemented with clients. The team meets weekly to discuss each client and determine the adequacy of diet and progress that has been made.⁴ One case study presented in this article describes the success of a young girl with craniofacial deformities learning to eat. She had been in a feeding intervention before, but had seen

little success from the process. The interdisciplinary approach was a highly successful approach because she learned to self-feed by the end of the intervention taking in a sufficient amount of calories to maintain health and growth.⁴

The success of interdisciplinary teams can be particularly applicable to the dietetics profession. A RDN is often the first practitioner to see patients with food aversion and severe food selectivity.²² Also, RDNs have the ability to determine the adequacy of the child's current diet and to identify any deficiencies or needs that should be addressed immediately.²² RDNs should talk with the families about the reaction the child has to various sensory inputs especially; smells, taste, or tactile stimulus. This will help the dietitian know if the child should be treated by an occupational therapist/physical therapist. These therapists have the ability to address behaviors that may be occurring due to sensory defensiveness, identify specific sensory issues, and assist the RDN in identifying alternative foods that will help improve overall nutrition.²² If nutritional inadequacy is identified, the RDN can provide information of nutrition supplements or other alternatives that will help improve nutrition until the sensory/behavioral issues can be resolved.²²

Consequences of untreated feeding delays

Children that experience chronic feeding disorders often develop malnutrition. Development of malnutrition in this population can be detrimental to the growth and development of these children.⁴⁷ Because of the accelerated rate at which the brain is growing during this stage of life, even moderate episodes of malnutrition in infancy have been associated with lifelong cognitive and intellectual impairments.^{47,48} These

impairments include significantly lowered IQ that can be classified as intellectual disability at some point in the child's development.⁴⁸ Recent studies indicate that different areas of the brain form at different rates and at different times during development.⁴⁹ Nutrition is extremely important during this process of brain development as deficiency during critical development stages can create a defect that cannot be repaired later in the development process.⁴⁵

Other consequences of malnutrition include: lasting behavioral deficits, slower language and fine motor development, and poorer school performance.^{47,50} Physical growth is often slowed or stunted due to poor nutritional quality. This can have detrimental effects on adult work capacity and economic productivity.⁵⁰ Also, malnutrition is the single biggest contributor of infant mortality under the age of five, contributing to almost half (45%) of the deaths recorded in children.^{47,51} This occurs partly due to the increased likelihood of children suffering from malnutrition to contract infectious diseases. Diseases like pneumonia and meningitis contribute to the high mortality rate among this population.⁵⁰ Persistent childhood malnutrition can often create a cycle of frequently occurring infections, impaired immunity, and worsening malnutrition.⁵¹

There is also emerging evidence that experiencing poor nutritional status in utero or early childhood, before 30 months, is associated with developing chronic diseases in adulthood.⁵² This concept is called developmental origins of health and disease (DOHaD). The research surrounding this concept is recent and is currently being expanded. One published paper reported results of several research studies that gathered data from adults with growth stunting, a marker of poor nutrition in childhood.⁵² Results of biometric tests revealed an alteration in lipid metabolism and profiles among this population. Changes in

lipid metabolism and low-density lipoproteins (LDL) were significant enough to assign increased risk for heart and cardio vascular disease to study participants.⁵² Another significant finding was an increase in weight gain among this population, it is postulated that the change in lipid metabolism may be causal to this finding. However, this is not conclusive as many changes in lifestyle also occurred as the participants entered adulthood.⁵²

Malnutrition experienced in childhood may also have persisting effects on cognitive function as well. Study results indicate that adults who experienced malnutrition in early childhood continue to struggle with attention deficit problems.⁵³ Another study reported a significant difference in personality profiles of children that had experienced malnutrition in infancy as compared to their adult peers.⁵⁴ The personality traits commonly seen among those who experienced childhood malnutrition include: heightened anxiety, depression, vulnerability to stress, lowered interpersonal orientation, lowered intellectual curiosity, tendency for withdrawal and distrust, and lowered sense of self-efficacy.⁵⁴ More research is needed, but these studies suggest that the effects of poor nutrition in childhood are not isolated to this stage of life.

Children with chronic conditions are more likely to suffer from malnutrition due to the complications of their condition. One study reported a high prevalence of malnutrition among pediatric cardiac patients.⁵⁰ The prevalence of congenital heart disease (CHD) reported by this study was 90.5% with 61.2% exhibiting symptoms of severe malnutrition.⁵⁰ This statistic may be elevated due to the level of morbidity experienced by study participants. The study was conducted using patients of a critical care hospital which may suggest that the participants were more ill than a general sample of CHD patients.⁵⁰

However, this data can add to the discussion of higher prevalence of feeding disorder among children with comorbidities.

Emerging research is also connecting malnutrition to delayed development, or altered composition, of gut microbiota. This is concerning because healthy intestinal microbiota is essential to overall human health.⁵¹ Altered microbiota function has been linked to a number of disease states and reduced efficiency in food digestion and micronutrient production which can further aggravate a condition of malnutrition.⁵¹ One hypothesis as to why children with malnutrition have altered gut microbiota, is the presence of inflammation. One study analyzed the stool of children who showed physical signs of malnutrition, i.e. stunting. These children had more inflammogenic bacteria present in their stools when compared to children without evidence of malnutrition.⁵¹ It is believed that the inflammation hinders the ability of bacteria to colonize successfully.⁵¹

Another study hypothesis suggested that gut microbiota immaturity is causally linked to neurologic delays and abnormalities.⁵⁵ Children require huge amounts of energy, almost twice the adult requirement, during their early years in order to facilitate normal brain development. Gut microbiota aid in the transition of food into energy and nutrient metabolism.⁵⁵ Research suggests that a corollary between metabolic output from the gut and human brain development and physiology are dependent on each other. The need for healthy gut bacteria is especially important in the first two years of life, as a child's brain will be 75% of its adult size by age 2.⁵⁵ Trials are still in the pre-clinical stages, but translation to human subjects could produce a large amount of information that would be beneficial to better informing the public and scientific research.⁵⁵

Early intervention (EI) is critical in this population in order to prevent undesirable outcomes. It is imperative that children gain and use adequate feeding skills as soon as they are able.¹⁷ Studies have suggested that infants exposed to textured food after the age of 9 months are more likely to develop feeding difficulties.¹⁷ However, children with special feeding needs often fail to qualify for or receive EI services because these services require that a child have a diagnosis of a feeding disorder in addition to another diagnosis (e.g., Down syndrome).⁵⁶ Concerns related to feeding can result in increased stress and anxiety for families of children with special health care needs.⁵⁷ Resources are limited and difficult to access, leaving families without the support needed for optimal outcomes (i.e., age-appropriate feeding skills)^{4,56}

Available therapy programs for feeding disorders

There are several programs dedicated to helping children overcome feeding disorders and develop age-appropriate feeding skills and habits. The following text will include information on several of these programs, where they are located, and the overall goal of the program.

*Monroe-Meyer Institutes, University of Nebraska Medical Center, Omaha, Nebraska.*⁵⁸

This is an admission centered program for children with feeding disorders. Generally, this program is for severe feeding cases that are admitted into a hospital feeding clinic. The length of stay is determined by the severity of the feeding disorder and any other morbid conditions that may exist.⁵⁸ The average length of stay is 40 days. Training is provided for the child and the caregivers in order to set and establish appropriate dietary

limits. Multidisciplinary teams collect and review data daily to determine progress.⁵⁸ This program uses goals set at admission to determine the success of treatment. Currently the program reports a 90.5% success rate.⁵⁸

*Pediatric Feeding Disorders Program, Kennedy Krieger Institute, Baltimore, Maryland*⁵⁹

This program combines medical expertise with therapeutic behavioral psychology techniques. Two intensive therapy programs are offered, inpatient and day treatment. They also have an outpatient program that is available.⁵⁹ Therapies are conducted by members of a multidisciplinary team who coordinate efforts to create an individual, comprehensive treatment experience for each patient. A high rate of success in all therapy programs is reported.⁵⁹

*Marcus Autism Center, Feeding Disorders Program, Atlanta, Georgia*⁶⁰

This program offers feeding intervention to any child 8 months to 21 years of age with a feeding disorder, this clinic is not autism specific. A multidisciplinary team is used to provide comprehensive treatment including; OT, behavioral psychology, nutritionists, nurses, and physicians.⁶⁰ This program offers different levels of service to meet the needs of every patient. The feeding clinic makes general recommendations for further evaluation and interventions at the Marcus center or in the community. The day treatment option provides daily intensive therapy including; feeding sessions, sensorimotor training, psychosocial family support, and medical/nutrition monitoring.⁶⁰ The outpatient program requires less intensive treatment or a requirement to have graduated from the day program. Patients will be offered services according to their current needs, i.e. weekly appointments, one discipline, etc.

St. Mary's, Feeding Program, Evansville, Indiana^{4,61}

This program offers treatment using a collaborative of specialists. The program offers a continuum of care and can treat a range of feeding problems from minor issues to complex feeding disorders. Several types of therapy are available including; outpatient feeding therapy 1-2 times per week, intensive day treatment, and inpatient consultation. The treatment approach of this facility incorporates training of feeding skill for child and successful feeding techniques for the whole family with practitioner recommendations to create a successful treatment plan for each patient.

Other Available Feeding Therapies

Primary Children's Hospital Rehab, Individual Feeding Therapy, Utah

Services provided based on individual needs of patient and family. Therapies include medical and neuromuscular treatment, behavior strategies, sensory integration strategies, and activities of daily living.

The University of Utah Neuropsychiatric Institute: Interdisciplinary Pediatric Feeding Disorders Clinic, Salt Lake City Utah

Services provided by a multidisciplinary team. Therapies are conducted once a week or less, overnight stays are not required. Therapies can also be conducted at home depending on patient needs.

SPECIFIC AIMS

The first specific aim of this dissertation was to summarize the current research surrounding the topic of pediatric feeding dysfunction, types of feeding disorders, how prevalent these disorders are among pediatrics, and treatment options. Thorough review of these subjects helped establish background knowledge that added credibility to the discussion of the need for increased awareness concerning the subject of feeding disorders. Common screening methods and assessment tools were also established through this search. This helped to increase understanding of how practitioners identify that a child suffers from feeding dysfunction and the steps to clinical diagnosis. Other knowledge gained from the literature review was the availability of therapy programs and treatment options available to clients.

The literature review also helped to inform the development of the survey created to assess current practice procedures among RDNs concerning identification of feeding dysfunction in the pediatric population. The specific aim of this survey was to gather information concerning how RDNs identify feeding dysfunction, if they diagnose specific conditions or refer to other practitioners for diagnosis, what therapies they provide, and the amount of pediatric patients they treat in a given time frame. The method of questioning we used was intended to gather adequate quantitative and qualitative data to better inform the conclusions drawn from the results of the survey.

An additional aim of this dissertation was to identify a screening tool that could be used in a pediatric population to improve identification of feeding dysfunction. A systematic review was conducted revealing 36 validated screening tools capable of identifying feeding dysfunction in children of all ages. Application of criteria to meet the needs of a specific early intervention program informed the decision to choose the Montreal

Children's Hospital Feeding Scale as the feeding screening tool to implement in our target population.

The final aim of this dissertation was to determine the effectiveness of the MCH screener to increase the ability of the RDN to identify patients at risk for feeding dysfunction. This tool proved to be effective because it incorporated items that identify physical deficits as well as behavioral components and is concise enough to make it practical for clinical use.

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CHAPTER 2

ASSESSMENT OF CLINICAL PRACTICE PROCEDURES AMONG
REGISTERED DIETITIAN NUTRITIONISTS FOR IDENTIFYING FEEDING
DYSFUNCTION IN THE PEDIATRIC POPULATION

ABSTRACT

Background Feeding difficulties are common in children, especially in children that experience delayed development. Efficient processes to identify and treat these types of feeding difficulties are not commonly known or used among healthcare practitioners.

Objective This study assessed the current practice procedures used by registered dietitian nutritionists (RDN) in the United States in identifying, diagnosing, and treating feeding difficulties in children 0-18 years of age.

Design Cross-sectional Qualtrics survey delivered to Registered Dietitian Nutritionists (RDNs) through email list serve.

Participants/setting 4,449 emails were sent to RDNs within the United States. All of the practitioners associated with the email addresses were classified by the Commission on Dietetic Registration (CDR) as clinical dietitians. 886 of the practitioners had acquired a Certified Specialty in Pediatrics (CSP) certification provided by CDR. All participants were required to have a current RDN certification and to be currently treating pediatric patients (at least once per month).

Main outcome measures The survey sought information about the prevalence, identification and treatment of feeding disorders among pediatric patients.

Statistical analyses performed The distribution and frequency of responses were assessed and, in the case of qualitative questions, categorized according to themes identified.

Results Data were collected from 341 RDs (7.7% response rate) representing 41 states in the United States. Frequency of treatment for children with feeding difficulties/disorders ranged from 1-2 per day to 1-3 per month. Eighty percent of participants do not use a specific screening tool to identify potential feeding difficulties. Twenty-two specific screening processes were identified; however, no specific screening tool was indicated for the majority of participants. Use of terms to describe disorders was consistent among participants, but next steps to diagnosis of specific disorders lacked standardization. Results concerning feeding therapy strategies used by RDNs were highly varied or lacking.

Conclusions Standardized Screening, diagnostic, and treatment protocols are needed to provide consistent and comprehensive care for the pediatric population. Use of these protocols among RDNs would enable them to provide therapies capable of improving feeding abilities in more patients earlier in their development.

Feeding and/or nutritional delays are relatively common in infancy and can occur in up to 45% of typically developing infants.^{1,2} Some form of feeding difficulty is also seen in 40% of toddlers and early school age children.³ Additionally, about 5%-10% of the pediatric population are regularly diagnosed with severe feeding disorders that require medical intervention.² Most of the feeding issues experienced by the pediatric population are mild and will generally resolve with time. However, about 3-10% of young children

will develop chronic feeding issues that can result in slowed development and other medical complications.³ When feeding difficulties contribute to other morbidities or delays they are called feeding disorders because the nature of the symptoms experienced by patients becomes chronic and/or severe.³ The prevalence of feeding dysfunction is more common in children that have documented developmental disabilities. About 80% of children with a developmental disability also have disordered feeding.¹ Certain subgroups of children with developmental disabilities have even higher prevalence of feeding dysfunction. For example, 89% of children with autism spectrum disorder (ASD) have feeding disorders.³ These statistics highlight a significant problem within the pediatric population, but there is also concern that the existence of feeding disorders in children often go unreported.¹

One reason for underreporting of pediatric feeding disorders could be that risky or problematic child behaviors are thought to be related to developmental stages, one that is assumed the child will “grow out of”.¹ In fact the diagnostic criteria currently used for this population is overly general in order to classify behaviors that do, or could, contribute to nutrient deficits in the future. The two most commonly used International Statistical Classification of Diseases and Related Health Problems (ICD 10) codes, R63.3 or F98.29,^{4,5} define feeding difficulties in general terms including delayed development of feeding skills dependent on age of the child. Nothing in the definition ties the delay to nutrient deficits, but indicates that the delay or behavior could become problematic in the future.³ A feeding disorder is a difficulty or delay that is severe enough to cause nutritional deficits (if left untreated) and contributes to other morbidities.³ There is little evidence based guidance on what is considered a significant feeding disorder and which

feeding dysfunctions have the tendency to become feeding disorders.¹

Broad definition of feeding dysfunction occurs because of the complex nature of these difficulties. The etiology of each patient is unique in the scope of the problem and depth of the treatment needed to address the feeding concerns.¹ Also, the current psychiatric and medical diagnoses used to identify feeding disorders cover a wide spectrum of symptoms from eating too little to eating a severely limited variety of foods.³ This makes identifying the etiology of the condition difficult. In addition, there are no standardized codes or language presently being used to describe the symptoms of the disorder.

Another challenge of diagnosing pediatric feeding dysfunction occurs because of the lack of standardized and validated screening tools.¹ Weight loss or failure to maintain weight is the most common determinant of nutritional risk in a child. Children with feeding dysfunction may eat extremely low quality diets that affect their overall physiology, while maintaining or even gaining weight.¹ Weight is a convenient way to measure the developmental progress of a child, but exclusive use of this criteria may hinder diagnosis of a problematic feeding condition. Other factors further challenge the diagnostic process including; mother/caregiver attitudes during feeding, presence of other morbid conditions, behavioral conditions that interrupt feeding, and psychological conditions.¹ Depending on the extent of the health concerns facing an affected child, feeding difficulties that may contribute to feeding disorders may range from simple aversion to certain types of foods to an inability to feed on their own.⁶ The outcome of feeding difficulties is concerning to feeding practitioners because extended periods of time on a restricted diet can lead to conditions of malnutrition.

However, malnutrition is not the only concern of practitioners that treat this population. Often children will suffer from undernutrition due to illness, environmental or behavioral factors, injury, congenital anomalies, etc.⁴ Currently a standardized method to recognize and diagnose pediatric malnutrition and undernutrition is lacking. This creates inconsistencies of routine nutritional assessment of high-risk children in facilities across the United States.⁷ The Academy of Nutrition and Dietetics (AND) recommends the following indicators be used when assessing and diagnosing pediatric malnutrition and undernutrition: food and nutrient intake, assessment of protein and energy needs, growth factors, weight gain velocity, mid-upper arm circumference, hand grip strength, proxy measures for traditional anthropometrics, and indication of Tanner stages.⁷ These are recommended as the beginning stages of developing protocols that will better identify patients of risk. There is currently not a universal screening tool commonly used by RDNs to identify feeding issues/disorders in this population.⁷

Screening tools are critical in getting as many patients as possible to a diagnosis of specific feeding issues. Without firm diagnoses healthcare professionals are limited in their ability to recommend or develop proper feeding therapies that will improve overall child nutrition intake.³ Once a patient receives a diagnosis, finding an appropriate therapy is the next step to ensure patients progress to more normal eating patterns. Most of the therapies currently used to treat feeding disorders are behavior based programs. However, there is some interest in medical management of these disorders as well as stimulus focused training.³

Any therapy employed to treat feeding disorders in children should be initiated through the actions of an interdisciplinary medical team.^{8,9} Many times feeding disorders

are complicated by other morbid conditions or conditions that develop secondary to the feeding disorder. The use of interdisciplinary teams encourages practitioners to coordinate care and build a comprehensive treatment plan for each individual patient.^{2,8,9} Using interdisciplinary teams also helps lower the risk that disciplines, acting independently, will overlook key etiologies or needs that will delay therapy progress or further exacerbate the current situation.² Having an interdisciplinary team contribute to the feeding plan is the best way to help patients rehabilitate and gain skill.⁹

Many healthcare teams are finding the expertise of RDNs to be valuable and necessary in providing comprehensive care for their patients.¹⁰ Recent studies have reported that physicians recognize a need for nutrition services as part of their patients care; however, few dietitians are included as part of healthcare/interdisciplinary teams. This occurs despite the fact that many physicians report improved patient care when an RDN is involved in their healthcare team. Several other healthcare organizations have also noted improved patient outcomes when RDNs provide nutrition services as part of the overall plan for individual patients.¹⁰

The purpose of this study is to assess the current practice procedures of RDNs currently practicing in the U.S. to identify and treat feeding disorders in pediatric patients. It is expected that the results of this survey will be used to inform the practice of RDNs that work in the pediatric population and support the inclusion of RDNs as part of interdisciplinary healthcare teams.

MATERIALS AND METHODS

This study was reviewed and approved by the Utah State University Institutional Review Board. All participants gave consent by moving forward with the survey after reading the study disclosure page.

Survey Question Development

A literature review was conducted to determine current clinical practices for identifying, diagnosing and treating feeding difficulties/disorders in the pediatric population. The information gathered was analyzed to identify areas that need more information and clarification to improve practice procedures. The following text will give a brief summary of the results of the review, the survey questions developed, and an explanation of why these questions are relevant to the survey.

As stated in the introduction, establishing prevalence of feeding difficulties/disorders in the pediatric population is difficult for various reasons.¹ One purpose of this survey is to establish an indication of the amount of feeding problems RDNs in several regions of the United States treat. Two of the questions developed for the survey asked RDNs to estimate how many patients they treat within a week's time. While this method will not provide perfectly accurate information about prevalence, it will provide a helpful estimate of the amount of patients that need feeding services.

Three questions addressed the need to develop a standardized way for RDNs to screen patients for feeding dysfunction.^{7,11} The Academy of Nutrition and Dietetics (AND) recommends certain criteria be measured to assess malnutrition risk in pediatrics. Some of these criteria include assessing food and nutrient intake, energy and protein

needs, growth parameters, weight gain velocity, and overall nutrition status. These criteria can also be applicable to screening methods for feeding dysfunction.⁷ These survey questions were included to help researchers understand the screening tools/methods currently being used and to help establish understanding of which tools are most effective in clinical practice.

The wide range of definitions used to classify feeding dysfunction in children can cause confusion and difficulty when communicating with other healthcare disciplines.¹ One survey question was included to provide information about language commonly used when classifying or describing feeding dysfunction. An understanding of how feeding issues in pediatrics are defined has the potential to improve practice procedures as it will help all members of the healthcare team communicate effectively.

An effective diagnosis of a feeding dysfunction should include many different tests in order to establish type and severity of the disorder.¹² Physiological monitoring and a thorough clinical examination are critical to ensuring appropriate information is considered when making a diagnosis.¹² Problematic behaviors should also be considered during the diagnostic process as behaviors often seriously hinders a child's ability to eat enough or a variety of foods.⁹ Two survey questions provided information about how RDNs move from identification of high risk patients to an actual diagnosis of a feeding dysfunction. These questions also help researchers identify areas where RDNs are qualified to provide diagnoses of this sort.

Once a diagnosis is decided upon referral to pertinent practitioners and/or available therapies should occur.¹³ There are many different therapies discussed in the literature that are based on a wide variety of theories and follow multiple techniques.^{2,14,15}

The survey contained two questions designed to gather information about how many RDNs offer therapeutic services for feeding dysfunctions and which methods they are employing for the therapy they provide. The next three questions provided information on what RDNs do if they are unable to provide feeding therapies in their practice. Information generated from these questions helped researchers determine if patients were typically referred to other programs, the availability of these programs, and if the RDN felt this type of system was adequate to address patient feeding needs. These questions also asked for qualitative feedback of ways treatment could be improved or changed to be more effective.

A diagnosis is more effective if it is implemented by an interdisciplinary team that uses the expertise of other healthcare practitioners to create a comprehensive therapy/feeding plan for each individual patient. Current literature has identified the ideal team to include the following disciplines: nurse coordinator, RDN, speech language pathologist, OT, psychologist, pediatrician, and gastroenterologist.⁸ Two survey questions address the concept of interdisciplinary teams in order to determine which healthcare disciplines are used most often.

Expert review of questions

Email requests were sent to 15 RDNs with expertise in the pediatric population in the United States. Seven RDNs responded to our request for review, a response rate of 47%. Each expert was asked to read through possible survey questions and analyze each question based on the following criteria: ability to determine current practices of RDNs

who identify and treat pediatric feeding disorders, ability to improve practices among pediatric RDNs, and relevance to the population surveyed. Each criterion was ranked using a numeric scale, 1-10. A question was eliminated if the totaled numeric value for the criteria listed above was below 7.5. Questions were also reviewed and revised based on free text comments made by expert reviewers. The revised survey, see Table 1, was then entered into an online survey program, Qualtrics.

Table 1. *Revised survey questions*

Survey Questions	
1.	How long have you been practicing as a registered dietitian in the pediatric population? a. 0-3 years b. 3-5 years c. 5-10 years d. >10 years
2.	How would you classify your area of practice? a. Inpatient b. Outpatient c. Feeding clinic d. Rehabilitation e. Other (open text answer)
3.	Which state do you currently practice in? (open text answer)
4.	Which of the following concerns prompt you to consider the possibility of a feeding difficulty/disorder in a patient? (Mark all that apply) a. Significant weight loss b. Failure to thrive c. Developmental delay in feeding d. Frequent spitting up/vomiting, retching, gagging e. Consistent food refusal f. Severely limited accepted foods (i.e. child will eat less than 10 different foods)
5.	During the past month, how many pediatric patients did you treat for feeding difficulties? a. 0-2 per day b. 3-6 per day c. 7-10 per day

	d. 0-3 per week
6.	Do you use a specific screening process to identify potential feeding disorders in pediatric patients? a. Yes b. No
7.	If you answered yes to question 6 please indicate the name of the screening tool if applicable or briefly describe the screening process you use. (open text answer)
8.	Which of the following terms do you use to classify feeding disorders among pediatric patients? a. Feeding delay b. Pickiness c. Oral/sensory food aversion d. Feeding disorder e. Food refusal f. Other (open text)
9.	What tests do you order or conduct with pediatric patients you suspect may have a feeding disorder? (mark all that apply) a. Laboratory tests to determine nutrient deficiency b. Diet history c. Behavioral/psychological tests d. Speech/swallow evaluation e. Other (open text)
10.	Do you identify or document, using specific diagnostic language, feeding disorders in pediatric patients? a. Yes b. No
11.	What is your current, first appointment approach to resolving feeding difficulties/disorders in pediatric patients? a. Counseling and at home interventions b. Counseling, at home interventions, and follow-up to determine feeding improvement c. Enrollment in your practice/facility feeding therapy d. Referral to outside feeding therapy e. Other (please indicate approach)
12.	Do you feel the treatment strategy indicated in question 14 is adequate to meet the needs of the population? a. Yes b. No
13.	Do you provide specific feeding therapies designed to improve or eliminate behaviors or mechanisms in the function of eating, or the acceptance of food, for pediatric patients that have been diagnosed with feeding disorder? a. Yes, I, or my facility, provide feeding therapies as described above. b. No, I refer patients to other practitioners for specific therapies. c. Both yes and no, depending on the therapy needed.

	d. Neither, there are no specific therapies provided at my facility, there are no feeding therapy practitioners in my area to refer to.
14.	If you answered yes or both to question 16, please provide the name(s) of the therapies used or a brief description. (Open text answer)
15.	If you answer no or both to question 16, please indicate which classification of therapist you refer to. (mark all that apply) a. Speech Language Pathologist b. Occupational therapist c. Physician d. Other (open text answer)
16.	How often do you provide referrals for patients to feeding therapies outside of your practice clinic? a. Often, my facility does not provide direct feeding therapies to patients b. Sometimes, if I or our professional team feel the services at our facility are not adequate to meet the needs of the patient. c. Rarely, few feeding therapies exist in my area.
17.	What specific feeding therapies or services do you feel are lacking for pediatric patients with feeding disorders? (open text answer)
18.	Do you use interdisciplinary teams on a consistent basis to determine the best practices for each patient you suspect may have a feeding difficulty/disorder? a. Yes b. No
19.	If you answered yes to the above question, which disciplines are included as part of the interdisciplinary team? (mark all that apply) a. Speech Language Pathologist b. Occupational Therapist c. SCFES Occupational Therapist d. Psychologist e. Pediatric Gastroenterologist f. Pediatrician g. Physical Therapist h. Other (open text answer)
20.	Please provide any additional comments in the box provided below. (Open text answer)

Pilot survey

A mailing list of potential survey candidates was obtained by contacting the Commission on Dietetic Registration. The list consisted of ~1,000 RDNs with a Certified Specialty in Pediatrics (CSP) board certification and ~4,000 clinical RDNs.

From this pool of 5,000 contacts, 10% were randomly selected to participate in a pilot survey. Candidates were sent two email reminders one week from the first contact and two weeks from first contact if they had not responded to the first survey request. After three weeks the survey was closed, a week later all unfinished responses were closed and results were reviewed.

Researchers expected a response rate of 10-19% based on response rates of other surveys.^{16,17} Of the 499 surveys sent 41 surveys were started, and 15 were completed. This is a response rate of ~8%, well below the expectations of researchers. Also, there was a low completion rate of 37% for this survey. Further analysis of responses recorded elicited elimination of one survey due to participant not agreeing to take the survey. Another survey was eliminated as responses to all questions were left blank. Five participants replied to the email sent to them to indicate that they did not work with the pediatric population in their practice.

Pilot survey review

The data gathered from the 13 survey responses recorded from the pilot study were reviewed by researchers. Responses were uniform and provided information adequate to answer study hypotheses. The low response rate of the pilot survey prompted researchers to review the methods used for survey distribution. The pilot survey sent unique, private links to each contact. It was decided to use an open survey link to allow more availability to the survey for any clinical RDN that had interest in completing it. Also, the distribution email was altered to be more inclusive of all clinical RDNs, not just

those that identified as pediatric dietitians by the CDR. An invitation to share the survey link among the RDN population was also included to employ a snow-ball recruiting method in hope that the survey would reach appropriate practitioners. A disqualifying question was added to the survey to eliminate any practitioners that had not worked with the pediatric population in the last month.

Survey

The revised survey was then sent to the remaining pool of candidates. The email included an invitation to share or forward the invitation to other appropriate practitioners.

Data Analysis

Survey responses were grouped according to the answer chosen by participants for question responses related to quantitative data. This data was then analyzed using chi square test of independence to determine any significant relationships between categorical variables. Frequency of the distribution responses were also examined to better understand the sample population. These frequencies were examined using both quantitative and qualitative data collected from the survey. The open text responses were read by the main researcher to determine the amount of responses recorded and the quality of data collected. The researcher determined that extensive thematic analysis could not be conducted for the responses collected because the amount of open text responses was lower than anticipated and the majority of the open text responses were the

same, or very similar, for each specific theme and question. It was decided that the main researcher would organize open text responses simply by the frequency of each theme categorized by the specific question answered.

RESULTS

A total of 341 responses were recorded for the survey, a response rate of 7.6%. This rate is lower than researchers had anticipated, but was similar to the results of the pilot survey. Of these 341 responses, 12 (3.5%) did not consent to participate, leaving 329 complete survey responses. A disqualifying question reduced the survey pool further by eliminating RDNs that had not provided services for at least one pediatric patient in the past month. Of the 329 responses, 150 (45.6%) of respondents were disqualified from the survey. The final population of respondents for the survey was 197, a true response rate of 4%. This is a very similar rate to that of the pilot study. It is possible that the amount of RDNs treating pediatric patients on a consistent basis is a small subset of the total RDN population in the United States.

The population of respondents were representative of Registered Dietitian Nutritionist practices from 41 states in the United States. Respondents indicated the amount of years they had been practicing as a registered dietitian; 100 (62%) practicing for more than 10 years, 29 (18%) practicing 5-10 years, 19 (11.8%) practicing 3-5 years, and 13 (8%) practicing 0-3 years. Responses to specified areas of practice are as follows; inpatient 53(32.7%), outpatient 75(46.3%), feeding clinic 10(6.2%), other 24(14.8%). The following categories were identified as part of the other option; inpatient and

outpatient 7, inpatient, outpatient, and feeding clinic 5, marketing and sales 2, outpatient and residential psych facility 1, mother 1, insurance 1, home infusion 1, early intervention 1, acute care 1.

No association was found between the amount of years a RDN had been practicing and the adequacy of the screening/diagnostic process they used. However, there was a significant relationship ($p < .001$) between RDNs that felt their treatment strategy was not adequate and the frequency (rarely and often) that they referred patients to other practitioners. RDNs that sometimes referred, were more likely to respond that their treatment strategy was adequate as compared to RDNs that referred rarely and often. Another significant association ($p = 0.02$) was noted between a less frequent use of screening procedures and a higher tendency to refer patients to other practitioners. No significant differences were noted concerning the adequacy of current screening procedures, methods for diagnosis, tendency to make referrals to outside practitioners, treatment strategies, and provision of feeding therapies as compared to length of time RDNs had been in practice.

Practitioners were asked to identify which symptoms observed in patients prompts them to consider a potential feeding dysfunction. Response choices for this question included common diagnostic language found in research literature. Respondents were allowed to mark multiple responses, at least 75% of respondents marked each diagnostic term listed. These terms include the following; developmental delay in feeding, failure to thrive, significant weight loss, frequent spitting up/vomiting, retching, gagging, consistent food refusal, and severely limited accepted foods (i.e. child will eat less than 10 different foods). Responses for the “other” category included in this question were as

follows; parental report, food pocketing, texture/sensory aversion, tube feeding, dysphagia, drink refusal, and malnutrition.

In determining frequency of provider services for feeding dysfunction, results indicate that 49(30%) respondents treat 0-2 pediatric patients per day, the second largest category, 34(21%) treat 0-3 times per month. For feeding disorders treated, 55(34%) indicated 0-2 per day and 40(24.7%) indicated 0-3 times per month. All other responses indicated can be seen in Figure 2 and Figure 3. These results indicate a consistent pattern of treatment for patients with feeding dysfunction by RDNs. The first two categories have the potential to be elevated as they do include the possibility of treating zero patients in the time period indicated. However, the inclusion criteria at the beginning of the survey excluded any practitioner that did not provide services to pediatric patients.

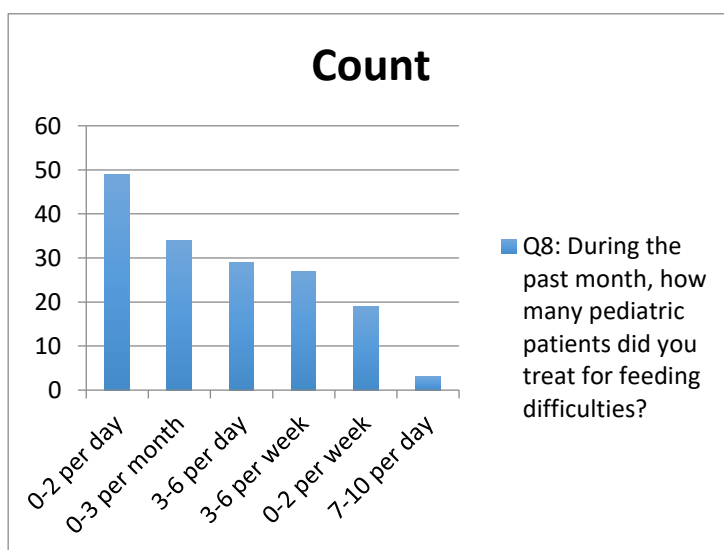


Figure 1. Survey Question 8 Results

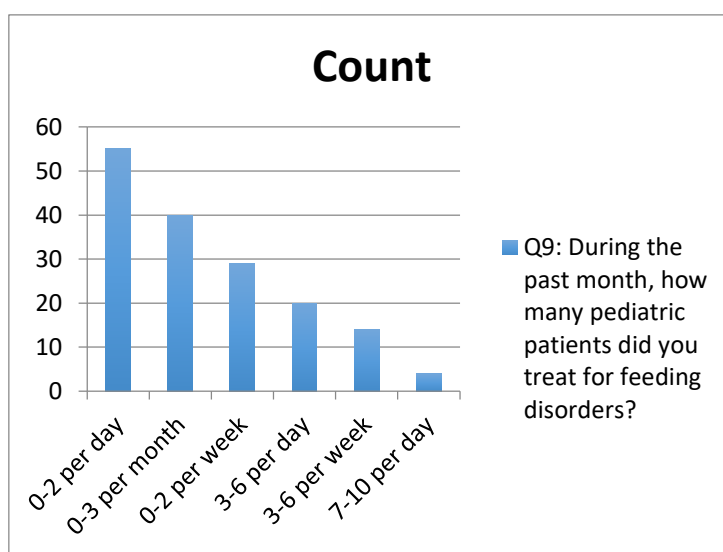


Figure 2. Survey Question 9 Results

Inquiries concerning the consistency of feeding dysfunction treated lead to practitioner responses that there is a lack of standardized methods for screening patients for feeding dysfunction. A majority of participants, 131(80.9%), indicated that they do not use a specific screening process to identify feeding issues in their patients. The remaining responses, 31(19%), did use a specific screening process. Participants were asked to name the screening tool or provide a brief description of how they screen patients. Categorical results based on recurring themes are detailed in table 2.

Table 2. Names of Screening Tools or Points of Concern

Screening Tool Name or Specific points of Concern	
Referral to or receiving services from SLP, OT, or child psychologist for feeding evaluation	4

Significant weight loss, low z scores, growth chart	4
Dietary Intake/history	4
Medical diagnosis associated with feeding issues; GI, swallowing, etc.	3
Review feeding/medical history	3
Limited food intake	3
Mealtime behaviors; choking, gagging, sensory issues	3
Developmental delays or issues	2
Admission nursing/nutrition screen	2
PEACH	2
Trouble breast feeding	1
Mealtime duration	1
BAMBI	1
Presence of wounds	1
Texture preferences/avoidance	1
Food brand preference	1
Eats non-food items	1
SLP evaluation	1
Tool screens two areas: nutritional need and high risk patients (Nevada Early Intervention Program)	1
Malnutrition Screening Tool	1

Several questions were asked to better understand the next steps once a patient is suspected of having a feeding problem. Participants were asked to indicate tests that they order, or recommend, to gain a more concrete diagnosis of the feeding issue. Responses included a likelihood of conducting a diet history 137(90%) and ordering a speech/swallow evaluation 131(86%). About 83(54%) respondents indicated that they would also order further laboratory testing. The survey responses suggest a need to gather more information about the etiology of the feeding issue before moving forward to a diagnosis. About 53 practitioners indicated that they would also order behavioral/psychological testing when gathering additional information. Some research would suggest that this type of testing should be conducted in most cases of concern

about eating dysfunction. Responses in the other category included performing a gastrointestinal work up and allergy testing.

Common diagnostic language was also surveyed. Often specific facilities and professionals use language that is not compatible with the language/understanding of other practitioners. This can be problematic when communicating, causing confusion and misinterpretation. This question sought to establish common terms that are understood by RDNS. Results can be seen in Table 2. Responses in the other category included: Dysphagia, ARFID (avoidant/restrictive food intake disorder), delayed/immature feeding development skills, feeding problem, feeding intolerance, inadequate P/O due to treatment of illness, oral aversion.

Table 3. Common terms as understood by RDNs

Choice	Checked Percent	Checked Count	Sample Size
Oral/Sensory food aversion	83%	126	152
Feeding difficulties: includes pickiness, difficulty eating, food refusal, feeding problem	80%	121	152
Food refusal	57%	86	152
Feeding disorder	49%	75	152
Pickiness	29%	44	152
Other	11%	17	152

While respondents acknowledged using diagnostic language, it is necessary to understand how these diagnoses are being determined. Participants were asked to indicate how diagnoses occurred, see results in figure 3.

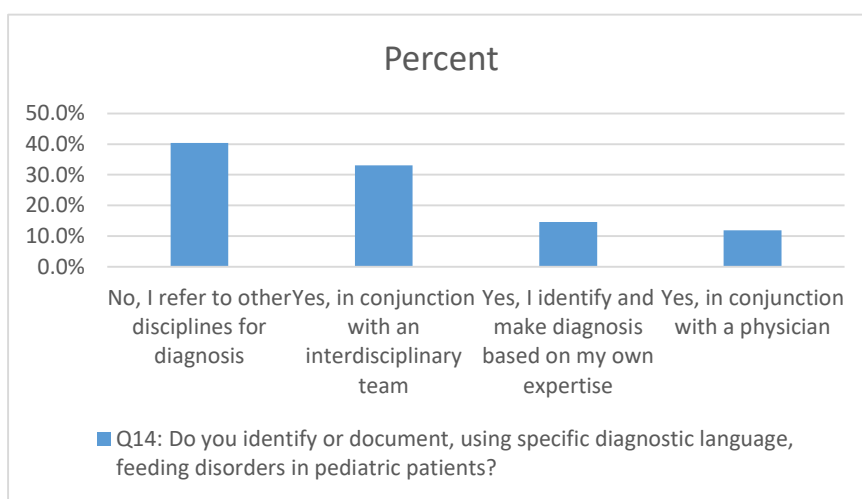


Figure 3. Survey Results Question 14

Responses indicate that the 41 practitioners automatically refer patients to other disciplines for diagnosis and 77 respondents either refer to other disciplines or participate in interdisciplinary teams to provide a diagnosis. A small percent of the practitioners, 14.6%, determine diagnoses for patients with feeding disorders as part of their practice procedures.

The next questions addressed what happens once a child is diagnosed with a feeding disorder. Respondents chose a category that best fit their approach to an initial appointment for a feeding disorder client. The majority of practitioners, 60(34%), provide counseling on therapies that can be done at home by the care giver. A follow up appointment is then scheduled to determine efficacy of the therapies recommended. Referral to outside feeding therapies was chosen by 34(22.5%) participants, with 24(15.9%) participants indicating that they enroll clients in their facilities feeding therapy program or have other avenues to follow. There were 9 (6%) participants that just

provide counseling in the office including at home therapies for care givers to implement.

Categorical responses for other procedures followed are found in table 4.

Table 4. Next steps after feeding disorder diagnosis

Next step after feeding disorder diagnosis	Frequency
Enrollment in outpatient feeding therapy	7
Interdisciplinary assessment including; MD, GI, RD, SLP, Psych, OT, RN	5
Inpatient feeding therapy	3
Counseling	3
Follow up appointment	3
At home nutrition interventions	2
SLP consultation	2
Medical/motor/nutrition approach	1
Nutrition consultation	1
Change in formula / mode of feeding	1
Feeding observation	1
Early intervention	1
Swallow study	1

Participants were then asked to indicate if they felt the current approach they indicated was adequate to meet the needs of the population. There were 78(55%) responses that indicated the procedures used are adequate, 64(45%) indicated that the procedures used were not adequate.

This split in perceptions of adequacy could be due to a lack of trained practitioners that provide feeding therapies to children. Participants were asked to indicate if they provided feeding therapies or if they referred to other sources for therapy. The majority of participants 73(48.7%) stated that their ability to provide therapy depended on the need of the patient. This result combined with 26(17.3%) that indicated that they were capable of providing feeding therapies suggests RDNs working with this

population have expertise in treating feeding disorders. Results of the other responses are as follows; No, I refer patients to other practitioners 42(28%), Neither, there are no available feeding therapists/programs in my area 9(6%).

Names or short descriptions of the feeding therapies used by practitioners were also gathered. Results can be found in Table 5.

Table 5. Name or Description of Feeding Therapy

Name or description of feeding therapy	Frequency
SLP* directed feeding therapy	22
OT* directed feeding therapy	17
Behavior modification feeding program	8
Sequential oral sensory approach (SOS)	5
Food chaining	4
Feeding therapy clinic: employees interdisciplinary team (MD*, RDN, RN*, SLP*, OT*)	3
PT* directed feeding therapy	3
Feeding position adjustments	3
Supplements	3
Structured meals with feeding team	2
Early intervention programs; Early On of Help Me Grow	2
Outpatient feeding therapy	2
RDN directed feeding therapy	2
Ellen Satter's Division of Responsibility	2
Applied Behavior Analysis	1
Hunger provocation (tube weaning)	1
Inpatient oral aversion feeding therapy	1
Intensive outpatient feeding therapy; 8 hours a day 5 days per week	1
Food texture modification	1
Intensive inpatient therapy	1
Medical Motor Approach to feeding	1
Sensory Integration Processes	1
Family based eating	1
Exposure therapy	1

* Speech Language Pathologist (SLP), Occupational Therapist (OT), Medical Doctor (MD), Registered Nurse (RN), Physical Therapist (PT)

When a referral is needed, the majority of RDNs indicated that they refer to a speech language pathologist (SLP) or an occupational therapist (OT). The choices of physician and other were indicated less often ~ 29% of participants refer to MDs or other sources. The frequency of these referrals is indicated in figure 4.

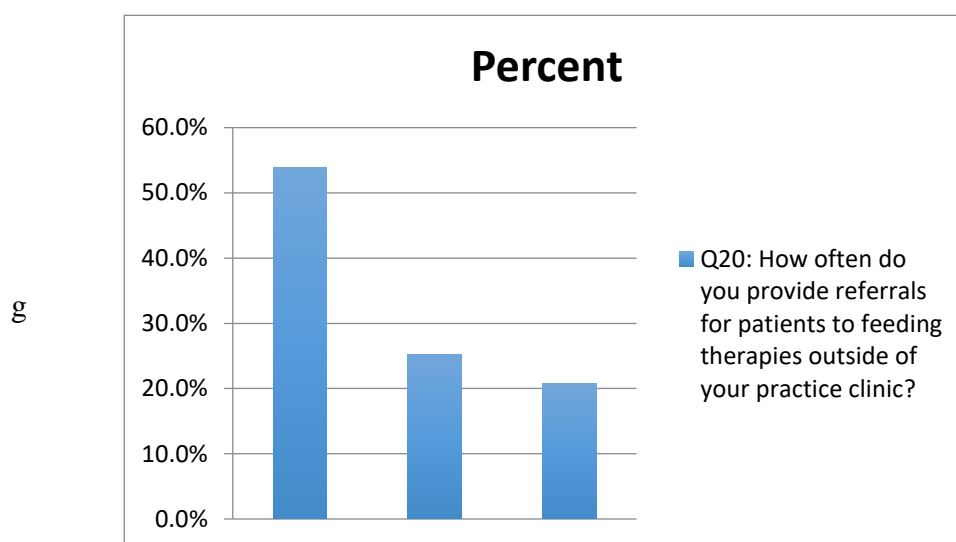


Figure 4. Survey Question 20 Results

While there may be protocols to refer patients to certain disciplines, there is often not an available feeding therapist or program that can provide services to these children. An open text question gathered information on what the practitioners feel is lacking in feeding services in their area. Table 6 classifies these responses.

Table 6. Description of Services That Are Lacking

Services that are lacking	Frequency
Outpatient feeding therapists/clinics; too few exist, difficult to get appointments, too far away from patients	18
Intensive inpatient feeding therapies	9
Skilled/experienced feeding therapists	9
Behavioral therapies	8
Insurance approved therapies and increased approved visit frequency	6
Psychological counseling	5
Oral aversion specific therapies	4
Early intervention lacks feeding services	3
RD's trained in feeding therapies	3
Follow up feeding therapies	3
ARFID (avoidant/restrictive food intake disorder) therapies	2
Food exposure therapies	2
Interdisciplinary services	2
Accountability among caregivers to provide therapies to child	1
Services beyond SLP directed therapies	1
SOS therapies	1
Parental support for executing therapies at home	1
Intensive feeding therapies	1
Early identification of feeding difficulties	1
Protocol for referral of patients with feeding difficulties	1
Patient inability to pay for feeding services	1
Insurance reimbursement for multi-disciplinary clinics	1
Micronutrient testing	1
Acceptance of referrals from RDs	1
Ability to perform sophisticated tests	1
Therapies for swallowing dysfunction	1
Onsite feeding clinic	1
Consistent protocols to diagnose and manage feeding problems	1
Improved accessibility to clinics (closer geographic locations)	1
Peer feeding groups	1

Participants were asked if they use interdisciplinary teams to provide services for feeding patients in their facilities. A large majority, 80%, indicated that they use teams to provide services for patients. When asked which disciplines participated in these teams the majority of respondents indicated the following: SLP, OT, Pediatric

Gastroenterologist, and pediatrician. Psychologist and PT were also indicated about 30% of the time. Other practitioners not mentioned in the question choices are categorized in table 7.

Table 7. Frequency of Other Practitioners on Multi-Disciplinary Teams

Other practitioners on Multi-disciplinary teams	Frequency
Registered Dietitian (RD) or Registered Dietitian Nutritionist (RDN)	13
Social Worker	7
Developmental Pediatrician	4
Nurse practitioner	4
RN	3
Neonatologist	2
Dentist	2
ENT	2
Pediatric Allergy	2
Pediatric GI	2
Pulmonary	1
Marriage and family Therapist	1
Phar.D.	1
Nephrologist	1

The last question asked participants for any final comments that they may have.

Frequent subject themes gathered from the survey responses can be found in table 8.

Table 8. Frequency of Final Comments

Subject Themes	Frequency
Lack of insurance reimbursement hinders services offered to patients	2
Limited access to interdisciplinary teams due to poor financial support	1
GI specialist only used in case by case basis	1
Increased frequency of behavioral eating disorders in practice	1

Families seem reluctant to seek medical help for feeding problems	1
Pediatric patients referred to specialty hospitals	1
Lack feeding therapies for renal clinic patients	1
Feeding clinic includes ST, OT, RD, GI, ENT, and pulmonary	1
See the need for RDs to work closer with OT and SLP	1
Must explore medical issues before treating feeding issue	1
Would use additional therapy more often if it were available	1

DISCUSSION

Despite a lower than expected response rate, results of this survey were able to provide valuable information to better inform the dietetic professional practice processes. Results suggested inefficiency among RDNs in identifying children with feeding dysfunction as the majority of RDN survey participants indicated they did not regularly use a standardized screening tool to assess patients. These results are similar to the findings of other studies to determine use of nutrition screening among various health care providers including RDNs.^{11,18} This is concerning as individual practitioner experience and opinion is often not enough to catch all incidences of disease in this population. Several healthcare organizations recommend nutritional screening for all patients, these include the AND, the European Society for Parental and Enteral Nutrition (ESPEN), and the American Society for Parental and Enteral Nutrition (ASPEN).^{7,11,18} In studies conducted by ESPEN and ASPEN, results suggested that nutritional screening improved patient outcomes because practitioners implemented interventions earlier during patient care.^{11,18}

Development or adoption of an existing, standardized screening tool, would be beneficial for all dietetic practitioners working with pediatric patients. Results of this

study also indicated that RDNs are encountering pediatric patients with feeding dysfunction about once per week. A specific feeding screening tool may increase the number of children identified and improve the ability of RDNs to treat all levels of feeding problems. Another benefit of a specific screening tool would be to aid less experienced RDNs as they learn to identify feeding problems in children. Demographic results of the survey indicated that 62% of those that participated in the survey had worked as an RDN for longer than 10 years. Perhaps a decade of experience working with children creates more interest in RDNs to improve the process of identifying and providing treatment to patients.

Survey findings further indicated that while RDNs use common diagnostic language in classifying patients, there is a lack of consistency in language used across disciplines. This was also true for specific facilities, each facility used their own language and classification systems. Study results were consistent with findings from other researchers as well, few healthcare disciplines share common diagnostic language.¹³ Varied language can lead to confusion concerning specific problems and suggested solutions for the problems identified. Standardized diagnostic language in the RDN profession would be helpful to improve communication and understanding among dietetic practitioners and other healthcare providers. The majority of survey respondents indicate that they use common diagnostic terms and indicators when determining diseases among their patients. But each facility uses unique terms to classify specific feeding problems. Another concerning outcome of the survey was lack of consistency in how a pediatric patient receives a full diagnosis of their feeding problems. This could be due, in part, to lack of ICD-9 codes for specific feeding problems in children. Also, diagnostic

protocols were very individual for each facility and lacked reported consistency among dietetic practitioners that participated in the survey.

There is also an inconsistency noted in how to treat feeding dysfunction once they are identified and diagnosed. A wide variety of treatments and referral procedures were indicated by survey respondents. Again, this is concerning as the care a patient would receive depends entirely upon the practitioner they see and the area they live in.

Consistency in treatment would provide more comprehensive care to all patients despite geographic location. Results also revealed a deeper concern in reference to available treatment programs. Many RDNs responded that their area lacked sufficient clinics and practitioners that were capable of providing feeding therapies to children. This was true of RDNs specifically, the majority of respondents indicated that they refer to other practitioners for feeding therapy, usually OT or SLP. While some of the techniques used by other practitioners are beyond the scope of RDN practice. The RDN is trained and capable of providing appropriate medical nutrition therapy and nutrition behavior therapy to children.¹⁹ These tasks are stated to be within the scope of practice for the RDN; however, additional training and experience may be needed to meet the needs of more complicated feeding disorders. In this case RDNs are trained to collaborate and work with other disciplines to provide comprehensive therapy.¹⁹

Participants indicated that the use of interdisciplinary teams that include RDNs was about 80%. This is an encouraging finding, as research suggests RDN involvement on such teams can improve overall outcomes for patients.^{20,21} The hope is that this trend will continue giving RDNs a voice in comprehensive care plans for all patients. Further

use of these teams will begin to help address the problems healthcare teams are having finding money and reimbursement for interdisciplinary teams.

One limitation of this research was the low response rate to the survey. However, we were able to get responses from 41 states in the U.S., this increases the strength and applicability of the conclusions of this study to RDN practice in America. Another limitation was the low amount of pediatric patients our study participants see on a monthly basis. About 50% of participants treat 1-2 pediatric patients a month, this may create some bias in responses concerning multi-disciplinary teams and therapies provided for children. Also, RDNs that work in hospitals that exclusively treat children may use different screening protocol as part of their services. This would create some bias since RDNs in a general practice clinic or hospital may use vastly different procedures. It would be beneficial to separate these two categories in the future in order to produce a more comprehensive picture of RDN practice. This limitation does; however, speak to the need for standardized screening in all facilities. Use of a standardized feeding screening protocol would help RDNs provide more consistent screening of pediatric patients across all facilities.

CONCLUSIONS

The findings of this study suggest some areas of improvement for the practice of RDNs that work in pediatric care, in regards to the diagnosis and treatment of feeding dysfunction. Perhaps the most needed change is implementation of standardized screening protocols in as many clinics as possible. Standardized screening protocols

would ensure that every client was assessed using a pre-determined scale. Use of a screening tool has the potential to identify more children at risk for feeding problems and would provide the knowledge needed to begin feeding therapy to reverse or halt malnutrition potential. Also, standard screening of all patients could also increase caseloads for RDNs in practice which may improve census counts and increase overall demand for dietetic services.

These findings also suggest a need for adherence to specific diagnostic language across the RDN discipline and companion healthcare disciplines. Use of standard language could help increase understanding among healthcare practitioners providing more competent, efficient care to all patients. Understanding of diagnostic language and further clarification of diagnostic procedures could help RDNs feel more capable of diagnosing and treating feeding problems in this population. It is within a RDNs scope of practice to identify and treat feeding needs; however, the training and expertise to do so is lacking in many areas of the US. As RDNs seek more knowledge and practice experience in these areas, we are hopeful that RDNs will become an integral resource for feeding therapies for children and be included as essential members of interdisciplinary teams.

The results of this survey suggest that use of standardized protocols could help RDNs identify and provide comprehensive services to all children at risk for feeding dysfunction. The current practices of RDNs in this study suggest that use of screening protocols of any sort are sporadic and often based on personal preference or opinion and not scientific reasoning. Also, providing and conducting feeding therapy is within the scope of practice for RDNs; however, few RDNs in this survey actually provided these

services to children. It was more common for them to refer services to other disciplines and facilities. Feeding screening and provision of therapy services by RDNs has the potential to increase demand for nutrition services by RDNs and improve the ability of dietitians to provide comprehensive nutrition services.

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CHAPTER 3

TOOLS AVAILABLE TO SCREEN FOR CHILD FEEDING DYSFUNCTION:
A SYSTEMATIC REVIEW

By April Litchford

ABSTRACT

Background: Problems with pediatric feeding is often discussed by parents and healthcare providers. Approximately 50% of parents report concern about their child's eating. Identification of feeding dysfunction in children is needed to identify children at risk for malnutrition and more serious feeding disorders.

Objective: This systematic review will identify screening tools capable of identifying children with feeding dysfunction. Particular attention will be given to tools that have been developed to identify risk for nutritional deficits beyond common feeding characteristics that are part of typical child development.

Methods: A systematic review was conducted based on protocols outlined by PRISMA. A database search produced 2,026 relevant articles to be screened based on pre-determined inclusion/exclusion criteria. After abstract review 94 studies received full text review and exclusions were made based on specific criteria. Total articles included in this review was 44.

Results: Thirty-six of the included studies detailed the development and validation of unique feeding screening tools for the pediatric population. Eight of the tools were re-validation studies of original tools in different populations. All studies employed several

methods of validation which showed effectiveness in identifying children at feeding/nutrition risk.

Conclusions: Multiple screening tools were shown to be effective in identifying feeding dysfunction in children. We were unable to determine that any one tool that could be used as a universal standard for feeding screening. However, the tools reviewed covered a wide variety of populations and settings, a review of these tools would reveal an appropriate option for most practice settings.

Because feeding problems are common in children, child eating practices are a frequent topic of discussion among parents and healthcare providers.¹ Children often participate in picky eating that is characterized as an unwillingness to try new foods with strong preferences.² Picky eating can become a great concern for parents because they may begin to worry about health and nutrition related consequences that may occur from picky eating behaviors.² A study gathered responses from 3,022 caregivers of children from 4 months to 2 years of age, 50% of these parents considered their child to be a picky eater.³ Another study found that 46% of mothers of children between 1.5 and 6 years reported their child participated in some level picky eating.⁴ While these statistics may seem alarming, picky eating is thought to be transient through growth and development and most children outgrow these eating patterns by the age of 6 years.^{1,4} Identifying feeding problems more serious than common picky eating is a challenge. Feeding problems are complex and many factors including physical, psychological, and environmental contribute to their development.¹ Despite the challenges involved in identifying feeding problems in children, several feeding/nutrition status screening tools

have been developed. The effectiveness of these tools depends on the complexity of administration, focus of the parameters, and the comprehensive nature of the measure.¹

Pediatric Feeding Disorder (PFD) has recently been defined by an interdisciplinary consensus group as “impaired oral intake that is not age appropriate and is associated with medical, nutrition, skill, or psychosocial dysfunction”.⁵ Specifying the severity and extent of the feeding disorder is dependent on the functional domain that is associated with each individual child’s feeding issue. Four functional domains have been defined by child feeding experts and include: medical, nutrition, skill, or psychosocial.⁵ Deficits identified in any of these domains can contribute to the development of a feeding disorder.⁵ However, identifying feeding dysfunction in children is often difficult because a standardized screening protocol is not well established.⁶ Also, the simplicity found in adult screening tools is often lacking in those designed for the pediatric population due to the need for inclusion of additional criteria to improve effectiveness of the tool.

Criteria deemed necessary for the adoption of a tool include: 1) a high degree of validity, specificity, reliability, and sensitivity; 2) easy to use, requiring little training on how to use screener; 3) inexpensive and requires little time to complete.⁶ Also, in order for a screener to be useful within the time constraints of a clinical setting, the measure must be easy to implement and interpret.⁷ Asking parents to complete the screener is generally inexpensive and places minimal burden on healthcare providers. However, parent reports are prone to bias.⁷ Parents may magnify child behaviors to get practitioner attention, or underreport behaviors they have become accustomed to.⁷

The aim of this systematic review is to identify existing pediatric feeding screening tools that have been shown to be effective in identifying feeding dysfunction in children. The purpose of this review is to provide a resource for those who are attempting to identify a screening tool for their practice.

METHODS

A systematic review of 44 published studies was conducted. The review protocols were based on those outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).⁸ Databases searched for applicable literature include the following: PubMed, Scopus, and Medline. The words and phrases used to search titles and abstracts within these databases are found in Table 9. Because of the nature of systematic reviews, data collected as part of a review becomes out-of-date almost as soon as the process of the review is completed.⁹ In order to increase the relevance of the information included in this review, a date range of 10 years was chosen as part of the inclusion criteria.

Table 9. Literature Review Database Search Criteria

Database	Date searched	Search terms	Filters	Paper results
PubMed	9/18/18	Pediatrics OR children AND feeding OR swallowing OR eating OR intake AND screening tool	Journal article, 2008-2018, full text, Humans, English,	383
Scopus	9/18/18	Pediatrics OR children AND feeding OR swallowing OR eating OR intake AND screening tool	Journal article, 2008-2018, English	232

Medline	9/18/18	Pediatrics OR children AND feeding OR swallowing OR eating OR intake AND screening tool	2008-2018, Academic Journals, English, All child: 0-18 years, Major subheadings: pediatrics, feeding behavior, parents, child development, Geography; United States, Canada, Australia, Europe	1,393
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The data base search yielded 2,007 studies, an additional 19 studies identified through other sources were added bringing the total number of articles to 2,026. Forty-seven duplicates were removed from the review list, leaving 1,979 articles for more in-depth review. Inclusion/exclusion criteria was applied during review of article abstracts which resulted in 1,885 being excluded from full text review. Full text review of the remaining 94 articles was conducted. After full text review, 50 articles were eliminated (see Figure 5 for specific reasoning).

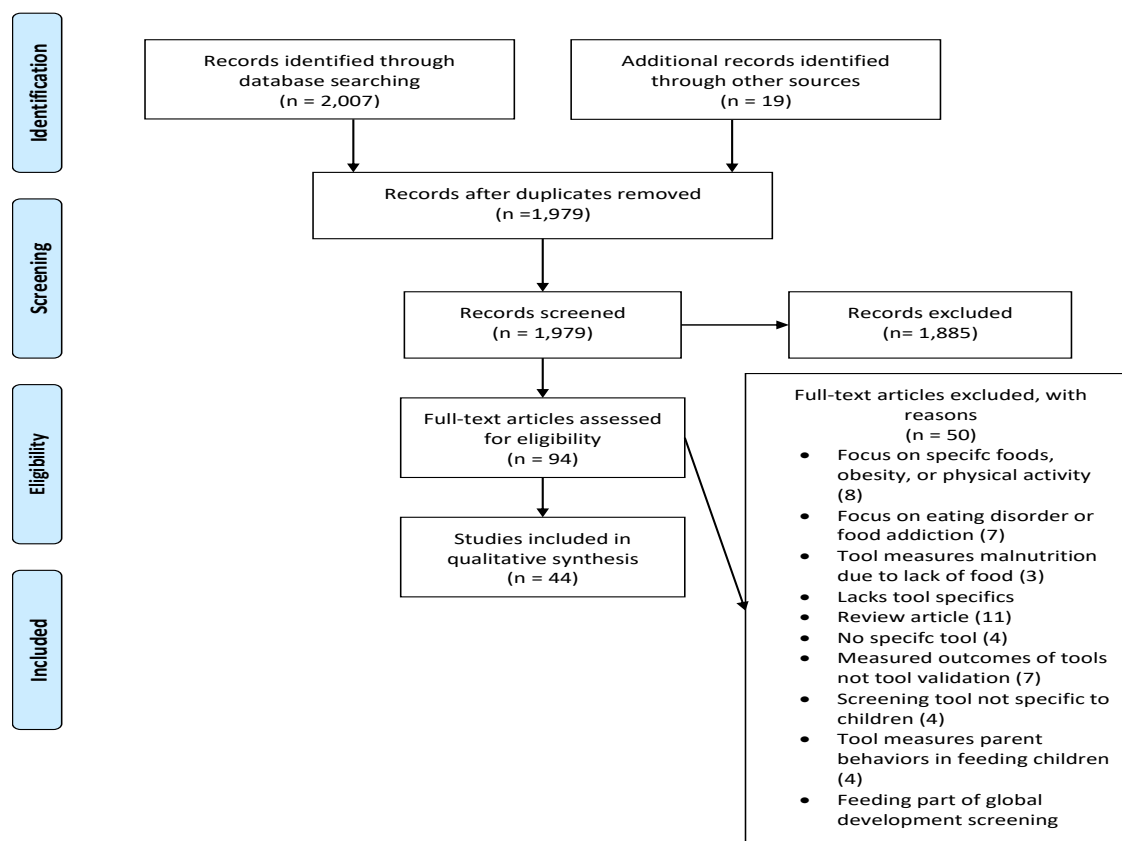


Figure 5. Study Selection according to PRISMA guidelines

Specific inclusion criteria included the following: printed between September 2008 and September 2018, published in the English language, quantitative research design, peer reviewed, and discussed a specific pediatric screening tool. Articles were excluded according to the following general criteria (for specific exclusion reasons see figure 1): no specific tool was mentioned, tool focused on parenting techniques not child outcomes, tool was designed to measure overall dietary patterns, tool focused on one specific nutritional outcome, tool focused on eating disorders in adolescents, tool focused

on obesity risk. Specific information extracted from included studies can be found in table 10.

Table 10. Screening Tools, Questionnaires, surveys identified in literature review

Tool	Criteria						
	<i>Tool administration</i>	<i>Tool age range</i>	<i>Style of tool</i>	<i># of items</i>	<i>Psychometric Properties*</i>	<i>Quadis-2 score*</i>	<i>Validation population</i>
<i>Unit of Measure: Nutrient or food intake</i>							
<i>Australian Child and Adolescent Eating Survey (ACAES) 2009^{10,11}</i>	Child	9-16 yrs.	Questionnaire	120	2	Low Risk	113
<i>Australian Child and Adolescent Recommended Food Score (ACARFS) ¹² 2012</i>	Child	9-12 yrs.	Questionnaire	70	2	Moderate Risk	720
<i>Australian Recommended Food Score for Pre-schoolers 2014 (ARFS-P)¹³</i>	Parent	2-5 yrs.	Questionnaire	70	2	Low Risk	142
<i>Child and Diet Evaluation Tool (CADET) 2006¹⁴</i>	Parent	3-7 yrs.	Food Tick List	92	2	Low Risk	180
<i>Children's Dietary Questionnaire¹⁵ 2009</i>	Parent	14-16 yrs.	Food Tick List	28	3	High Risk	706
<i>NutricheQ¹⁶ 2015</i>	Parent	12-36 mo.	Questionnaire	18	4	Low Risk	371
<i>NutriSTEP 2018¹⁷</i>	Parent	3-5 yrs.	Questionnaire	17	3	Low Risk	294
<i>Toddler dietary questionnaire (TDQ) 2014¹⁸</i>	Parent	12-36 mo.	Questionnaire	19	3	Low Risk	111
<i>Unit of Measure: indicators of malnutrition (height, weight, BMI, change in eating habits, etc.)</i>							
<i>Neonatal Nutritional</i>	RN	Birth to 28 weeks	Questionnaire	5	2	Moderate Risk	908

<i>Screening Tool (NNST) 2015</i> ¹⁹							
<i>Paediatric Yorkhill Malnutrition 2011</i> ²⁰	RN	1-16 yrs.	Questionnaire	4	2	Low Risk	1,571
<i>Pediatric Nutritional Screening Score(PNSS) 2018</i> ²¹	RDN	1 mo. – 17 yrs.	Ratings	3	4	Low Risk	2,830
<i>Pediatric Nutrition Screening Tool(PNST) 2016</i> ⁶	RN	Birth - 18 yrs.	Questionnaire	4	2	Low Risk	295
<i>Screening Tool for the Assessment of Malnutrition in Pediatrics(STAMP) 2012</i> ^{22,23}	RN	2-17 yrs.	Questionnaire	27	3	Low Risk	360
<i>STRONG_{kids} 2010</i> ^{24,25}	RDN or RN	31 d– 17.7 yrs.	Questionnaire	4	2	Low Risk	424
<i>Subjective Global Nutrition Assessment, child 2007</i> ²⁶	RDN	31 d - 17.9 yrs.	Questionnaire and physical exam	18	2	Moderate Risk	175
<i>Unit of Measure: Behavior</i>							
<i>About Your Child's Eating 2007</i> ²⁷	Parent	8-16 yrs.	Questionnaire	31	2	Low Risk	763
<i>Baby Eating Behavior Questionnaire(BEBQ) 2011</i> ^{28,29}	Parent	Infants	Questionnaire	18	3	Low Risk	2402
<i>Behavioral pediatrics feeding assessment scale 2015</i> ³⁰	parent	2-6 years	Questionnaire	35	2	Moderate Risk	135
<i>Children's Eating Behavior Inventory 1991</i> ³¹	Parent	2-12 yrs.	Questionnaire	39	3	Low Risk	316
<i>Children's Eating Behavior Questionnaire 2001</i> ^{32–35}	Parent	2-9 yrs.	Questionnaire	35	3	Low Risk	308
<i>Early Feeding Skills (EFS)</i> ³⁶	Clinician	0-50 weeks	Observed Feeding	19	3	Low Risk	150
<i>Food Fussiness Scale</i> ³⁷ 2017	Parent	6 yrs.	Questionnaire	6	2	Low Risk	752
<i>Infant and Child Feeding</i>	Parent	0-3 years	Web-based Questionnaire	12	2	High Risk	121

<i>Questionnaire 2017</i> ³⁸							
<i>Mealtime Behavior Questionnaire 2010</i> ³⁹	Parents	2-6 yrs.	Questionnaire	33	2	Low Risk	356
<i>Montreal Children's Hospital Feeding Scale 2011</i> ^{1,40}	Parents	6 mo– 6 yrs.	Questionnaire	14	3	Low Risk	198
<i>Parent Mealtime Action Scale Revised 2009</i> ⁴¹	Parent	~6 yrs.	Questionnaire	31	4	Low Risk	~3,000
<i>Pedi-EAT</i> ⁷ 2014	Parent	6 mo-7 yrs.	Questionnaire	87	3	Low Risk	48
<i>Screening Solid Foods infants 1</i> 2015 ⁴²	Parent/practitioner	Target range 6-9 mo.	Questionnaire	10	3	Low Risk	120
<i>Unit of Measure: Presence of specific condition</i>							
<i>STEP-CHILD 2011</i> ⁴³	Parent	2-9 yrs.	Questionnaire	15	2	RCT	142
<i>Brief Autism Mealtime Behavior Inventory (BAMBI) 2008</i> ⁴⁴	Parent	3-11 yrs.	Questionnaire	18 items	4	Low Risk	108
<i>Dysphagia disorder survey 2014</i> ⁴⁵	Trained practitioner	Adults and children	Scale	15 items	3	Low Risk	648
<i>Infant Malnutrition and Feeding Checklist for Congenital Heart Disease 2009</i> ⁴⁶	Health care professional	Infants	Parameters	3 items	3	N/A	14
<i>McDonald CF screener 2016</i> ⁴⁷	Not specified	6-18 yrs.	Questionnaire	10 items	2	Moderate Risk	85
<i>Nine Item ARFID screen (NIAS) 2018</i> ⁴⁸	Parent	5-17 yrs.	Questionnaire	9 items	3	Low Risk	505
<i>PeDiSMART (CKD) 2014</i> ⁴⁹	Not specified	1-16 yrs.	Parameters	4 items	2	High Risk	30
<i>STEP (Individuals with ASD) 2014</i> ⁵⁰	Parent	~ 9 yrs.	Questionnaire	23 items	34	Low Risk	360

* Psychometric properties were scaled based on the following coding:

1= no mention of reliability or validity

2= tested reliability OR validity

3 = tested both reliability AND validity

4= tested both reliability AND validity AND have at least 2 different methods for either reliability OR validity

* Quadis-2 scores based on potential for bias in the following four domains: Patient Selection, Index Tests, Reference Tests, and Flow and Timing.

Table scores are categorized as follows:

Low Risk = All four domains strong with little risk for bias

Moderate Risk = 1-2 domains unclear or at high risk for bias

High Risk = 3-4 domains unclear or at high risk for bias
 N/A = Study parameters not applicable with quality assessment

RESULTS

The results reported are intended to support the aim of this review to create a more general resource listing effective screening tools and their ability to identify feeding dysfunction in children. Results specific to certain types of healthcare practice or specific categories of feeding dysfunction will not be reported in depth in this review. However, table 10 lists the level of psychometric strength for each tool and a rating of quality to help the reader choose a tool applicable to their specific practice and pediatric setting. In order for a screening tool to be deemed effective, the unit of measure used to test reliability and validity must yield results at certain thresholds.⁵¹ Also, in order for a screening tool to be considered psychometrically sound it must demonstrate appropriate levels of validity and reliability.⁵² See table 10 for specific psychometric ratings.

All of the studies included in this review but one, used a cross-sectional study design, the other study used a randomized control trial study design.⁴³ Study populations ranged from 12 to 3,000 participants. Thirty-six of the studies were descriptions of the development and initial validation of a questionnaire that would be used to screen patients to determine nutrition risk.^{1,6,7,10,13–22,24,26–28,30–32,36–39,42,43,43–50} The other eight studies were validation studies of an original screener in different populations.^{11,23,25,29,33–35,40} All of the studies included in this review used statistical methods to determine reliability and validity of the various screeners, see Table 10 for specific methods used.

The majority of the behavioral screeners accurately measure feeding risk in a range of ages, from 6 months to 16 years old. Three screening tools and one validation study of a screening tool measured feeding risk in earlier ages ranging from birth to 3 years of age.^{28,29,36,37} None of the screening tools included in this review covered all ages defined as a pediatric population, birth to 18 years of age.

An assessment of methodological quality of the studies included in this review was conducted using the QUADAS-2 tool, designed to assess the diagnostic accuracy of studies.^{53,54} Thirty-six of the studies showed good “Methodological Performance”.^{1,6,7,10,11,13,14,16–18,20–25,27–29,31–45,50} In two studies the sample was not representative of the population,^{12,15} Three studies used unclear methods of sampling or flow^{12,26,49}, one study had high risk for sampling and flow,¹⁹ one study had high risk for the index and reference tests,⁴⁷ and one study was a development study that did not fit within the parameters of the quality review.⁴⁶

The literature review revealed four general methods used to identify feeding issues in children, these methods are: nutrient/food intake measures, measures of malnutrition, measures of behavior, and measures for specific disease conditions. While several of these tools include criteria from multiple methods, for this review tools will be classified by their specific emphasis.

Nutrient or Food Frequency Method

Nine of the tools were validated in pediatric populations and are based on food frequency questionnaires or specific nutrient questions.^{10–18} The majority of the screeners

in this category used intake of specific types of food to measure risk. Four of the screeners asked participants to estimate how often they eat certain foods over a certain amount of time, usually 6 months.¹⁰⁻¹³ Three screeners asked more general questions concerning dietary patterns generally over 7 days.¹⁶⁻¹⁸ These types of patterns include intake of foods in certain food groups, ‘core’ foods, and other nutrition risk constructs.¹⁶⁻¹⁸ Two screening tools used a tick mark system to estimate actual nutrient intake.^{14,15}

Indicators of Malnutrition Method

Nine studies were identified that focused on malnutrition screening. These screeners used various methods to measure malnutrition including; anthropometrics, questions about food/beverage intake, and inquiries about recent changes in eating behaviors.^{6,19-26} Seven unique malnutrition screening tools were identified during this systematic review.^{6,19-22,25,26} Two other studies attempted to replicate validation of previously validated screening tools.^{23,24} The majority of the malnutrition screeners identified employed 5 questions or less in order to determine level of nutrition risk.^{6,19-21,24,25} The questions on these screeners gathered information about weight (in percentiles or BMI), weight loss (last month), nutritional intake, and disease state. The other three malnutrition screeners in this review employed 18-27 questions to determine nutrition risk.^{22,23,26}

Behavioral Method

Nineteen tools used various psychometric measures to quantify behaviors and determine potential for nutrition risk.^{7,43,37,38,42,30,41,40,1,27,39,31–35,28,29,36} All of these tools incorporated survey items that gathered information about typical patterns of food intake and level of concern about a child's growth.^{1,7,27–42} The majority of the behavior based screeners included in the review measured the frequency of certain behaviors observed by parents or researchers.^{7,27,30–32,37–40} Some of the behaviors of concern include the following; food refusal/selectivity, choking/gagging/vomiting, avoidance of certain textures, chewing problems, rapid eating, etc.

Three of the feeding screening tools included items that measured parent behaviors in feeding their children.^{27,39,41} Two of these tools asked questions about child behaviors and parent behaviors to create a more comprehensive picture of the environment the child was exposed to.^{27,39} The other tool focused on the concept of parental modeling and the direct effect parent behaviors have on child eating and feeding behaviors.⁴¹

Specific Condition Method

Lastly, eight tools reviewed were developed for specific pediatric conditions or disease states.^{43–50} One tool was developed specifically for populations that have developmental delays, it is a good general tool to meet the needs of this specific population.⁴³ Other screeners were developed to identify feeding risk in conditions including; autism, dysphagia, cystic fibrosis, chronic kidney disease, Avoidant/Restrictive Food Intake Disorder (ARFID), and congenital malformations.

DISCUSSION

The purpose of this review was to identify existing screening tools that could improve identification of feeding dysfunction in children. Researchers were hopeful that one universal tool could be identified that would be capable of effective identification in a variety of settings. A universal tool would be ideal because it would make training and understanding of the tool among healthcare professionals easier to establish. However, the variability of symptoms and challenges faced by patients/clients and different clinic structures would make the use of a universal screening tool challenging. This systematic review supported this conclusion by identifying 35 different tools that have showed a good ability to gather valid information concerning nutrition risk in children. The tools use a variety of methods to gather this information, but all of them were able to identify nutrition risk in children.

While there is not one specific tool that covers the complete range of pediatric ages, careful selection of one or two of these tools would meet the needs of virtually all pediatric populations. Also, several studies were re-validated in populations different from the original validation population. For example, the Children's Eating Behavior Questionnaire (CEBQ) was developed and validated in a preschool population in London.³² Three subsequent studies were able to validate the CEBQ in different population to determine effectiveness, including a low-income population, three ethnically diverse populations, and a Dutch population^{29,34,35} The Montreal Children's Hospital Feeding Scale was another scale validated in two different population. It was originally developed and validated in a Canadian hospital population, similar results were noted in validation conducted in a clinical population located in the United Kingdom.^{1,40}

Lastly, the Baby Eating Behaviour Questionnaire (BEBQ) was developed and validated in connection to with the Gemini twins study, it was re-validated in a general population of children receiving care at a hospital in Australia.^{28,29}

Nutrient or Food Frequency Method

Using a tick mark system to measure food frequency is often used to simplify the process and increase accuracy. One study in this review used pictures and the other food categories to improve accuracy of responses and asked participants to mark a tick (or line) for every time that food was eaten in a weeks' time. While this tool was easier to complete than traditional food frequency questionnaires, the use of a tick system tends to overestimate intake of some foods like fruits and vegetables.^{14,15,43}

One advantage of nutrient and food frequency screeners is that they can estimate average intake of specific nutrients or food groups. This type of information can help practitioners pinpoint specific areas or nutrients of concerns in order to focus therapies and identify specific areas of nutrition risk. A limitation of these types of screeners is the length of the questionnaires. True food frequency questionnaires must be long in order to get an accurate picture of overall food intake. Also, those that fill out the screeners are relying on memory and estimates of food intake, which are rarely accurate. The three screeners that used general questions about food groups tried to shorten the questionnaire, but in doing so lost the ability to estimate specific nutrient intake due to more general questions.¹⁶⁻¹⁸ Also, these tools often focus solely on what a child is eating and not how they are behaving or other factors that may play a major role in overall nutrition risk.

Indicators of Malnutrition Method

Malnutrition and feeding issues don't always appear to be the same thing in healthcare practice. Not all children that have feeding issues will be malnourished, yet many have the potential to become malnourished.^{20,22} Also, many children that have a feeding issue or disorder may not be flagged as at risk because their anthropometric measures are within normal limits. However, measures of malnutrition identify many children that are at risk due to inability or insufficiency of nutrients making them valuable for this review.^{20,22}

Most of these screeners in this review limited the amount of survey items, 5 or less, to determine nutrition risk. Shorter tools are desirable because they provide a quick and easy way to classify nutrition status and are cost effective.²⁰ Screeners with more questions require more training on how to accurately respond, limiting the number of people that will be able to use it. However, longer tools mean more information which could be beneficial for patients that are already at high nutrition risk.

Behavioral Method

Criteria used to determine nutrition risk in children often focuses on the amount of food eaten and rate of growth tracked over time. These are good indicators of a child's diet adequacy, but they fail to account for behaviors used by children and/or their caregivers that dramatically change the volume and type of food a child eats on a regular

basis. It is critical that comprehensive measurement of feeding and eating behaviors be measured to increase the ability of practitioners to identify all children at nutrition risk.⁷ Many of the screeners developed to measure child behaviors do not ask about specific foods a child may eat or measure exact weight and height. However, they do include questions that estimate intake, growth velocity, and dietary patterns. Behavioral specific screeners have shown to be effective and comprehensive tools because behavior can impact nutritional intake and nutritional intake can impact behavior, the effect of one often affects the other.⁷

Strong, uncontrolled behaviors can seriously limit the amount and variety of foods a child can or will eat. Restrictive eating over time will reduce the amount of nutrients available to a child which could contribute to reduced growth and development in children afflicted with severe behavior issues. While measuring the behaviors of children can help us classify nutrition risk, measuring parent behaviors in feeding their children can help us determine child feeding risk and future concerns. The way a parent presents food or applies expectations and pressure to get a child to eat can have strong influence on child food preferences and desire to eat adequate amounts of food. These screeners combined previous concepts developed from previous research to create an overall understanding of the “why” behind child behaviors.

Specific Condition Method

One limitation of the majority of screening tools included in this review is that the screeners were developed and validated for typically developing populations. The Step-

Child screening tool was validated from an adult version that was specifically developed for individuals with special health care needs. Because this tool was validated in this specific population, it is a good general tool to determine nutrition risk among individuals that do not follow typical development patterns.⁴³

CONCLUSIONS

This systematic review resulted in the identification of multiple screening tools that have shown to be effective in identifying feeding issues in children. We were unable to determine whether any of these tools could be used as a universal standard for feeding screening. The wide range of individual patient characteristics and practice areas made it impossible to recommend a single tool as comprehensive for all. However, there are many screening tools listed in this review that are effective and capable of identifying children at nutrition risk. We would suggest that registered dietitians and other healthcare practitioners research the tools applicable to their practice and patient population. There are several tools that are determined by researchers to be more valuable in practice. The Infant Feeding Questionnaire includes items that gather information about how much the child eats, how the child behaves during feedings, parent concerns, and any abnormal behavior. The screener also has a simple way to score and determine nutrition risk, which is necessary to quickly identify feeding concerns.³⁸ The Montreal Children's Hospital feeding screener is also recommended. This screener is short (14 questions), includes scoring criteria with cut off points, and includes items that gather information about food intake, child behaviors, parent concerns, and abnormal

eating actions.^{1,40} The MCH scale has also been validated in at least two separate studies and has been determined to be effective in determining feeding risk in children. The last feeding screening tool we recommend is the Step-CHILD. This screener is unique as it was developed to determine nutrition risk in children developing outside of typical norms. These children often have higher rates of feeding problems than typically developing children, so a screener specific to their needs is warranted.⁴³

The wide variety of diversity and disciplines represented by the feeding screeners included in this review could be considered a limitation of this review. If we had focused solely on malnutrition or behavior components we could potentially have identified tools most beneficial for specific practice areas. Also, the wide range of statistical analysis used to determine effectiveness of the individual screening tools made comparison difficult as we attempted to compare overall effectiveness of the tools in this review.

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CHAPTER 4
IMPLEMENTING FEEDING SCREENING IN AN EARLY INTERVENTION
PROGRAM

By April Litchford

ABSTRACT

Background

Developmental delays in feeding skills or abilities is relatively common in children from birth to 3 years of age. However, feeding delays may contribute to other developmental delays and have the potential to aggravate conditions of delay and disease in this population.

Objectives

The purpose of this study was to implement the use of a feeding screener in an early intervention program to increase identification of children at risk for feeding dysfunction and to increase nutrition services provided to these children in order to improve feeding behavior and overall nutrition status.

Design

One-to-one interviews of early intervention (EI) service coordinators to determine need for and best placement of feeding screening among clients. Feeding screening survey of all children referred to an EI program to determine feeding/nutrition risk.

Results

All service coordinators interviewed indicated that feeding screening could be beneficial to clients of the EI program by gathering more information which would be used to provide more comprehensive care. Online feeding screening surveys were sent to 128 families

entering an early intervention program, 100 responses were received (response rate 78%). Referrals for nutrition services increased, on average, from 2 per month to 6 per month with 63% of referrals being determined eligible for further nutrition services.

Conclusions

Implementation of a feeding screening process in an early intervention population was successful in increasing rate of referrals to Registered Dietitian Nutritionist (RDN) and decreasing time to services.

Feeding and/or nutritional delays are relatively common in infancy and can occur in up to 45% of typically developing infants.^{1,2} Some form of feeding difficulty is also seen in 40% of toddlers and early school age children.^{3,4} These numbers suggest that feeding issues are relatively common in children; however, the majority of these feeding problems resolve themselves over time. In some children more severe or chronic feeding disorders can develop in 3%-10% of this population.³⁻⁵ These feeding issues are considered more severe and contribute to malnutrition, failure to thrive, and other behavioral and developmental delays.^{4,5} The numbers reported above are estimated for typically developing children. The prevalence of feeding issues climb dramatically, to almost 80%, when a child is experiencing some sort of developmental disability.^{1,6} However, many experts believe that these statistics are lower than the actual prevalence in this population. One reason for this discrepancy is a lack of standardized organizational procedures to identify children with feeding problems.⁵

The Early Initiative Act of the Center for Disease Control, works in collaboration with state programs to identify developmental delay in children as early as possible.⁷

Also, this initiative helps to fund state organizations in getting children with significant developmental delays services designed to reduce delays and mitigate symptoms of a condition or disability.⁷ All children that enter a state's early intervention (EI) program are evaluated using a standardized developmental tool to determine specific delays and service needs. Each child is re-assessed twice yearly to determine developmental progress and to identify any further needs. A child is eligible for EI services if they demonstrate a moderate delay (-1.5 SD, at or below the 7th percentile) in one or more of the development domains, be diagnosed with a condition that is approved for EI services, and/or be recommended for services through informed clinical opinion.^{8,9}

Prevalence of developmental delay in children is currently estimated to be 15% in the United States.¹⁰ However, only about 3% of this population received public early intervention services by the age of 3. Use of EI services are associated with improved cognitive and academic performance in children.^{10,11} Early intervention focuses on the ability of children to meet developmental milestones in order to promote overall wellness and growth in a child.¹¹ Nutrition and feeding risk impacts overall health and wellness and may contribute to delays in other domains; however, nutrition and feeding risk is rarely addressed as part of the screening procedures.¹⁰

As a case in point, EI services in Northern Utah counties are provided by the Up to 3 Program. When a child is referred to the Up to 3 program the parents or caregivers complete the Ages and Stages Questionnaire (ASQ) that is designed to determine developmental progress in children from birth to 6 years of age.^{12,13} The ASQ has been shown to be effective in identifying developmental delays in children, however it is focused on global development of children and does not screen for feeding problems.

Currently feeding issues are only identified at Up to 3 if a parent makes a specific request for feeding services or a service or therapy provider notices that a child is struggling with feeding issues. Currently about 7% of this EI population are receiving nutrition services. However, according to practitioner report, feeding problems in children at Up to 3 often go unidentified for 6-9 months after initiation of EI services.

The objective of this study was to assess the feasibility and determine the potential impact of implementing a feeding screening in the Up to 3 program. Including questions to screen for feeding issues during usual screening and assessment procedures at Up to 3 has the potential to identify children in need of feeding intervention earlier than is currently realized in this program. We hypothesize that implementing the use of a feeding screener in Up to 3 will increase the number of children that receive feeding/nutrition services and improve overall feeding abilities in EI clients.

METHODS

Qualitative Interviews

This study was reviewed and approved by the Institutional Review Board at Utah State University and all participants consented to participate in this research prior to being interviewed or surveyed. The Consolidated Criteria for Reporting Qualitative Studies (COREQ) was used to ensure adequate reporting of the methods used in this study to gather qualitative data.¹⁴

In order to determine the need for feeding screening among children in Up to 3, the 9 service coordinators currently employed at Up to 3 were asked through email or a

phone call to participate in one-on-one interviews. A service coordinator (SC) is tasked with assessing and/or assigning assessments to be conducted for each child that is referred to the early intervention program. They work directly with the families to ensure that the therapeutic needs of the child are addressed and met through therapy or other services. Service coordinators also offer therapy according to their specialty and the needs of the child. Their work is critical to creating a comprehensive, interdisciplinary service to address developmental delays in children.

The author of this dissertation conducted all interviews with the SCs. The investigator had a Master's of Science in Nutrition Science and was working as the Registered Dietitian Nutritionist for the Up to 3 Program at the time of the interviews. She had participated in several studies that focused specifically on gathering and analyzing qualitative data including analysis of open text survey responses and focus groups studying an eating disorder in adolescents.

Seven of the nine (78%) Up to 3 SCs agreed to participate in the interviews. The interviewer met privately with each SC at the Up to 3 offices and began the interaction by explaining the confidentiality agreement and that the interviews would be audio recorded on two different devices for transcription purposes. The basic outline of what would happen during the interviews was then explained to each participant. The researcher then began the recording and asked each participant if they had any questions or were in need of further clarification before the interview began. Once all concerns were settled, the researcher began asking the specific interview questions. Participants were instructed to answer the question to the best of their knowledge and to add any details they felt may be helpful to informing the study. Time duration for the interviews ranged from 9 to 15

minutes. A set of seven structured questions were asked each SC, see questions in Table 11.

Table 11. Semi-structured Interview Questions for Service Coordinators

What specific feeding/nutrition needs do you often observe in the clients you service?
Do you feel that Up to 3 clients are more at risk for feeding problems? Why?
Do you think there is a need for feeding screening in the Up to 3 population?
How would screening clients at intake be beneficial to them? (prompts: developmentally, socially, time to treatment) How would screening clients during IFSP assessments or BDI assessment be beneficial to them? Which assessment would the feeding screener best fit in and why would it be better to use it during this assessment?
What barriers can you think of that would make feeding screening difficult during periodic assessments? How could that barrier be reduced or eliminated?
Do you think it would be successful to have the screening tool available in an online platform that the parent could complete? Why or why not?
What barriers can you think of that would prevent parents from completing the feeding screener prior to the IFSP visit? (language, illiteracy with technology, distraction)

If participant was unsure of what the question was asking, the question was restated or pre-determined prompts were given to initiate a response. Interviews were transcribed by listening to the recorded interviews and typing responses by hand. Two researchers, AL and EK, then conducted thematic qualitative analysis of participant responses. Both researchers independently coded each document, assigning general themes and sub codes to responses on a question by question basis. Once coding was completed, frequency of themes coded for each interview question was compared between researchers and discrepancies were discussed and reviewed.

Feeding Screening

Parents or care-givers of children entering the Up to 3 Program during the 3-month study period from June 2019 through August 2019 were asked to complete a feeding screening tool to assess need for further feeding/nutrition services. The feeding screener selected for use in this study was the 14-question Montreal Children's Hospital Feeding Scale (MCH), which was developed by psychologists working with pediatric patients with feeding disorders.⁵ The questions were developed according to a biopsychosocial model of feeding problems and were categorized into three domains as follows: oral motor, oral sensory, and appetite.⁵ Researchers also included other domain categories in order to gather information regarding maternal and family concerns connected to the child's feeding behaviors. These additional questions addressed: parental concerns about feeding, mealtime behaviors, parental strategies, and family reactions to child's feeding.^{5,15} See Figure 1 for MCH questions.

The MCH Feeding Scale

1. How do you find mealtimes with your child?	1 2 3 4 5 6 7	
	Very difficult	Easy
2. How worried are you about your child's eating?	1 2 3 4 5 6 7	
	Not worried	Very worried
3. How much appetite (hunger) does your child have?	1 2 3 4 5 6 7	
	Never hungry	Good appetite
4. When does your child start refusing to eat during mealtimes?	1 2 3 4 5 6 7	
	At the beginning	At the end
5. How long do mealtimes take for your child (in minutes)?	1 2 3 4 5 6 7	
	1-10 11-20 21-30 31-40 41-50 51-60 >60	
6. How does your child behave during mealtimes?	1 2 3 4 5 6 7	
	Behaves well	Acts up, makes a fuss
7. Does your child gag or spit or vomit with certain types of food?	1 2 3 4 5 6 7	
	Never	Most of the time
8. Does your child hold food in his/her mouth without swallowing it?	1 2 3 4 5 6 7	
	Most of the time	Never
9. Do you have to follow your child around or use distractions (toys, TV) so that your child will eat?	1 2 3 4 5 6 7	
	Never	Most of the time
10. Do you have to force your child to eat or drink?	1 2 3 4 5 6 7	
	Most of the time	Never
11. How are your child's chewing (or sucking) abilities?	1 2 3 4 5 6 7	
	Good	Very Poor
12. How do you find your child's growth?	1 2 3 4 5 6 7	
	Growing Poorly	Growing Well
13. How does your child's feeding influence your relationship with him/her?	1 2 3 4 5 6 7	
	Very negatively	Not at all
14. How does your child's feeding influence your family relationships?	1 2 3 4 5 6 7	
	No at all	Very negatively

Figure 6. MCH Feeding Scale and Responses

This MCH screener was selected for this study because 1) it is capable of identifying feeding risk in children 6 months to 6 years of age, 2) it measures a wide range of behaviors and actions associated with feeding problems, and 3) it is short and easy to administer. The MCH Feeding Scale takes about 5 minutes to complete and is designed to be easy to fill out for practitioner or care-givers. Furthermore, it has been validated and shown to be effective in identifying children at risk for feeding

problems.^{5,15} This tool also uses a standardized scoring system that uses visual and numeric cut-offs to identify children with potential feeding risk.

Parents of children seeking to enter the Up to 3 program are required to participate in a phone interview with staff personnel. Ideally this would be the best place to add feeding screening; however, the length of the phone interview prohibited addition of more question. For the purpose of this research and implementation in the Up to 3 program, the survey was administered to parents through Qualtrics (an online survey platform). Once the intake interview was complete, the staff personnel conducting the interview informed each parent that they would receive a link to an online survey that would assess the feeding skills and development of their child. Once referral information was available through the program's computer software, the main researcher accessed contact information for all referral families. Each family, 128, were sent an email explaining the feeding screener and consent to participate particulars. The email also contained a link to complete the survey online. A follow up request was sent 1 week later through text message if the family had not responded. A last request was sent through text message two weeks from the initial email.

Annual assessments are also conducted for each child participating in Up to 3. These assessments determine progress of delays and reassess qualification for the program. Researchers determined that the assessment appointment would be a good opportunity to assess feeding delays in current program participants. During the 3 month course of this study 31 children were scheduled to have an annual reassessment. Of these 31 clients 3 clients were removed from the contact list because they would be exiting the program in the next 6 weeks. Also, 3 more were removed as they were currently

receiving nutrition services from the RDN. The link to the screening tool was sent to 25 families through an email. The email explained the purpose of the survey and provided a link to the online survey. One week later, the researcher sent a text message containing survey information and link. A last follow up text was sent 2 weeks after the first email was sent.

Data Analysis

Interview responses were analyzed using qualitative classic content analysis.¹⁵ The author of this dissertation read through the responses and compiled themes appropriate to answer each question asked during the interview using the Dedoose coding software. This list of themes, organized by question, were provided to another researcher as part of a separate coding document in Dedoose. The two reviewers then independently coded the responses again indicating reference to the themes, adding sub headings where needed for clarity. These lists were then compared and themes and sub-headings were consolidated to represent 3-4 major thematic responses for each interview question. Investigators then met to resolve any discrepancies and review coding rationale until they were both in agreement. For an example of a coding tree used please see Figure 7.

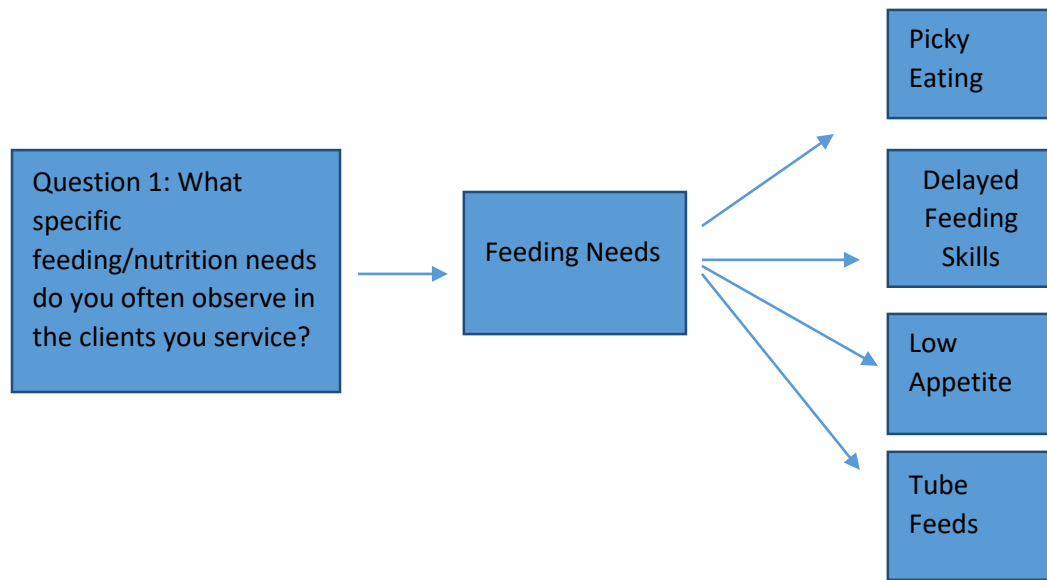


Figure 7. Example Coding Tree for Interview Question 1

Descriptive statistics were applied to the quantitative data collected from the online survey responses. The characteristics of participants were reviewed and compared to the thematic coding discussed above to determine agreement with service coordinator responses. A cutoff level was applied to the overall score calculated for each survey response and respondents were separated into two groups. Participant scores <45 were considered at low nutrition risk and no further nutrition services were offered to the client. Participants with scores >45 were considered at moderate or high nutrition risk, further nutrition services were scheduled for these patients according to parental preference.

RESULTS

Qualitative Interviews

The average experience of the SCs interviewed was 4.25 years with a range from 1 year to 14 years as early intervention providers. SCs described specific feeding needs of this population as: picky eating, delayed feeding skills, presence of a gastric tube or nasogastric tube, feeding dysfunction secondary to a diagnosis, and low appetite. Picky eating was a major theme discussed by all SCs, for example, “I have had a few kids that are very picky eaters” was typical of many of the SCs comments concerning this problem. Also, due to the nature of the children serviced by Up to 3, the majority of SCs, 6 of the 7, also felt that the prevalence of feeding issues in the Up to 3 populations were more frequent than in typically developing children. The concern for risk of feeding problems was elevated even more if the child had a medical or disability diagnosis of some kind. One SC said, “When I have a child with a medical diagnosis...they often have feeding problems.” Also, another SC indicated that screening could help them catch more feeding problems because, “One thing can be related to another so yah,it is a good idea.”

All seven of the practitioners interviewed indicated that feeding screening was needed in this population and that feeding screening at intake would be the best time to gather this information. Some of the reasons the SCs felt feeding screening would be beneficial include: feeding is often a secondary concern of parents, would increase parent/care-giver awareness that feeding/nutrition services are available at Up to 3, and increase awareness that feeding problems are relevant to a child’s developmental progression. When asked to determine the benefits of feeding screening the most

frequent themes were: the ability to gather critical information, provide clients with more services, address feeding needs, and reduce time to services. One notable excerpt highlighted that knowing a child's needs allowed service coordinators to provide more comprehensive services, "we could give them resources and information and maybe refer an OT (occupational therapist) or nutritionist".

Responses were mixed when discussing the benefit of screening all participating clients at their yearly assessment. Four of the providers felt like it would be a good time to gather more information and five comments were made about the changeable nature of a child's developmental state. One provider commented that an annual, regular screening would "help them ask the right questions about feeding." However, three providers weren't sure if the screening would be beneficial. One provider specifically stated, "if a child is just in the program for speech there would be no need for feeding screening." Another provider thought feeding screening could be beneficial because, "the needs of children change over time." Providers also, cited lack of feeding concern by parents as the most frequent reason that feeding screening shouldn't be done for every child every year.

When asked if using an online screener would be successful in this population, the responses were mixed. All providers felt that an online platform could be successful for certain parents, but that there were also many barriers that could reduce response rates. Some of the most frequent barriers mentioned include: don't access email or online resources regularly, time, technology, either lack of knowledge on using technology or no access to technology, not concerned about feeding, or forgetfulness.

Feeding Screening

Emails containing a survey link were sent to 128 families once their initial intake interview was completed. We received 100 responses to the survey for a response rate of 78%. A parent was asked to fill out the survey on behalf of their child, survey demographics will be reported for the children. Of those surveyed 68% were male and 32% were female. This is consistent with the rate of participants in the program; overall rates of males are 66% and females are 34%. The majority of participants were white (86%), Hispanic/Latino (7%), Black or African American (4%), and Native Hawaiian or other Pacific Islander (3%). These values are different from the overall ethnicity for the early intervention population, the percent of whites in the program is 80%, Hispanics/Latinos is 14%, and Black/African American and NHOPI (.7%).

Of the 100 children surveyed, 19 scored above 45 which is the cut off for feeding risk using the MCH feeding scale⁵ and were referred to the RDN to receive nutrition services. This is a prevalence rate of 19% for our population. The prevalence rate in typically developing children has been estimated at a rate of 25%, the rate we saw from our survey is close to the estimated national rate.¹⁶ However, based on SC interviews in this study and estimated prevalence in other studies to be 80% for children with developmental delays our prevalence rate is low.¹ Of the 19 clients referred to the RDN 12 accepted nutrition services and received at least one visit from the RDN. Four of the 19 refused nutrition services for various reasons including limited time or interest in correcting feeding deficits. Two of the clients were already receiving nutrition services from a RDN outside of the UP to 3 program.

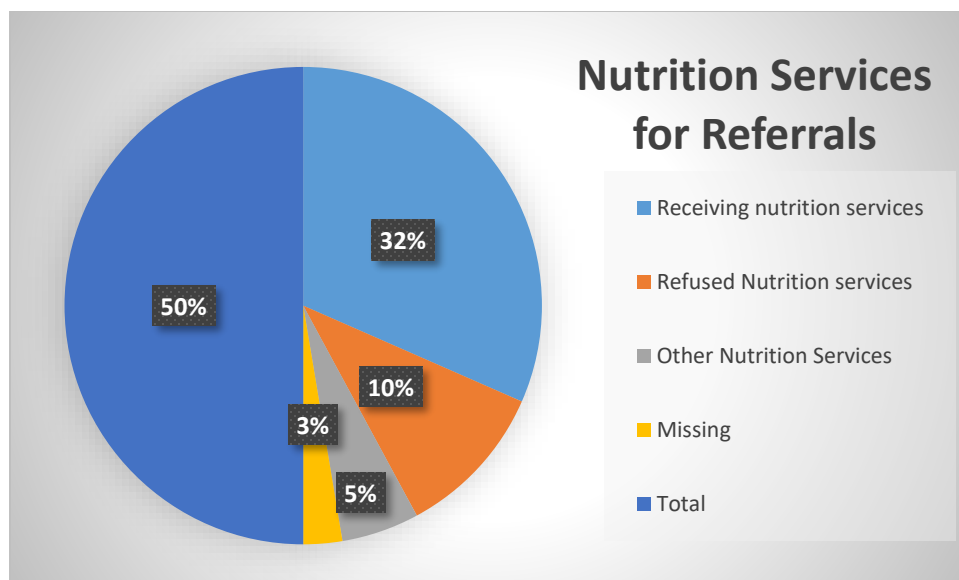


Figure 8. Nutrition Services for Referrals

In the three months prior to implementing the feeding screener, the RDN was receiving an average of 2 nutrition referrals per month. During the three-month duration of the study, referrals to the RDN increased from an average of two per month to an average of 6 per month, this is a 300% increase. (See Figure 2) Significance for this increase could not be computed due to the low level of referrals prior to the implementation of the feeding screening and the outcomes of individual children were not observed.

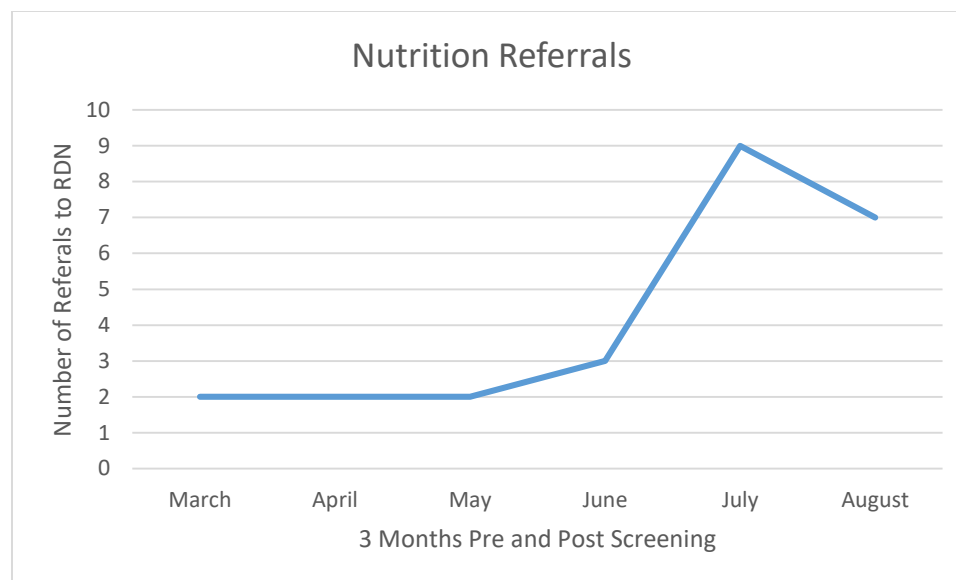


Figure 9. Increase of Referrals for Nutrition Services

Time to nutrition services prior to feeding screening was estimated by several experienced practitioners working at Up to 3 to be anywhere from 6-9 months. No numeric records were previously gathered to track how long it took to get nutrition services to clients from first concern. Average time to services for the survey population was 20 days. This was calculated by counting days from the completion of the intake interview to first contact by the RDN.

We had originally estimated that about 25% of the program EI participants, ~100, would be scheduled for their yearly reassessment during the 3 months of our study. However, there were only 31 clients that were scheduled for reassessment during the study period. We received 9 responses to the annual feeding survey, for a response rate of 36%. All of the children involved in this population were white, and the average age

was 29 months. Two of the 9 responses scored in the at risk range and were referred to the RDN, both families refused nutrition services.

DISCUSSION

Incorporating screening tools into early intervention services can be challenging; however, the use of screening tools has been successfully incorporated into EI services for other services.¹⁰ One notable screening tool, the Ages and Stages Questionnaire, is used in many EI programs across the nation and has been very effective in identifying children with developmental delays.¹⁰ The service coordinators interviewed as part of this study felt that screening clients for feeding/nutritional risk at the intake interview would be a helpful addition to the EI program's procedures. The results of the feeding screening survey support this conclusion. While we were unable to show significance through statistical modeling, the average rate of referrals tripled during the course of this study. We also estimate that through this screening we were able to decrease the time to referral by ~160 days. This reduction in time is critical to the overall goals of EI and the Act Early initiative of the CDC.⁷ One major goal of EI programs is to identify children quickly and provide interventions as soon as possible.⁷

As stated above, the MCH screener has been validated in several child populations and is capable of identifying children that struggle with feeding dysfunction.^{5,15} The results of the survey suggest that the MCH screener was also effective in identifying feeding risk in this population. The 12 children identified for feeding risk by the MCH screener who received further assessment by the RDN met

criteria for nutrition services within the program. The severity and etiology of the feeding dysfunction identified in these children was varied, but all situations qualified for nutrition services according to the service protocols of the EI program. Specific reasons for the identified feeding dysfunction included a diagnosis of a genetic syndrome, barriers transitioning to solids, and restrictive/picky eating. According to SC interviews having a way to gather more information about Up to 3 clients allows the SCs to provide more comprehensive services. It is evident from these results that intervention services were improved for the clients identified through the feeding screening.

Prevalence rates of feeding dysfunction in children diagnosed with developmental disability is thought to be ~80%.^{1,6} Also, SC interviewed in this study agreed, almost unanimously, that children in the EI program were more likely to have feeding dysfunction in connection to other delays they were experiencing. Our result; however, did not support this conclusion. A 19% prevalence rate in the population of children screened during this study was closer to the typically developing feeding dysfunction rate reported earlier.^{3,4} This discrepancy may be due to the short time frame for this study, determining prevalence rate over a year span of time may be more accurate. Also, parent report may not be particularly accurate especially if feeding is not a main concern for the families.

Interview responses also suggested that conducting feeding surveys during the yearly assessments would not be as beneficial or successful among Up to 3 participants. This line of thinking was validated in a marked reduction in survey response rates for the yearly assessments (36%) vs. the initial intake assessments (78%). Specific interview responses indicated that parents may not be willing to complete the feeding survey

because feeding was not a major concern to them. Other developmental issues were more of a priority and they were not willing to address feeding issues.

Another reason for the large reduction in response rates between the initial and annual surveys could be due to the nature of the time points. At the initial intake parents are hoping their child will qualify for services and are more willing to complete all interviews/assessments asked of them. Once the child is in the program their interest for other services may drop off because their most pressing concerns are being addressed. Also, feeding may have been addressed by their SC at other points in their care, but parents had no desire to change the eating patterns at that current point in time.

The online platform for this type of screening proved to be successful. One of the reasons for the success may be that the survey was easy to access from email or a text message sent to a smartphone. The ability to take the survey in the moment was helpful in increasing the response rates to these surveys. Typical online survey response rates reported in other literature are ~20%.¹⁷⁻¹⁹ Our rates were higher, in part, due to the ability of the survey software to be accessible by smartphone. However, this approach was time intensive, especially with follow-up reminders every 2 weeks.

One limitation for the annual feeding screening was that the volume of children scheduled for annual assessments was much lower than expected by researchers. Due to increased busyness of families in the EI program during the summer months, assessments and family visits are reduced and a community event in July replaces a good amount of visits. Perhaps repeating this annual screening process in the fall or spring months would have generated a larger pool of participants. Also, parents were read a statement at the initial intake interview that informed them about a survey link that would be

emailed/texted to them. Perhaps a call or statement from a SC at assessment appointments would make parents more aware of the survey and more willing to participate.

CONCLUSIONS

Use of the MCH feeding screening tool was successful in identifying children at risk for feeding dysfunction in an early intervention program. Increased rates of identification of children in need of feeding services increased the referral rate of clients to the RDN in the program three-fold during the course of the study. Also, 63% of the children referred to nutrition services received at least one visit from a RDN improving overall services in the EI program. Feeding screening is recommended for all children involved in early intervention services in order to provide more comprehensive therapy for children with developmental delays.²⁰

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CHAPTER 5

DISCUSSION AND OVERALL CONCLUSIONS

By April Litchford

The position of the Academy of Nutrition and Dietetics states that registered dietitian nutritionists (RDNs) with expertise in child feeding are best prepared to provide appropriate nutrition information that will promote health and wellness in children.¹ RDNs can be more effective in this role by increasing their understanding of the need for consistent procedures to identify feeding dysfunction in children. The Academy recommends procedures to identify (screen) children at risk for feeding/nutrition concerns; however, no universal screening tool or standardized protocol is used by RDNs to screen for feeding dysfunction.³³

The first chapter of this paper describes the current practices of RDNs concerning identifying and treating feeding dysfunction in children. The results of the survey conducted suggest some areas of improvement for the practice of RDNs that work in pediatric care. These changes include: implementation of screening procedures in as many clinics as possible, adherence to specific diagnostic language across the RDN discipline and companion healthcare disciplines, and increasing training expertise of RDNs to make them capable of treating feeding needs in children. These changes would: standardized screening procedures, increase the amount of practitioners capable of providing feeding therapy, and increase census levels and demand for dietetic services.

The second study presented (Chapter 3) is a systematic review of current feeding/nutrition screening tools published in literature. The review resulted in the identifying 44 published validation studies of 36 unique feeding/nutrition screening tools

shown to be effective in identifying feeding issues in children. We were unable to determine whether any of these tools could be used as a universal standard for feeding screening among RDNs. The wide range of individual patient characteristics and practice areas made it impossible to recommend a single tool as comprehensive for all. However, there are many screening tools listed in this review that are effective and capable of identifying children at nutrition risk.

The final study (Chapter 4) results indicated that implementing use of a feeding screening tool in an early intervention population (children birth to 3 years of age) was capable of increasing identification of feeding dysfunction in program participants. The Montreal Children's Hospital Feeding Scale (MCH), was selected for this study because 1) it is capable of identifying feeding risk in children 6 months to 6 years of age, 2) it measures a wide range of behaviors and actions associated with feeding problems, and 3) it is short and easy to administer.^{71,99} Use of the MCH feeding screening tool was successful in identifying children at risk for feeding dysfunction in an early intervention program. Increased rates of identification for children in need of feeding services increased the referral rate of clients to the RDN in the program three-fold during the course of the study. Also, 63% of the children referred to nutrition services received at least one visit from a RDN improving overall services in the EI program.

The information gathered through these three research studies will add depth and understanding to the practice of RDNs, helping them provide better, more comprehensive services to their clients. It is anticipated that RDNs will seek to implement feeding screening protocol in any area where they provide nutrition services in order to identify

more clients in need. Also, this information will help RDNs to increase their scope of practice to identify and seek training to treat feeding dysfunction in children.

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APPENDICES

APPENDIX A

IRB APPROVAL LETTER FOR SURVEY OF REGISTERED DIETITIAN
NUTRITIONISTS

From: Melanie Domenech Rodriguez, IRB Chair and Nicole Vouvalis, IRB
Administrator

To: Heidi Wengreen, April Litchford

Date: November 29, 2017

Protocol #: 8941

Title: Assessment of Clinical Practice Procedures Among Registered Dietitians for
Identifying Feeding Difficulties and Disorders in The Pediatric Population

The Institutional Review Board has determined that the above-referenced study is exempt
from review under federal guidelines 45 CFR Part 46.101(b) category #2:

Research involving the use of educational tests (cognitive, diagnostic, aptitude,
achievement), survey procedures, interview procedures or observation of public
behavior, unless: (a) information obtained is recorded in such a manner that
human subjects can be identified, directly or through the identifiers linked to the
subjects: and (b) any disclosure of human subjects' responses outside the research
could reasonably place the subjects at risk of criminal or civil liability or be
damaging to the subjects' financial standing, employability, or reputation.

This exemption is valid for three years from the date of this correspondence, after which
the study will be closed. If the research will extend beyond three years, it is your
responsibility as the Principal Investigator to notify the IRB before the study's expiration
date and submit a new application to continue the research. Research activities that
continue beyond the expiration date without new certification of exempt status will be in
violation of those federal guidelines which permit the exempt status.

As part of the IRB's quality assurance procedures, this research may be randomly
selected for continuing review during the three-year period of exemption. If so, you will
receive a request for completion of a Protocol Status Report during the month of the
anniversary date of this certification.

In all cases, it is your responsibility to notify the IRB prior to making any changes to the
study by submitting an Amendment/Modification request. This will document whether or
not the study still meets the requirements for exempt status under federal regulations.

Upon receipt of this memo, you may begin your research. If you have questions,
please call the IRB office at (435) 797-1821 or email to irb@usu.edu.

APPENDIX B

IRB APPROVAL LETTER FOR EARLY INTERVENTION RESERCH

From: Melanie Domenech Rodriguez, IRB Chair, Nicole Vouvalis, IRB Director
To: Heidi Wengreen
Date: May 1, 2019
Protocol #: 10185
Title: Implementation of Pediatric Feeding Screening Tool in Early Intervention Program (Birth to 3)

The Institutional Review Board has determined that the above-referenced study is exempt from review under federal guidelines 45 CFR Part 46.104(d) category #2:

Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met: (i) The information obtained is recorded in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subject; (ii) Any disclosure of the responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation, or (iii) the information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and the IRB conducts a limited IRB review to make required determinations.

This exemption is valid for five years from the date of this correspondence, after which the study will be closed. If the research will extend beyond five years, it is your responsibility as the Principal Investigator to notify the IRB before the study's expiration date and submit a new application to continue the research. Research activities that continue beyond the expiration date without new certification of exempt status will be in violation of those federal guidelines which permit the exempt status.

As part of the IRB's quality assurance procedures, this research may be randomly selected for audit during the five-year period of exemption. If so, you will receive a request for completion of an Audit Report form during the month of the anniversary date of this certification.

In all cases, it is your responsibility to notify the IRB prior to making any changes to the study by submitting an Amendment request. This will document whether or not the study still meets the requirements for exempt status under federal regulations. Upon receipt of this memo, you may begin your research. If you have questions, please call the IRB office at (435) 797-1821 or email to irb@usu.edu.

APPENDIX C CURRICULUM VITAE

April Litchford Ph.D., RDN, CD
December 2019

Personal Statement

A passionate, dynamic instructor and Registered Dietitian Nutritionist with expertise in current nutrition theories, child feeding, and teaching pedagogy. Proven effectiveness in increasing student and client knowledge gain in various teaching conditions through use of multiple instructional techniques. Experienced writer capable of producing curriculum, course and program evaluation standards, literature reviews, textbook material, research articles, and personalized nutrition care plans. Trained to meet the needs of students and nutrition clients with varying levels of abilities and nutrition needs.

Academic Qualifications

Ph.D. Nutrition Science, Utah State University, December 2019

Dissertation: Improving Identification of Pediatric Feeding Dysfunction Among Registered Dietitian Nutritionists

Masters of Science, Utah State University, May 2015

Thesis: Implementation of Online Tutoring Program to Increase University Student Information Retention

Bachelors of Science, Utah State University, May 2012

Experience

Up to 3 Early Intervention Program-Logan Utah

EARLY INTERVENTION NUTRITIONIST

August 2018-Present

Provide support to parents and children from birth to age 3 regarding eating habits, growth trajectory, and feeding skills appropriate for individual child development.

Duties:

- Conducts nutrition assessments to determine current child feeding abilities, habits, preferences, and risk for malnutrition.
- Delivers education and coaching to parents designed to help children transition to solid foods and develop age-appropriate eating skills.
- Determines nutrient needs for each individual child.

- Tracks individual child growth according to recommended parameters and percentiles.
- Develops eating plans to help parents provide necessary calories and nutrients for optimal growth and development.
- Collaborates with other Up to 3 personnel to provide comprehensive care for every client.

Utah State University-Logan Utah

ADJUNCT PROFESSOR – HYBRID COURSE

August 2013-Present

The Science and Application of Human Nutrition (3 credits)

Working to build basic nutrition knowledge in entry level university students. Course is designed to introduce vocabulary, concepts, and ideas of nutrition that will allow students to gain more complex knowledge in the future and change patterns of eating and behavior in the present.

Duties:

- Introduced basic nutrition concepts to students through lectures and assignments designed to increase knowledge and change behavior.
- Provided instructive feedback on assignments to enhance understanding and correct mistakes.
- Communicated regularly with students to solve problems with concept understanding, course requirements, and technology issues.
- Wrote and administered appropriate assessments that gave accurate feedback of student conceptual knowledge gain.
- Evaluated course materials regularly to address student feedback and effectiveness of course material and assignments.

Utah State University-Logan, Utah

TEACNING ASSISTANT

August 2016-December 2019

The Science and Application of Human Nutrition

Assist entry-level university students in their understanding of basic nutrition principles and how to apply them to personal behavior change.

Duties:

- Ensured online components of course were in place and easily accessible to students.
- Graded student responses to diet analysis assignments and personal healthy habit goals.
- Provided nutrition based recommendations to improve success in creating and maintaining behavior change.

- Provided support to instructor as needed in alterations to student grades, assignments, or other tasks.

Utah State University-Logan, Utah

ADJUNCT PROFESSOR

August 2018-May 2019

Transition to Professional Practice course and lab (3 credits)

Assist senior dietetic students to gain practical knowledge needed in the field of dietetics to aid them in becoming successful and capable dietetic professionals.

- Worked in collaboration with dietetic faculty and graduate students to determine research project for undergraduate dietetic students.
- Worked with undergraduate students to complete literature review, research design, and research procedures specific to research project.
- Communicated with necessary parties to obtain approval to execute research project.
- Instructed students on requirements of research and their role in the research process.
- Prepared dietetic students to enter professional practice in the dietetics field. Ensure they are prepared to complete professional portfolio and continuing education credits in the future.
- Introduced students to public policy and government processes, focusing on current nutrition and dietetic related legislature.
- Aided students in writing a resume and building online profiles they will use to search for entry level dietetics position.
- Increased student understanding of client needs by addressing personal bias and the needs of individuals with mental and physical disabilities.

Utah State University-Logan, Utah

TEACHING ASSISTANT, ONLINE COURSE

August 2014-May 2018

Masters of Dietetic Administration Program

Assist graduate students in their pursuit of an advanced degree in dietetic management through student support and course management.

Duties:

- Conducted thorough review of courses and completed changes and updates to course material as necessary.
- Created rubrics for all course assignments to ensure uniformity in grading procedures.
- Researched and updated course readings to ensure that course material was as accurate as possible.
- Graded assignments, case studies, projects, and assessments providing pertinent feedback.

- Communicated regularly with students to resolve concerns, questions, and/or problems that occurred.
- Corresponded regularly with course instructor to ensure course progression was favorable and effective for students.
- Used student evaluations and personal experience to update and improve course curriculum.

Utah Regional Leadership Education in Neurodevelopmental Disabilities (URLEND)

TRAINEE – AUTISM SPECIFIC

July 2016-May 2017

Participated in leadership training program designed to build exceptional leadership skills of individuals from a diverse set of professional disciplines.

- Participated in 150 hours of learning experiences that include didactic learning, clinical observation, and leadership development.
- Gained an understanding of key practices emphasizing family-centered care designed to improve therapies and services for individuals with autism.
- Developed understanding of how to create a professional environment that encourages disabled individuals to be proactive in personal care.
- Worked on a multi-disciplinary team to analyze and disseminate information gathered about pediatrician led diagnostic sessions for children with autism.
- Learned to find appropriate resources to support the social and emotional health of individuals with autism.

Utah Regional Leadership Education in Neurodevelopmental Disabilities (URLEND)

TRAINEE

July 2015-May 2016

Participated in leadership training program designed to build exceptional leadership skills of individuals from a diverse set of professional disciplines.

- Participated in 300 hours of learning experiences that include didactic learning, clinical observation, and leadership development.
- Gained an understanding of key practices emphasizing family-centered care that puts disabled individuals first.
- Developed understanding of how to create a professional environment that encourages disabled individuals to be proactive in personal care.
- Worked on a multi-disciplinary team to develop program improvement recommendations for pediatric health care clinic.

Utah State University-Logan Utah

ADJUNCT PROFESSOR

August 2014-May 2015

Food Service Systems, Management, and associated labs (6 credits)

Prepared dietetic students for a career in the dietetics field through instruction of food service organization and management techniques.

Duties:

- Prepared and conducted lectures, class discussions, and other activities to introduce students to course concepts.
- Prepared required assignments and projects that re-enforced key course concepts allowing students to develop a comprehensive understanding.
- Provided instructional feedback to students in order to correct misunderstandings and expand understanding of course concepts.
- Wrote and administered assessments designed to test comprehensive critical knowledge gained during course.
- Arranged hands-on experiences for students by communicating with various food service professionals to schedule opportunities for students to intern at their facilities.
- Communicated with students regularly by phone, email, and in person to answer questions, advise about future plans, and help solve pressing problems.
- Ensured all requirements imposed upon the dietetics program by accrediting body are met and followed established guidelines.
- Conducted regular evaluations of course and course material to ensure they met the needs of students.

Peer Reviewed Publications

- Wengreen H, Litchford A, Graff M. Increasing Learning Potential in Entry Level Nutrition Students Through Online Tutorial. *J Nutr Educ Behav*. 2015;47: S14-S14. [10.5539/jedp.v6n1p37](https://doi.org/10.5539/jedp.v6n1p37)
- Bernstein, McMahon K. *Nutrition Across Life Stages*. Jones & Bartlett Learning; 2017.
- Ahlers KP, Gabrielsen TP, Lewis D, Brady AM, Litchford A. Supporting individuals with autism spectrum disorder in understanding and coping with complex social emotional issues. *Sch Psychol Int*. 2017;38(6):586-607. doi:10.1177/0143034317719942
- Ahlers K, Gabrielsen TP, Ellzey A, Brady A, Litchford A, Fox J, Nguyen QT, Carbone PS. Pilot Project Utilizing Pediatricians as Initial Diagnosticians in Multidisciplinary Autism Evaluations for Young Children. *J Dev Behav Pediatr*. 2018. doi.org/10.1097%2FDBP.0000000000000621

Posters

- Ahlers, K., Brady, A., Litchford, A., Ellzey, A., Fox, J., Winter, S., Gabrielsen, T., & Carbone, P. (2017, July). *Pediatricians as initial diagnosticians within multidisciplinary autism spectrum disorder evaluations in young children*. Poster session presented at the meeting of Autism CARES, Bethesda, MD.

Honors/Awards

- Graduate Student Teacher of the Year, Utah State University, College of Agriculture, Fall 2019
- Graduate Student Teacher of the Year, Utah State University, Department of Nutrition, Dietetics, and Food Science, Spring 2019
- URLEND Interdisciplinary Training Completion, Autism Specific Track, Spring 2017
- URLEND Interdisciplinary Training Completion, Spring 2016
- Student Research Award, Society for Nutrition Education and Behavior, Summer 2015
- Dr. Bonita Wyse Scholarship, College of Agriculture, Utah State University, Spring 2011
- Susie Sanford Cook Scholarship, College of Agriculture, Utah State University, Fall 2012
- Dietetic Professional Advancement Scholarship, UAND, Spring 2012

Professional Affiliations/Certifications

- Early Intervention Specialist State of Utah June 2019-Present
- Member of the Academy of Nutrition and Dietetics May 2014-Present
- URLEND Aug 2015-May 2017
(*Utah Regional Leadership Education in Neurodevelopmental Disabilities*)