Validation of a Nutrition Risk Screening Tool for Children and Adolescents With Cystic Fibrosis Ages 2–20 Years

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ABSTRACT

Objectives: According to the 2002 Cystic Fibrosis (CF) Foundation nutrition consensus report, children with CF should grow normally. Cross-sectional data from the foundation’s patient registry concluded that a body mass index at or greater than the 50th percentile is associated with better lung function. A consistent, evidence-based screening process can identify those individuals with CF having nutrition risk factors associated with a decrease in pulmonary function, target early intervention, and prevent further decline. A tool for screening nutrition risk is described to identify those children with CF who would benefit from more extensive nutrition intervention.

Methods: The proposed screening tool is a risk-based classification system with 3 categories: weight gain, height velocity, and body mass index. The CF Foundation recommendations regarding these parameters are incorporated, with risk points assigned when minimum body mass index, weight gain, and/or height gain standards are unmet.

Results: An interrater measure of agreement determined a satisfactory level of reliability ($\kappa = 0.85$). Patient records ($n = 85$) were reviewed to determine nutrition status category (no risk or at risk) of this tool compared with the CF Foundation 2002 Nutrition Consensus, yielding sensitivity and specificity at 84% and 75%, respectively. A second comparison was made with combined, independent nutrition risk factors not included in the screening tool. The sensitivity and specificity of the screening tool compared with the combined risk factors were 86% and 78%, respectively.

Conclusions: This tool for screening nutrition risk for CF is reliable and valid, with consistent, reproducible results, free from subject or observer bias. JPGN 46:438–446, 2008.

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the CFF tool were published. Also, clinicians voiced concerns about the psychological effects of labeling some individuals with CF as “nutritional failures.”

Consistent, evidence-based nutrition care is an essential component of overall CF management. The basis of an excellent nutrition care process is an effective, efficient nutrition screening tool applied in an appropriate and timely manner. The nutrition screening tool described here is derived from standards for BMI, weight gain, and height velocity according to the recommendations of the CFF Clinical Practice Guidelines Subcommittee on Growth and Nutrition (4). The registered dietitian associated with the CF health care team or a trained staff member is the intended administrator of this screening tool. Each outpatient or inpatient clinical encounter is an opportunity to review the nutrition status of the individual with CF and intervene when appropriate. The nutrition screening tool does not meet all of the criteria recommended (7) for an annual nutrition assessment and is not intended for use as an alternative to a full nutrition assessment by a registered dietitian.

Malnutrition and growth failure in children in general are associated with increased morbidity and mortality, including pulmonary deterioration and neurological deficits, regardless of comorbid conditions such as CF (8,9). Anthropometric classifications for child malnutrition include underweight (low weight for age), stunting (low height for age), and wasting (low weight for height) (10). Combined features of malnutrition (e.g., a child who is underweight with wasting and stunting) increase the risk of experiencing nutrition-related morbidity and mortality (11,12).

Impaired nutrition status has been a hallmark of CF since the first descriptions of this disease in the 1930s. A comparison of survival, growth, and pulmonary function demonstrated longer survival for individuals with CF who were better nourished (13). Impaired accretion of body cell mass is associated with diminished lung growth and progressive lung dysfunction in CF (14). Malnutrition in a person of any age with CF has a negative impact on lung function and a more rapid yearly decline in FEV1 (15). Conversely, children with CF who experience continuous, appropriate weight gain will have better FEV1 and less decline in FEV1 than children who sustain suboptimal growth patterns for age and sex (16). Weight-for-age, height-for-age, and percent of ideal body weight at age 3 years are strongly associated with pulmonary function at age 6 years (17). Stature as determined by height-for-age percentiles is a significant prognostic factor in CF survival. Relative hazard values determined that taller individuals with CF were more likely to survive longer than their shorter peers, matched for age and sex (18). Fat-free mass and BMI, as markers of nutrition status, are important determinants of diaphragm strength and longitudinal peak aerobic performance for children and adolescents with CF (19,20).

According to the 2002 CFF nutrition consensus guidelines, children and adolescents with cystic fibrosis are expected to experience typical growth when appropriate nutrition is given (7). The CF care team is charged with monitoring growth, providing anticipatory counseling, and planning intervention strategies when indicated. Early detection of suboptimal growth allows for early intervention and timely rehabilitation. The CFF consensus statement recommends that growth and nutrition status of children with CF should be monitored on a routine basis, at least every 3 months. Anthropometric measurements including weight, length/height, and occipital-frontal head circumference, as determined by age, must be completed accurately with appropriate, calibrated equipment by trained staff using standard protocols (21–23).

Serial measurements of weight and stature for normal children from the Fels Longitudinal Study were used to determine expected incremental weight and stature gains for ages 2 through 18 years (24). Longitudinal data for growth increments provide sensitive assessments for the detection of abnormal growth patterns or the response of growth to therapy (24). Cross-sectional studies of populations at different ages may lack sensitivity when assessing the serial growth of an individual, especially during periods of rapid growth such as infancy or adolescence. However, in the absence of available longitudinal data in the Fels data for stature for 2- to 3-year-olds and weight and stature for 18- to 20-year-olds, the differences between age- and sex-specific values for the 50th and 10th percentiles were calculated from the Centers for Disease Control and Prevention (CDC) tables (6). Comparison of the recumbent length incremental change standards and the differences in the CDC stature by age tables for 2- to 3-year-olds showed no differences when rounded to whole-number values for the 50th percentile (6,24). The difference values for recumbent lengths were slightly less (~1 cm) at the 10th percentile than the CDC stature for age. The lower values from recumbent length measurements were selected for the standard at the 10th percentile for both males and females at 2.0 to 2.99 years old.

Weight-for-stature measures describe body proportionality and are sensitive to both current energy intake and long-term nutrition status. Determined as weight (kilograms) divided by height (meters) squared (kg/m2), BMI is used to assess appropriateness of weight to height for age and sex (6,25). The CDC BMI-for-age percentiles evolved from standardized measurements of height and weight from 9 epidemiological studies including 66,772 children ages 5 to 17 years (6,26). CDC defines a BMI for age greater than the 95th percentile as overweight, 85th to 95th percentile as risk of overweight, and less than the 5th percentile as underweight (6).
Analysis of CFF Patient Registry Data

Regression equations derived from analyses of cross-sectional data from the CFF patient registry estimate BMI for age percentile cutoff values needed to maintain percentage of predicted FEV$_1$ at 80%, a value indicative of mild lung disease (27). At age 7 years, BMI-for-age values of 6th and 9th percentile are needed for boys and girls, respectively, to maintain FEV$_1$ at >80% of predicted. However, as children with CF age, an increase is noted in the BMI-for-age percentile cutoff values associated with lung function at or above 80% of predicted value for FEV$_1$ (27). At age 15 years, BMI-for-age values greater than the 28th and 43rd percentiles for boys and girls, respectively, were found necessary to maintain pulmonary function at >80% of predicted FEV$_1$ (27).

More recent cross-sectional data from the CFF patient registries in the United States and Canada using revised spirometry reference equations were analyzed by age and by sex to determine whether any association existed between pulmonary function as measured by FEV$_1$ and BMI for age percentile (28,29). BMI-for-age percentile values above the 50th percentile were associated with well-preserved lung function and lower values of BMI were associated with incrementally lower values of FEV$_1$. Thus, the CFF recommended that children with CF between the ages of 2 and 20 years maintain a BMI at or greater than the 50th percentile for age and sex (4).

MATERIALS AND METHODS

Nutrition screening parameters should be specific to the population being evaluated. The parameters used in this disease- and age-specific screening tool are selected from general pediatric nutrition and growth literature and CF-specific evidence. The screening classification system is based upon 3 anthropometric categories identified by the World Health Organization: weight for age, height for age, and weight for height (2). Because many children are diagnosed with CF after failing to thrive, longitudinal weight gain and height gain for age and sex were determined to be more indicative of nutrition status changes than absolute percentiles for weight for age or height for age.

The CFF Subcommittee on Growth and Nutrition recommended that BMI remain at or greater than the 50th percentile for individuals with CF ages 2 to 20 years because of the strong association with more normal pulmonary function (4). A second downward inflection point was detected in the association between FEV$_1$ and BMI for age at the 10th percentile (4). Based upon the CFF subcommittee recommendations for BMI, the nutrition screening tool for CF assigns 1 risk point for BMI less than 50th percentile and 2 risk points for BMI less than the 10th percentile (4).

The Fels Longitudinal Study of healthy children was recommended by the CFF subcommittee as the reference for weight gain and height velocity (24). Tables (shown in Fig. 1) using the Fels data describe weight gain and annual height velocity by sex, by age for the 10th percentile, and by age for the 50th percentile. Normal growth was operationally described as proceeding between the 10th and 50th percentiles for weight and height. All of the values are rounded to the closest whole number to facilitate clinical use.

The nutrition screening tool for CF assigns risk points when minimum weight gain and/or height gain standards are not met. A minimum standard of average daily weight gain at or greater than the 10th percentile for the Fels Longitudinal Study is suggested for children who are greater than or equal to the 50th percentile for BMI. Children less than the BMI 50th percentile have a minimum standard of average daily weight gain at or greater than the 50th percentile. Similarly, a minimum standard of annualized height gain at or greater than the 10th percentile for the Fels Longitudinal Study is used for children who are at or greater than the 50th percentile for BMI. Children less than the 50th percentile for BMI have a minimum standard for annual height gain set at the 50th percentile for the Fels data. Heritable factors of stature are important and should be considered by the practitioner for the individual with CF. However, the evidence is not available for incorporating this component into a screening tool at this time (25).

Acceleration of growth, or catch-up growth, is important for any malnourished child with CF. Catch-up growth is defined here as gaining in BMI percentiles over time and/or exceeding the 50th percentile for sex- and age-specific expected daily weight and annual height gains. The proposed nutrition screening tool for CF does not distinguish catch-up growth from achievement of normal weight gain and linear growth. Some nutrition risk continues as long as a child remains at less than the 50th percentile for BMI, even though rapid weight and height gains may occur. Individualized catch-up growth goals for a malnourished child with CF should be determined and monitored by the CF care team.

Nutrition risk associated with being at risk for overweight (BMI for age in 85th–95th percentile) or overweight (BMI for age at or greater than the 95th percentile) in an individual with CF is not specifically addressed by this screening tool, although it is a bona fide issue in CF (6,30). Insufficient numbers of children and adolescents meeting the criteria for overweight are available for statistical analysis of an association with pulmonary function. Clinicians counseling overweight children or adolescents with CF are encouraged to promote healthy lifestyle changes in conjunction with maintenance of prescribed pancreatic enzyme replacement therapy. Careful monitoring is essential if weight maintenance or weight reduction is indicated for a child or adolescent with CF.

Height velocity values may not apply to individual children during adolescence because the timing and age of the adolescent growth spurt occurs in close relationship with sexual maturation (25,31). Height velocity is omitted as a nutrition risk factor if the individual with CF has reached sexual maturity. Only BMI percentile and weight velocity are included in risk scoring for individuals with CF who have completed maturation.

Pubertal scoring can be assigned by physical assessment during the medical examination. Self-assessment of pubertal status is an alternative to a physical examination (32–35). Sex-specific line drawings of the Tanner puberty stages are available for the adolescent to self-assess pubertal status when direct examination by a physician is not possible (33,35).

The proposed nutrition screening tool for CF was designed to maximize interobserver agreement and produce consistent, reproducible results free from subject and observer bias.

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NUTRITION RISK SCREENING WORKSHEET

Patient ID: __________________________

Gender: ______ Age: ______ months ______

**Weight for stature** (26)

Determine BMI percentile for gender & age using CDC BMI chart: __________

**Weight velocity** (24, 26)

Current weight (kg): ______ Date: ______

Previous weight (kg): ______ Date: ______ (≥ 90 day interval)

Net change in weight: ______ (convert kg to gm)

Number of days between weights: ______

Daily weight gain (gm/day) ______ (round to nearest whole number)

Minimally acceptable rate of weight gain per day (gm/day) ______ (See table 3)

**Height velocity*** (24, 26, 33-37)

*NOTE: Omit annual height gain category if an adolescent is either Tanner Stage V (any age) or female >13 years old or male > 17 years old

Tanner Stage: 1 _ II _ III _ IV _ V _ (For children ≥ 10 yr of age)

Current height (cm): ______ Date: ______

Previous height (cm): ______ Date: ______ (an interval of ≥ 1 year, but ≤ 2 yr)

Net change in height between visits (cm): ______

Number of years between height measurements ______ (example: 15 months = 1.25 years)

Δannual height gain (cm/year) ______ (round to nearest whole number)

Minimally acceptable rate of annual height gain (cm/year) ______ (See table 3)

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### TABLE 1. Comparison of nutrition risk categories for children and adolescents with CF according to the 2002 CFF Consensus Report vs the proposed nutrition risk screening tool (N = 85)

<table>
<thead>
<tr>
<th>Category</th>
<th>Existent 2002 CFF Consensus Report</th>
<th>Proposed nutrition risk screening tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/low risk</td>
<td>Acceptable (no/low risk)</td>
<td>41</td>
</tr>
<tr>
<td>Moderate/high risk</td>
<td>At risk/nutritional failure</td>
<td>9</td>
</tr>
</tbody>
</table>

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### TABLE 2. Comparison of nutrition risk categories for children and adolescents with CF according to compiled, concurrent, independent nutrition risk factors determined by in-depth assessment vs the proposed nutrition risk screening tool (N = 85)

<table>
<thead>
<tr>
<th>Category</th>
<th>Presence of independent nutritional risk factors by in-depth assessment</th>
<th>Proposed nutrition risk screening tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/low risk</td>
<td>0–1 nutrition risk factors</td>
<td>42</td>
</tr>
<tr>
<td>Moderate/high risk</td>
<td>≥2 nutrition risk factors</td>
<td>8</td>
</tr>
</tbody>
</table>

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FIG. 1. Worksheet used to determine level of risk for cystic fibrosis nutrition screening.
The validation process for the effectiveness of this screening tool included pilot studies by people who were most likely to use the tool in clinical practice. Trials included qualitative feedback to assess the performance of the screening tool.

An American Dietetic Association pediatric CF subspecialty e-mail list was used to recruit dietitians in pediatric CF practice to test the nutrition screening tool and submit comments. Seven respondents to an e-mail questionnaire assessed their perceptions of the screening tool and its clinical application. Each respondent applied the screening tool to 5 to 10 actual patients being seen by the respondent in a CF clinic. Respondents estimated the average time required to complete the screening tool manually was approximately 5 minutes per patient. Respondents reported the nutrition screening tool for CF accurately reflected their perceived nutrition risk of the individual patient most of the time to all of the time. Comments from the respondents were used to further refine the screening tool.

The revised screening tool was tested with 6 case studies by 17 pediatric dietitians. Overall agreement on nutrition risk was computed using a $\kappa$ coefficient to obtain a value of 0.75, a satisfactory level of interrater reliability. However, closer review of the categories within the different case studies and interviews with the participating dietitians revealed discrepancies in scoring due to differences in interpretation of the instructions. A revised version of the proposed screening form included clarification regarding the use of weight and height tools, instructions to round patient values to the nearest whole number for consistency with the data tables, and clarification on Tanner staging.

FIG. 2. Algorithm for categorization of risk of cystic fibrosis complications due to compromised nutritional status.
The validity was determined with a chi-square goodness of fit test to detect a 30% difference with a significance of 0.05 and a power of 0.80. A $2 \times 2$ comparison was completed first for the nutrition screening tool versus an existing screening tool. The existing CF nutrition screening tool is based on the 2002 CFF consensus report (6). Second, the nutrition screening tool was compared with an in-depth nutrition assessment with compiled, independent nutrition risk factors, including arm muscle circumference and/or triceps skinfold measurements less than 25th percentile for sex and age, suboptimal serum vitamin and/or trace mineral levels, pulmonary exacerbation, and suboptimal dietary intake. The presence of 2 or more independent nutrition risk factors was defined as a moderate/high nutrition risk. Outpatient clinic charts ($n = 85$) were reviewed to determine the nutrition status category as either no/low risk or moderate/high risk according to different methods of screening.

**RESULTS**

**Reliability**

The final version of the screening tool was applied to each of 18 case studies by 6 registered dietitians. The $k$ score, an interrater measure of agreement, was determined to be 0.85, a satisfactory level of reliability for a nutrition screening tool.

**Validation**

The comparison of the 2002 CFF Consensus Report on Nutrition screening versus the nutrition screening tool proposed here yielded a sensitivity and specificity for the proposed screening tool at 84% and 75%, respectively (see Table 1). Sensitivity and specificity of the proposed nutrition screening tool compared with the in-depth nutrition assessment were 86% and 78%, respectively (see Table 2). Both tests suggest the proposed nutrition screening tool is adequately sensitive and specific in correctly identifying nutrition risk for children and adolescents with CF.

**Application**

Necessary data elements for this screening tool are the child’s age, sex, weights at the current visit and at the previous clinical encounter, and heights at the current visit and at a clinical encounter at least 1 year but no more than 2 years before the current visit. Tanner staging by examination by a physician or a validated self-report method is required for children older than 10 years. Body mass index is calculated and a percentile value for sex and age is determined. A worksheet for determining risk status, including calculation of weight- and height-gain velocity, is presented in Fig. 1. An accompanying algorithm for the nutrition screening process is available in Fig. 2.

Risk points are assigned for each of 3 categories: BMI percentile, daily weight-gain velocity, and annual height-gain velocity. The standards for weight and height gain are rounded to the nearest whole number. Likewise, the calculated values for an individual patient’s weight and height gain also are rounded to the nearest whole number.

**TABLE 3. Minimally acceptable rates of weight and height gain used to determine levels of risk in CF nutrition screening (24,26)**

<table>
<thead>
<tr>
<th>Age, y</th>
<th>Use these values if BMI ≥ 50th percentile</th>
<th>Use these values if BMI &lt; 50th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily weight gain (g/day)</td>
<td>Annual height gain (cm/yr)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2.0–2.99*</td>
<td>3 3</td>
<td>7 7</td>
</tr>
<tr>
<td>3.0–3.99</td>
<td>3 3</td>
<td>6 6</td>
</tr>
<tr>
<td>4.0–4.99</td>
<td>3 2</td>
<td>5 5</td>
</tr>
<tr>
<td>5.0–5.99</td>
<td>3 2</td>
<td>5 5</td>
</tr>
<tr>
<td>6.0–6.99</td>
<td>3 2</td>
<td>5 5</td>
</tr>
<tr>
<td>7.0–7.99</td>
<td>3 3</td>
<td>4 4</td>
</tr>
<tr>
<td>8.0–8.99</td>
<td>3 3</td>
<td>4 4</td>
</tr>
<tr>
<td>9.0–9.99</td>
<td>2 3</td>
<td>4 4</td>
</tr>
<tr>
<td>10.0–10.99</td>
<td>3 3</td>
<td>4 4</td>
</tr>
<tr>
<td>11.0–11.99</td>
<td>3 4</td>
<td>4 4</td>
</tr>
<tr>
<td>12.0–12.99</td>
<td>4 1</td>
<td>4 3</td>
</tr>
<tr>
<td>13.0–13.99</td>
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<td>14.0–14.99</td>
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<td>15.0–15.99</td>
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<td>&lt;1 &lt;1</td>
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<tr>
<td>16.0–16.99</td>
<td>&lt;1 &lt;1</td>
<td>&lt;1 &lt;1</td>
</tr>
<tr>
<td>17.0–17.99</td>
<td>&lt;1 &lt;1</td>
<td>&lt;1 &lt;1</td>
</tr>
<tr>
<td>18.0–18.99*</td>
<td>&lt;1 &lt;1</td>
<td>&lt;0.1 &lt;0.1</td>
</tr>
<tr>
<td>19.0–19.99*</td>
<td>&lt;1 &lt;1</td>
<td>&lt;0.1 &lt;0.1</td>
</tr>
</tbody>
</table>

BMI = body mass index.

*No categories exist in the Fels data (24) for stature for 2- to 3-year-olds or weight and stature for 18- to 20-year-olds. The differences between age- and sex-specific values for the 50th and 10th percentiles for these groups were calculated from the CDC tables (6).
A BMI less than the 10th percentile is assigned 2 risk points. A BMI greater than or equal to the 10th percentile and less than the 50th percentile is assigned 1 risk point. No risk points are assigned when the BMI is equal to or greater than the 50th percentile.

The child’s current BMI determines which level of weight and height gain for sex and age is minimally acceptable. If the child’s BMI is equal to or greater than the 50th percentile, then the minimally acceptable standards for weight and height gain are at the 10th percentile for the Fels growth standards as shown in Table 3 (24). However, if the child’s BMI percentile is less than the 50th percentile, higher expectations for weight and height velocity are set by using the standard values for weight and height gain at the 50th percentile according to the Fels data (24).

The height velocity category is omitted for adolescents who are determined to have reached sexual maturity by Tanner staging, age 15 years for females or age 17 years for males. Nutrition risk status is determined by using the 2 remaining categories, BMI, and weight gain.

A risk score is assigned by tallying points accrued in each of the 3 categories. A score of 0 suggests the absence of growth-related compromise that would potentially result in pulmonary decline. A score of 1 is defined as low risk, 2 or 3 is moderate risk, and 4 is high risk for worsening pulmonary status due to growth impairment. Appropriate medical nutrition therapy should be applied to any risk factors identified in nutrition screening.

The nutrition risk screening tool can be adapted to a take-home, educational document for people with CF and families as shown in Fig. 3. The level of identified

### NUTRITION RISK SCREENING

<table>
<thead>
<tr>
<th>Risk Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today’s date / /</td>
</tr>
<tr>
<td>Body mass index (BMI) percentile</td>
</tr>
<tr>
<td>Today’s weight date / / pounds ounces percentile</td>
</tr>
<tr>
<td>Previous weight date / / pounds ounces percentile</td>
</tr>
<tr>
<td>Weight gain since previous ounces per month</td>
</tr>
<tr>
<td>Expected weight gain for age ounces per month</td>
</tr>
<tr>
<td>Today’s length/height inches percentile</td>
</tr>
<tr>
<td>Previous length/height date / / inches percentile</td>
</tr>
<tr>
<td>Height gain in last year centimeters per year</td>
</tr>
<tr>
<td>Expected length/height gain per year centimeters per year</td>
</tr>
<tr>
<td>Total risk points</td>
</tr>
</tbody>
</table>

Risk point scoring: 0 to 1 = no or low risk, 2 to 3 = moderate risk, 4 or more = high risk.

The risk is for having more lung infections or other problems due to poor nutrition. How well you grow shows how good your nutrition is.

Your Nutrition Status today is: __RED__ High risk. Needs urgent attention!

YELLOW Needs improvement. Watch carefully!

GREEN Low or no risk. Keep up the good work!

This is important because:

Children with CF who grow in height and gain weight normally are more likely to have better lung function as they grow up and become adults.

Nutrition risk screening identifies problems with growth. Finding and fixing growth problems helps to keep your lungs healthy for a long time.

Nutrition Action Plan:

Enzymes: with meals with snacks
Vitamins: Calorie goal: per day

Recommendations:

If you have questions about this contact: CF clinic diettian
Phone Number: Email: Patient Name

FIG. 3. Example of a nutrition risk screening handout adapted for patient and family education.
nutrition risk is reported, along with suggestions for changes or improvements. The original document is reviewed with and given to the family at each clinic visit. A carbonless copy or an electronic version is retained for the medical record.

Although parents are charged with the primary responsibility for managing a child’s nutritional status, the educational document was designed to be easily understood by as many of the children served in CF clinics as possible. Readability scores were determined by the software used to generate the document (Word 2000, Microsoft, Redmond, WA). The Flesch Reading Ease test rates text on a 100-point scale; the higher the score, the easier it is to understand the document. Most standard documents for the general population rate between 60 to 70 points. The Nutrition Risk Screening document was rated at 82.9. The second readability test, Flesch-Kincaid Grade Level Score, rates text on a US educational level. Most standard documents aim for a score of 7.0 to 8.0, between seventh- and eighth-grade level. The Nutrition Screening Risk document was rated as being at 3.4 (third grade, fourth month).

CONCLUSIONS

An evidence-based, validated, and adequately reliable nutrition screening tool is proposed for children and adolescents with CF 2 to 20 years old. Three numerically based categories of weight for height, daily weight gain, and annual height velocity are evaluated to determine nutrition risk. This screening tool is a means of standardizing nutrition status categorization for children and adolescents with CF. The purpose of this tool is to provide clinical direction for determining those individuals at nutrition risk who would benefit from more extensive medical nutrition therapy.

The nutrition screening tool should be administered by the dietitian or a trained staff member at each clinical encounter with an individual with CF. A completed screening does not replace an in-depth nutrition assessment by a registered dietitian. A nutrition assessment is recommended at least yearly to address issues identified by nutrition screening, in addition to dietary intake, biochemical parameters such as micrometnut status, and changes in fat and muscle stores. The clinical judgment of the dietetic practitioner and CF clinic staff decides medical nutrition therapy for the individual with CF.

This nutrition screening tool is based upon available evidence and the expert opinion of the CFF Clinical Practice Guidelines Subcommittee on Growth and Nutrition presented at the North American CF Conference 2005 (4). No data are available to determine the impact of this tool on patient outcomes. As additional evidence becomes available, it is expected that this tool on nutrition screening will be revised or replaced. An example of an anticipated change to this tool is the addition of target height parameters for the child with CF based upon biological parents’ heights. Although the concept of target height is accepted as an important consideration when evaluating growth for any child, the exact methodology does not yet exist for standardized clinical application of this concept. Additional nutrition screening tools are needed for infants and children less than 2 years of age and for adults with CF.

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