

# Preliminary Study of a Caregiver-based Infant and Child Feeding and Swallowing Screening Tool

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## ABSTRACT

**Objectives:** The *Infant and Child Feeding Questionnaire* (ICFQ) was created to facilitate early detection of feeding and swallowing problems. This is achieved by promoting effective communication between caregivers and health care providers resulting in referral for evaluation and treatment of feeding and swallowing problems by specialists. The purpose of this pilot study was to determine whether items from the ICFQ could be used to screen for differences between children with known feeding problems (FP) and without known feeding problems (NFP).

**Methods:** Caregivers of children ages 36 months or younger with FP and NFP were recruited to complete the ICFQ and demographic questions. *T* tests were completed to compare demographic characteristics of the research groups. Responses to ICFQ items were analyzed using receiver operating characteristic analysis and odds ratios to determine whether questionnaire items distinguished between study groups.

**Results:** Sixty-four caregivers of children with FP and 57 caregivers of NFP children were recruited. Three participants in the NFP group did not meet inclusion criteria and were excluded from analysis. A combination of 4 ICFQ questions distinguished between groups (receiver operating characteristic = 0.974). Significant odds ratios were also found for 9 feeding behaviors that distinguished between groups.

**Conclusions:** A subset of items from the ICFQ showed promise for distinguishing FP from NFP groups. Future work will expand the regional representation of the participant samples and obtain equal representation of participants across all age-adjusted questionnaires to determine whether the same combination of ICFQ items continues to distinguish between FP and NFP groups.

**Key Words:** assessment, deglutition, dysphagia, feeding disorder, pediatric feeding

(*JPGN* 2017;64: 979–983)

Received November 29, 2015; accepted October 6, 2016.

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Supplemental digital content is available for this article. Direct URL citations appear in the printed text, and links to the digital files are provided in the HTML text of this article on the journal's Web site ([www.jpagn.org](http://www.jpagn.org)).

Funding to support this pilot project was awarded by Del E. Webb Foundation.

The co-PIs of this research (J.M.B.K. and A.H.S.) serve on the medical professional council for the nonprofit organization, Feeding Matters and C.L. serves as their Executive Director. The other authors report no conflicts of interest.

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DOI: 10.1097/MPG.0000000000001442

## What Is Known

- Severe feeding problems are estimated to affect 3% to 20% of children.
- Early detection and treatment of feeding problems prevent the onset of negative developmental factors including stunted physical development, global cognitive and social delays, and increased risk of disruptive behavioral and attention disorders.

## What Is New

- Four questions on the Infant and Child Feeding Questionnaire (ICFQ) significantly distinguished between caregivers of feeding and nonfeeding disordered children ages 0 to 36 months of age (receiver operating characteristic = 0.974).
- Nine feeding behaviors were significantly associated with an increased likelihood of belonging to the feeding disordered group with 3 feeding behaviors accounting for two third of the variance between groups.

Feeding problems are a heterogeneous group of disorders with many causes that disrupt the acquisition of age-appropriate feeding habits. Feeding problems, including food refusal, swallowing problems, disruptive mealtime behavior, rigid food preferences, failure to master age-appropriate feeding skills, inadequate weight gain, and other nutritional concerns (defined hereafter as feeding problems or FP) have been reported in 15% to 45% of typically developing children (1–3), in approximately 70% of children with chronic medical conditions (4–6), and in approximately 80% of children with developmental disabilities (2). In approximately one half to two thirds of children with feeding disorders, their feeding disorders have mixed causes including behavioral, physiological, and developmental factors (7,8). Problems may also originate extrinsic to the child, including caregiver-child interaction problems, caregiver competence (eg, misinformed understanding of childhood nutrition, caregiver mental health issues), and societal problems such as food scarcity or poverty (9,10). The heterogeneity of feeding problems necessitates that clinicians carefully consider a broad range of factors, including the medical history, developmental history, family variables, and caregiver resources, when designing an individualized treatment approach. Often treatment is provided by a variety of health care professionals from medicine, psychology, speech-language pathology, nutrition, and other specialties (11).

Transient FPs are estimated to occur in 25% to 40% of toddlers and preschoolers (2,12). Severe feeding problems that require medical attention and threaten long-term growth and development are estimated to affect 3% to 20% of children (13–15). Based on 2015 United States Census Bureau (16) population estimates, approximately 1 million children younger than 5 years are conservatively estimated to have severe feeding difficulties. Furthermore, feeding problems account for 3% of hospital admissions (17) representing a significant burden on the health care system in terms of care provision and cost. Unfortunately, the number of infants and children with FPs is likely to increase due to reduced infant mortality rates and increased preterm births in the United States (18–21).

One major concern is that some severe FPs are not identified and referred to appropriate treatment until the affected child is 2 to 3 years old (8). Delays in identifying and treating FP may negatively affect child cognitive, physical, emotional, and social development, and have an adverse effect on caregiver-child relationships (10). Chronic FPs also tend to worsen over time, leading to significant health and behavioral complications (22). Delays in referrals for assessment of FP may be related to the limited training primary care providers (PCPs) receive regarding pediatric feeding and swallowing disorders (23–26). In addition, inadequate time is available during the typical well-child visit to assess for the presence of an FP (27). Subsequently, delayed identification and referral for FP often occurs once health and behavioral complications arise (8,10).

Given the growing number of assessments required of PCPs during well-child visits, methods that could improve FP screening accuracy and efficiency are highly desirable. Screening tools have increasingly been used to maximize physician efficiency and diagnostic accuracy during well-child visits for a variety of developmental and behavioral problems (28). In fact, many such instruments have been developed and used in various feeding clinics (28). Although these measures may be helpful to clinicians, they are not readily available to families thereby limiting their usefulness. Self-screening technology available online, linked with pediatric well-child visits, and offering individualized feedback for caregivers and PCPs may offer 1 solution.

The Web-based *Infant and Child Feeding Questionnaire* (ICFQ) was created as an online anticipatory guidance and engagement tool to help caregivers effectively discuss concerns regarding their child's feeding problems with their PCP. The ICFQ yields an individualized report based on caregiver responses that identify their child's developmental feeding strengths and potential feeding problems to discuss with the child's PCP. The final questionnaire items of the ICFQ were determined through a consensus-based process between caregivers of children with FP and 16 internationally recognized pediatric FP experts across multiple disciplines (29). Questionnaire items were developed to achieve a fourth to sixth grade reading level using terminology that was meaningful to caregivers with final questionnaire versions created after testing with caregivers in a primary practice setting. The ICFQ is currently available online to the public on the Feeding Matters Web site and anonymous responses are maintained in a centralized database that is secured and protected from access outside of the Feeding Matters organization. The next step in the development of this questionnaire is to evaluate the psychometric properties of the questionnaire items to determine the potential utility of the ICFQ as a screening tool for detecting children at risk for feeding and swallowing problems.

The purpose of this pilot study was to determine whether items on the ICFQ could distinguish between responses from caregivers of children with and without FPs. We hypothesized that specific questionnaire items, or groups of items would distinguish between responses obtained from caregivers of children with and without FP.

## METHODS

Methods are available online as Supplemental Digital Content (<http://links.lww.com/MPG/A815>).

## RESULTS

### Participants

Sixty-four caregivers of children in the FP group were recruited during their evaluation by the interdisciplinary feeding and swallowing team at the clinical site. Fifty-seven caregivers of children in the NFP (without known feeding problems) group were recruited and consented from the community well-child clinic site. Fifty-four children met final inclusion criteria for the NFP group based upon final consensus between the 2 pediatricians at the well-baby site.

### Demographic Findings

A comparison of the demographic variables showed differences between caregivers within the FP and NFP groups for 3 of the demographic variables (Table 1). As shown in this table, children within the FP group were older, on average, than those within the NFP group ( $P < 0.0001$ ). The caregivers of children with FP also had a significantly higher education level than for caregivers of the NFP group ( $P = 0.015$ ). In addition, the NFP group represented greater ethnic diversity than did those within the FP group ( $P = 0.0001$ ).

### Core Questions Distinguishing Groups

Four of the core questions were determined to provide the optimum sensitivity and specificity for distinguishing between the 2 groups. Based on stepwise logistic regression analysis, the receiver operating characteristic curve was 0.974 (Fig. 1) for the cluster of questions: Based on the questions you have answered, do you have concerns about feeding your baby? Do you think your baby eats enough? Does your baby like to be fed? Do you often have to do anything special to help your baby eat?

### Feeding Behavior Problems Distinguishing Groups

Out of 17 itemized behaviors, 9 were identified with significant odds ratios ranging from most likely to less likely to indicate FP (Table 2). As shown in Table 2, a child identified to cough during feeds/meals, for example, was 25.2 times more likely to belong to the FP group than the NFP group.

Of the 9 feeding behaviors identified with sufficient power to discriminate the presence of FP, items 2, 4, and 5 (Table 2), combined, explained approximately two thirds of the total variance ( $r^2 = 0.627$ ). That is, the combination of 3 questions, "Falls asleep before the end of feedings," "Refuses to eat," and "Does not swallow," accounted for 62.7% of the variance in data when the FP and NFP group responses were compared. In other words, caregivers selecting these 3 items were much more likely to have a child belonging to the FP group rather than the NFP group.

## DISCUSSION

The Web-based ICFQ was created as an online anticipatory guidance and engagement tool to help caregivers effectively discuss concerns regarding their child's feeding problems with their PCP. The ICFQ was also designed to improve awareness and potential for early intervention with children with feeding and swallowing

TABLE 1. Comparison of caregiver demographics by group

Demographic variable	Feeding problems	No feeding problems	P
Age of referenced child, mo	27 (±11)	8.6 (±9)	<0.0001*
Relationship to child	88% Mother	89% Mother	0.853
	11% Father	9% Father	
	1% Grandmother	2% Grandmother	
Marital status	13% Single	38% Single	0.053
	73% Married	58% Married	
	11% Divorced	2% Divorced	
First child	47% = Yes	55% = Yes	0.635
	52% = No	45% = No	
Size of household	N = 2 (8%)	N = 2 (7%)	0.109
	N = 3 (27%)	N = 3 (31%)	
	N = 4 (42%)	N = 4 (24%)	
	N = 5 (17%)	N = 5 (18%)	
	N = 6 (5%)	N = 6 (20%)	
Education level	3% = Some high school	7% = Some high school	0.015*
	10% = High school	20% = High school	
	5% = Technical	9% = Technical	
	11% = Some college	17% = Some college	
	51% = College	31% = College	
Ethnicity	21% = Postgraduate	15% = Postgraduate	0.0001*
	75% = Caucasian	35% = Caucasian	
	6% = Hispanic	18% = Hispanic	
	3% = African American	20% = African American	
	8% = Asian	15% = Asian	
Income level	2% = Multiracial	7% = Multiracial	0.114
	2% = Other	4% = Other	
	9% = <\$15,000	24% = <\$15,000	
	11% = \$15–20,000	7% = \$15–20,000	
	19% = \$21–50,000	15% = \$21–50,000	
	11% = \$51–75,000	25% = \$51–75,000	
19% = \$76–100,000	5% = \$76–100,000		
	23% = >\$100,000	16% = >\$100,000	

\*Demographic variables that were significantly different between the study groups.

problems. To our knowledge, the ICFQ is the first caregiver-focused questionnaire of its kind, blending standard assessment methods with Web-based technology. The ICFQ provides education

and anticipatory guidance to caregivers to enhance their ability to accurately identify feeding problems, and to have a method by which they can more effectively share these concerns with medical professionals.

We hypothesized that specific items, or groups of items on the ICFQ would significantly distinguish between responses from caregivers of children with and without FPs without control for developmental age. The results of the present study support that a subset of items from the ICFQ could serve as a screening instrument, and perhaps provide a novel method for rapid referrals to feeding specialty care. The questions identified with the strongest power to differentiate children with clinical feeding problems from those who do not describe the adult caregiver’s experience of attempting to feed their child. Not surprisingly, caregivers who are interacting with their children each day as they attempt to feed them are very much in tune with feeding interactive difficulties. The 3 directly observable behaviors that distinguished children in the FP and NFP groups (falls asleep before the end of feedings, refuses to eat, and does not swallow) may be more related to specific feeding difficulties, including chewing and swallowing skills deficits, or physiologic compromise. Taken together, these questions are qualitatively different from the objective data (eg, body mass index, quality of diet), which PCPs generally use in the evaluation of a

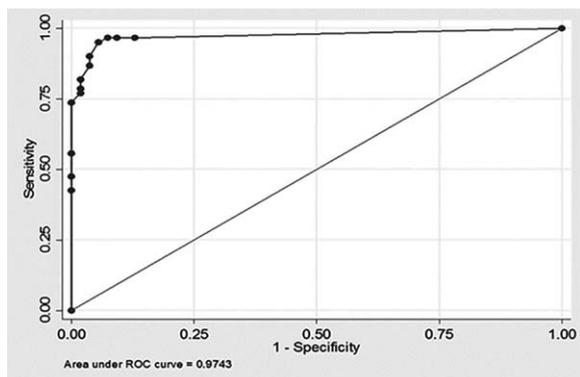


FIGURE 1. The level of correlation between 4 core questions (ROC) and group (FP vs NFP). FP = feeding problems; NFP = known feeding problems; ROC = receiver operating curve.

TABLE 2. Association between feeding behaviors and membership in the FP group

Behaviors during feeding	Odds ratio	95% Confidence intervals
1. Coughs	25.2*	(3.83, 166.18)
2. Falls asleep before the end of feedings	23.8*	(1.68, 338.58)
3. Chokes	20.5*	(3.48, 121.02)
4. Refuses to eat	18.6*	(5.74, 60.25)
5. Does not swallow	10.8*	(2.62, 44.78)
6. Makes loud breathing noises	9.49*	(1.84, 48.79)
7. Gags	6.7*	(1.80, 24.92)
8. Turns away from the breast or bottle or cup	5.33*	(1.31, 21.69)
9. Arching his body	2.59*	(1.50, 18.15)
10. Cries	2.62	(0.88, 7.74)
11. Turns blue	NA	
12. Becomes limp or worn out before the end of feedings	0.536	(0.07, 4.25)
13. Vomits after eating	NA	
14. Gets upset when face is touched at the start of feeding	3.1	(0.51, 18.81)

NA is "not able to be analyzed." Odds ratios >1 indicate a positive association between the behavior and FP.

FP = feeding problems.

\*Statistically significant.

child's growth and nutrition. By bringing the specific concerns yielded by the ICFQ to PCPs, it is likely that a much more comprehensive discussion of FP concerns will occur.

Early detection and referral to appropriate specialists for evaluation and intervention for feeding concerns is the major objective of this work, as undiagnosed feeding problems may evolve into fully developed feeding disorders that threaten the affected child's nutritional health and development and clinically become more difficult to treat (8). Feeding disorders are not only disruptive to the affected children and their caregivers, but also to providers who are asked to manage these difficulties. Fortunately, malnutrition and other associated medical concerns are preventable with early detection and intervention (30,31). Early detection and treatment of feeding problems may also reduce caregiver-related stress (32,33) and health care utilization costs (34).

Although this pilot study demonstrated that items from the ICFQ showed promise for distinguishing between the FP and NFP groups in the present study, there are limitations that warrant mentioning. First, equal representation of participants for each of the 11 age-adjusted versions of the ICFQ was not controlled in this pilot project. Thus, the influence of age on feeding and swallowing developmental milestones on caregiver responses to items that distinguish the 2 research groups cannot be addressed with the current pilot data collection. This is particularly important as many of the children with known FPs also have developmental challenges. This factor will be important to study in future expansion of this research to determine whether specific items from the ICFQ may serve a role in successfully screening children at medical or developmental risk for FPs for improved early identification and referral for treatment.

Another consideration in future investigations is to reduce demographic differences between the 2 groups that were studied. The FP group was, on average, significantly older than the NFP group (Table 1). This difference was not unexpected given the average age of 2 to 3 years by the time children with chronic FPs are seen by an interdisciplinary team (8). Future work will expand upon the current data set to achieve equal representation across age groups to evaluate whether developmental or age-specific differences arise with regard to the specific questionnaire items that distinguish between FP and NFP groups.

Another difference identified was that the FP group represented a greater proportion of caregivers identifying as

Caucasian compared to the NFP group (Table 1). The latter were equally distributed across being single and married with a higher proportion identifying with minority groups (eg, Latino, African American, and Asian) and the proportion of those being Caucasian as lowest between the 2 sites. Although education levels were demonstrated as significantly higher, on average, for the FP than the NFP group, the general distribution of education levels appeared fairly similar. The association between the demographic variables and response patterns was not directly studied or controlled within the present study. The demographic differences associated with ethnicity and education level likely reflect regional clinical differences rather than specific patient population differences. Nonetheless, future work needs to equalize demographic representation between the FP and NFP groups as a potential influence on responses to assure that differences in the ICFQ item responses are related specifically to FPs and not due to cultural or other demographic influences.

The larger confidence interval ranges on some odds ratio items in Table 2 highlight the smaller pilot population size and the heterogeneous FP group. That is, the behavioral items with wider confidence interval ranges likely reflect that not all children with feeding problems exhibited the full range of symptoms identified with this group. In addition, the small pilot population size has an inherently lower power. Future work will target a larger sample with improved matching of respondent demographics between groups to achieve a larger power level and more consistency across symptoms.

Another factor for future consideration is that caregivers in the NFP group completed their questionnaires after rather than before their well check visit as was the case for the FP group. It is possible that completion of the questionnaire before appointments may show more concerns by caregivers in the NFP group. This factor will need to be counterbalanced in future work to rule out response influences associated with the timing of caregiver responses relative to their clinical appointment.

A final future consideration will be the final construction of questionnaire items. The original questionnaire item development for the ICFQ included consensus between multiple professionals and end users for final content and wording. Some of the terms and phrases used within the current questionnaire may, however, require additional adjustment to improve the clarity of current term usage and phrasing. Thus, finalization of the screening instrument will

require systematic and psychometric assessment of wording and phrase usage.

In sum, the present study reports the initial psychometric qualities of the ICFQ. Overall, the questionnaire shows promise as a clinical tool, and may be helpful to caregivers of affected children and medical providers who manage their care. The outcomes of the present study will be used to refine the ICFQ so that a final screening instrument will include only those items demonstrating the greatest power to identify FPs. To achieve this goal, future research will strive to achieve comparable age representation to control for developmental factors and demographic variables that may influence group responses to the ICFQ items. Thereafter, the final screening instrument will be tested for feasibility and effect on clinical outcomes within typical primary care populations.

**Acknowledgments:** The authors would like to thank the Del E. Webb Foundation for their financial support of this research. In addition, several individuals contributed to the data collection process at each research site. The following individuals were involved in the recruitment, consent, and data collection process at the University of California, Davis site: Theresa Kim Thai, MD, Khai Nguyen, BA, Kristine Miller, BA, and Miya Sindle. The following individuals made similar contributions at the Milwaukee Children's Hospital site: Kelsey Weinberger, MS, Elizabeth Fischer, PhD, and Andrea Begotka, PhD. The authors would also like to thank Feeding Matters for their development of the ICFQ, support of this study, and their mission, vision, and persistence to develop the necessary and optimal resources for caregivers seeking help for their children with feeding and swallowing problems.

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