SMILE Kids: Simple Malnutrition indicators for Improving nutritional Elements in hospitalized Kids

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Introduction

There are problems everywhere, it’s just you see it or not.
Malnutrition is a common problem in hospitalized pediatric patients ...
Prevalence of malnutrition in hospitalized pediatric patients

(Tienboon P. Asia Pac J Clin Nutr. 2002.)
... which affects clinical outcomes including ...

• Longer length of stay in the hospital\(^1\) (> 3 days)
  \[17.8\% \text{ vs } 38.7\% \ (p=.0001)\]
• Longer use of ventilation\(^2\)
  \[\text{OR}=1.76 \ (1.08-2.88) \ (p=.024)\]
• Increased mortality\(^3\)
  \[\text{OR}=3.98 \ (1.14-13.94) \ (p=.03)\]

3 Leite HP et al. JPEN. 2012.
To prevent, especially, hospital-acquired malnutrition, the risk needs to be identified at the time of admission so that appropriate nutrition intervention can be initiated early ...
... in which nutrition screening and assessment play a big role.
There are several nutrition assessment tools being developed and published ... 

- **Nutrition Risk Score (NRS)**
  - Both adult and pediatric populations (Relly HM et al. Clin Nutr. 1995.)

- **Simple Pediatric Nutritional Risk Score (SPNRS)**
  - Pediatric patients aged > 1 month (Sermet-Gaudelus I et al. Am J Clin Nutr. 2000.)

- **Screening Tool for Assessment of Malnutrition in Pediatrics (STAMP)**
  - Pediatric patients aged 2-17 years (McCarthy H et al. J Hum Nutr Diet. 2008.)

- **Pediatric Yorkhill Malnutrition Score (PYMS)**
  - Pediatric patients aged 1 month – 16 years (Gerasimidis K et al. Br J Nutr. 2010.)

- **Screening Tool for Risk On Nutritional Status and Growth (STRONGkids)**
  - Pediatric patients aged 1 month – 16 years (Hulst JM et al. Clin Nutr. 2010.)

- **Subjective Global Nutritional Assessment for Children (SGNA)**
  - Pediatric patients aged 30 days – 17.9 years (Secker DJ et al. Am J Clin Nutr. 2012.)

... but there is no gold standard for nutrition assessment tool in pediatric population yet.
Why Private Hospital?

Clickpoints of starting R2R
Due to **JCI standards**, nutrition screening and assessment need to be **routinely done** by healthcare professionals in which ...

- Nurses = nutrition screening
- Dietitians = nutrition assessment
Standard AOP.1.4

Patients are screened for nutritional status, functional needs, and other special needs and are referred for further assessment and treatment when necessary.

Intent of AOP.1.4

The information gathered at the initial medical and/or nursing assessment, through the application of screening criteria, may indicate that the patient needs further or more in-depth assessment of nutritional status or functional status, including a fall-risk assessment (also see IPSG.6). The more in-depth assessment may be necessary to identify those patients in need of nutritional interventions and patients in need of rehabilitation services or other services related to their ability to function independently or at their greatest potential.

The most effective way to identify patients with nutritional or functional needs is through screening criteria. Screening generally involves performing a very simple, high-level evaluation of a patient to determine if the patient exhibits a risk that might indicate the need for a more in-depth assessment. For example, the initial nursing assessment form may contain basic criteria for a nutritional screen, such as five or six simple questions with a numerical score relating to recent decline in food intake, weight loss during the past three months, mobility, and the like. The patient’s total score would then identify a patient at nutritional risk requiring a more in-depth nutritional assessment.

In each case, the screening criteria are developed by qualified individuals able to further assess and, if necessary, to provide any required patient treatment. For example, screening criteria for nutritional risk may be developed by nurses who will apply the criteria, dietitians who will supply the recommended dietary intervention, and nutritionists able to integrate nutritional needs with the other needs of the patient. (Also see COP.4 and COP.5)

The information gathered at the initial medical and/or nursing assessment may also identify a need for other assessments, such as dental, hearing, vision, and so on. (Also see AOP.1.2 and AOP.1.2.1) The hospital refers the patient for further assessments within the hospital when available, or through the community following discharge.
Usual pediatric nutrition assessment tool in BI Hospital ...

<table>
<thead>
<tr>
<th>High Risk (✓ = 3)</th>
<th>Moderate Risk (✓ = 2)</th>
<th>Low Risk (✓ = 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Weight loss &gt; 5 % in 1 month (no volunteer)</td>
<td>1. Weight loss &gt; 2 % in 1 month (no volunteer)</td>
<td>1. Weight Stable / gain</td>
</tr>
<tr>
<td>2. BMI &lt; 17 or BMI &gt; 30</td>
<td>2. BMI 17-19.9</td>
<td>2. BMI 20 - 30 N/A</td>
</tr>
<tr>
<td>3. %IW &lt; 65 or % IBW &gt;120</td>
<td>3. %IW 65-79.9</td>
<td>3. %IW 80-120 N/A</td>
</tr>
<tr>
<td>4. Intake meet &lt; 50% TEE</td>
<td>4. Intake meet 50-75 %TEE</td>
<td>4. Intake meet &gt;75-100% TEE ✓</td>
</tr>
<tr>
<td>5. Serum Albumin &lt; 3.0(gm/dl)</td>
<td>5. Serum Albumin 3.0-3.5(gm/dl)</td>
<td>5. Serum Albumin &gt; 3.5 (gm/dl) N/A</td>
</tr>
<tr>
<td>6. NPO 3-5 days / IV 5 days</td>
<td>6. Ordered diet restriction</td>
<td>6. Regular diet</td>
</tr>
<tr>
<td>7. Non oral feeds : TPN / T/P</td>
<td>7. Limited eating due to Food allergies present</td>
<td></td>
</tr>
<tr>
<td>8. Increased needs present: Wound healing /Trauma Dialysis / Post surgery Sepsis / Neoplasm / infection</td>
<td>8. Self feeding limited: Disabilities/ Limited vision/ Hearing impaired/ Mental status change/ Dental / Dementia Wired Jaw Chewing / Swallowing</td>
<td></td>
</tr>
<tr>
<td>**10. High risk diagnosis N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal point...6...</td>
<td>Subtotal point...2...</td>
<td>Subtotal point...3...</td>
</tr>
</tbody>
</table>
... was not able to detect significant differences in anthromopetry ...

Tested using One-way ANOVA with variances of the distributions equal
No statistical difference at p < .05 (n=59)
... nor clinical parameters.

Tested using Welch statistic due to unequal variances of the distributions.
No statistical difference at p < .05 (n=59)
Therefore, our pediatric nutrition assessment tool needs to be revised due to 4 reasons which are ...

• Several nutritional parameters not available ex. Height for age, weight for age, etc.
• Several nutritional parameters not applicable ex. Ideal body weight, body mass index, etc.
• Clinical outcomes not correlated with nutritional status from the assessment
• No evidences support the use of current form
So we decide to ...

develop nutrition assessment tool for hospitalized pediatric patients in BIH which is more precise and accurate than the usual form and be able to detect patients at risk of malnutrition with different clinical outcomes.
The Methods
Doing research is like playing board game.
Implementation

Let's see what we got from this R2R
SMILEkids nutrition assessment tool

Pediatric Nutrition Assessment Form

**Anthropometric Data**

<table>
<thead>
<tr>
<th>Height (cm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usual Body Weight (kg) (<em><strong>/</strong></em>/___)</td>
<td>Ideal Body Weight (kg)</td>
</tr>
<tr>
<td>% Weight/Age</td>
<td>Percentile Weight/Age</td>
</tr>
<tr>
<td>% Weight/Height</td>
<td>Percentile Weight/Height</td>
</tr>
<tr>
<td>% Height/Age</td>
<td>Percentile Height/Age</td>
</tr>
</tbody>
</table>

**Laboratory Data**

<table>
<thead>
<tr>
<th>Date</th>
<th>Hb</th>
<th>Hct</th>
<th>MCV</th>
<th>Albumin</th>
<th>BUN</th>
<th>Cr</th>
<th>ALP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Dietary Assessment**

- Estimated energy expenditure ________ kcal/d
- Estimated protein needs ________ g/d
- Food pattern
  - □ Breastmilk
  - □ Infant Formula
  - □ Medical Food
  - □ Normal diet
  - □ Other ________________________
- Method of feeding
  - □ Breastfeed
  - □ By Caregiver
  - □ Self
  - □ Enteral
  - □ Parenteral
  - □ Other ________________________
- Food intolerance
  - □ Cow Milk
  - □ Soy
  - □ Gluten
  - □ Other ________________________
  - □ No Known Allergy

Medical diagnosis ____________________________________
Current Dietary Intake ____________________________________
### Subjective Global Nutritional Assessment (SGNA)*

<table>
<thead>
<tr>
<th>Nutritional Parameters</th>
<th>SGNA Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal (Score = 1)</td>
</tr>
<tr>
<td></td>
<td>Moderate (Score = 2)</td>
</tr>
<tr>
<td></td>
<td>Severe (Score = 3)</td>
</tr>
<tr>
<td>Current W/A</td>
<td>□ 25th - 97th percentile</td>
</tr>
<tr>
<td></td>
<td>□ &gt; 25th percentile</td>
</tr>
<tr>
<td>Current H/A</td>
<td>□ 25th percentile</td>
</tr>
<tr>
<td>Current Weight</td>
<td>□ &gt; 90% IBW</td>
</tr>
<tr>
<td>Weight loss in past 2 weeks</td>
<td>□ &lt; 5% UBW</td>
</tr>
<tr>
<td>Dietary intake</td>
<td>□ &gt; 75% TEE</td>
</tr>
<tr>
<td>Gastrointestinal symptoms</td>
<td>□ no symptoms</td>
</tr>
<tr>
<td>(anorexia/diarrhea/constipation/nausea/</td>
<td>□ one or more symptoms; not daily</td>
</tr>
<tr>
<td>vomiting)</td>
<td>□ one or more symptoms; daily</td>
</tr>
<tr>
<td>Functional capacity</td>
<td>□ no impairment, energetic, able to perform</td>
</tr>
<tr>
<td></td>
<td>□ restricted in physical strenuous activity,</td>
</tr>
<tr>
<td></td>
<td>□ little or no activities, confined to bed or</td>
</tr>
<tr>
<td></td>
<td>□ severe stress</td>
</tr>
<tr>
<td>Metabolic capacity</td>
<td>□ no stress</td>
</tr>
<tr>
<td></td>
<td>□ moderate stress</td>
</tr>
<tr>
<td></td>
<td>□ severe stress</td>
</tr>
</tbody>
</table>

Subtotal (Total Score) __________


Dietitian’s signature __________________________ Employee ID __________________________ Date ______/______/______


**Moderate Stress:** routine surgery, laparoscopic surgery, minor fracture, infection, pressure sore stage I, II

**Severe Stress:** major surgery, trauma, multiple injury, burn, major fractures, multiple organ failure, pancreatitis, sepsis, multiple sores, chronic illness with acute deterioration, cancer, AIDS, hyperthyroidism.
Data Collection I (n=59)

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Admission</th>
<th>Height</th>
<th>BMI</th>
<th>Weight</th>
<th>%BMI</th>
<th>T2E</th>
<th>Score</th>
<th>Risk</th>
<th>Risk_font</th>
<th>Risk_font_size</th>
<th>Risk_font_color</th>
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</thead>
<tbody>
<tr>
<td>0.1</td>
<td>1m</td>
<td>F</td>
<td>24/5/44</td>
<td>55</td>
<td>54</td>
<td>103.82</td>
<td>4.3</td>
<td>4.2</td>
<td>104.84</td>
<td>46</td>
<td>L</td>
<td>5</td>
</tr>
<tr>
<td>0.5</td>
<td>2m</td>
<td>F</td>
<td>29/5/44</td>
<td>56</td>
<td>57</td>
<td>94.905</td>
<td>4.96</td>
<td>5.7</td>
<td>104.84</td>
<td>46</td>
<td>L</td>
<td>5</td>
</tr>
<tr>
<td>0.1</td>
<td>3m</td>
<td>M</td>
<td>24/5/44</td>
<td>55</td>
<td>54</td>
<td>103.82</td>
<td>4.3</td>
<td>4.2</td>
<td>104.84</td>
<td>46</td>
<td>L</td>
<td>5</td>
</tr>
<tr>
<td>0.5</td>
<td>4m</td>
<td>M</td>
<td>29/5/44</td>
<td>56</td>
<td>57</td>
<td>94.905</td>
<td>4.96</td>
<td>5.7</td>
<td>104.84</td>
<td>46</td>
<td>L</td>
<td>5</td>
</tr>
<tr>
<td>0.1</td>
<td>5m</td>
<td>F</td>
<td>24/5/44</td>
<td>55</td>
<td>54</td>
<td>103.82</td>
<td>4.3</td>
<td>4.2</td>
<td>104.84</td>
<td>46</td>
<td>L</td>
<td>5</td>
</tr>
<tr>
<td>0.5</td>
<td>6m</td>
<td>M</td>
<td>29/5/44</td>
<td>56</td>
<td>57</td>
<td>94.905</td>
<td>4.96</td>
<td>5.7</td>
<td>104.84</td>
<td>46</td>
<td>L</td>
<td>5</td>
</tr>
<tr>
<td>0.1</td>
<td>7m</td>
<td>M</td>
<td>24/5/44</td>
<td>55</td>
<td>54</td>
<td>103.82</td>
<td>4.3</td>
<td>4.2</td>
<td>104.84</td>
<td>46</td>
<td>L</td>
<td>5</td>
</tr>
<tr>
<td>0.5</td>
<td>8m</td>
<td>M</td>
<td>29/5/44</td>
<td>56</td>
<td>57</td>
<td>94.905</td>
<td>4.96</td>
<td>5.7</td>
<td>104.84</td>
<td>46</td>
<td>L</td>
<td>5</td>
</tr>
<tr>
<td>0.1</td>
<td>9m</td>
<td>M</td>
<td>24/5/44</td>
<td>55</td>
<td>54</td>
<td>103.82</td>
<td>4.3</td>
<td>4.2</td>
<td>104.84</td>
<td>46</td>
<td>L</td>
<td>5</td>
</tr>
<tr>
<td>0.5</td>
<td>10m</td>
<td>M</td>
<td>29/5/44</td>
<td>56</td>
<td>57</td>
<td>94.905</td>
<td>4.96</td>
<td>5.7</td>
<td>104.84</td>
<td>46</td>
<td>L</td>
<td>5</td>
</tr>
</tbody>
</table>

Bumrungrad Hospital
%W/A parameters of pediatric patients with different nutritional status (n=59)

Tested using One-way ANOVA with variances of the distributions equal
* statistical difference at p < .05

- Low risk
- Moderate risk
- High risk

Usual SGA
SMILEkids
%H/A parameters of pediatric patients with different nutritional status (n=59)

Tested using One-way ANOVA with variances of the distributions equal
**,** statistical difference at p < .05
Length of stay of pediatric patients with different nutritional status (n=59)

Tested using Welch statistic due to unequal variances of the distributions.
No statistical difference at p < .05.
Length of stay in ICU of pediatric patients with different nutritional status (n=59)

Tested using Welch statistic due to unequal variances of the distributions.
No statistical difference at p < .05.
Days of ventilator use of pediatric patients with different nutritional status (n=59)

Tested using Welch statistic due to unequal variances of the distributions
No statistical difference at p < .05
Discussion

• There are still limitations of interpreting data from pilot study (ex. excluding patients with LOS < 4 days due to no protocol for routine visit before 4 days)

• Characteristics of pediatric patients admitted in regular ward of BIH may not be so critical that nutritional status play significant role in differentiating LOS.
Data collection II (Critical care (CC) pediatric patients admitted from 1/1/2014 to 30/9/2014) (n=49)
%W/A parameters of CC pediatric patients with different nutritional status (n=59)

- Tested using One-way ANOVA with variances of the distributions equal
- No statistical difference at p < .05
Tested using One-way ANOVA with variances of the distributions equal no statistical difference at p < .05
Length of stay of CC pediatric patients with different nutritional status (n=59)

Tested using Welch statistic due to unequal variances of the distributions

* statistical difference at p < .05
Length of stay in ICU of CC pediatric patients with different nutritional status (n=59)

Tested using Welch statistic due to unequal variances of the distributions

* statistical difference at p < .05

** statistical difference at p < .01

Bumrungrad International Hospital

Usual SGA
SMILEkids

Nutritional status
Low risk
Moderate risk
High risk
Days of ventilator use of CC pediatric patients with different nutritional status (n=59)

Tested using Welch statistic due to unequal variances of the distributions

* statistical difference at p < .05

Nutritional status

- Low risk
- Moderate risk
- High risk

Length of stay in ICU (days)

Usual SGA
SMILEkids
Discussion

• There is a **trend of difference** between growth and length of stay of patients using SMILEkids, but **post-hoc analysis couldn’t be done** because only 1 patient is categorized in ‘high risk’ using SMILEkids

• **Revision of indicators used** (along with increasing number of subjects) may be needed to yield better results.
Data collection III (Critical care (CC) pediatric patients admitted in the year 2013) (n=40)
### Subjective Global Nutritional Assessment (SGNA)

<table>
<thead>
<tr>
<th>Nutritional Parameters</th>
<th>SGNA Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal (Score = 1)</td>
</tr>
<tr>
<td>Current W/A: 25th - 97th percentile</td>
<td>□</td>
</tr>
<tr>
<td>Current H/A: 25th percentile</td>
<td>□</td>
</tr>
<tr>
<td>Current Weight: &gt; 90% IBW</td>
<td>□</td>
</tr>
<tr>
<td>Weight loss in past 2 weeks: &lt; 5% UBW</td>
<td>□</td>
</tr>
<tr>
<td>Dietary intake: &gt; 75% TEE</td>
<td>□</td>
</tr>
<tr>
<td>Gastrointestinal symptoms (anorexia/diarrhea/constipation/nausea/vomiting): no symptoms</td>
<td>□</td>
</tr>
<tr>
<td>Functional capacity: no impairment, energetic, able to perform age-appropriate activity</td>
<td>□</td>
</tr>
<tr>
<td>Metabolic stress: no stress</td>
<td>□</td>
</tr>
</tbody>
</table>

Subtotal

Total Score  

- **[6–9]**: Normal/mildly malnourished
- **[10–13]**: Moderately malnourished
- **[14–18]**: Severely malnourished

Score:

- Dietitian’s signature: ___________________________  
- Employee ID: ___________________________  
- Date: __________/________/______

---


**Moderate Stress**: routine surgery, laparoscopic surgery, minor fracture, infection, pressure sore stage I, II

**Severe Stress**: major surgery, trauma, multiple injury, burn, major fractures, multiple organ failure, pancreatitis, sepsis, multiple sores, chronic illness with acute deterioration, cancer, AIDS, hyperthyroidism.
Tested using One-way ANOVA with variances of the distributions equal
**,** statistical difference at $p < .05$

%W/A parameters of CC pediatric patients with different nutritional status ($n=89$)
%H/A parameters of CC pediatric patients with different nutritional status (n=89)

Tested using One-way ANOVA with variances of the distributions equal
**,** statistical difference at p < .05
Length of stay of CC pediatric patients with different nutritional status (n=89)

Tested using Welch statistic due to unequal variances of the distributions

*,** statistical difference at p < .05

Length of stay (days)

Low risk                      Moderate risk                High risk

Nutritional status

SMILEkids

SMILEkids V2
Length of stay in ICU of CC pediatric patients with different nutritional status (n=89)

Tested using Welch statistic due to unequal variances of the distributions, no statistical difference at p < .05.
Days of ventilator use of CC pediatric patients with different nutritional status (n=89)

Tested using Welch statistic due to unequal variances of the distributions
no statistical difference at p < .05
Discussion

• There is an improved trend of difference between growth, LOS, LOS in ICU, days of ventilator using SMILEkids V2 comparing with SMILEkids original though not statistically significant.

• LOS in critical care pediatric patients not at risk of malnutrition seems to be significantly less than patients with risk or with malnutrition.
Growth parameters of CC pediatric patients with different nutritional status (n=89)

Tested using One-way ANOVA with variances of the distributions equal
* statistical difference at p < .05
Clinical outcomes of CC pediatric patients with different nutritional status (n=89)

Tested using Welch statistic due to unequal variances of the distributions
* statistical difference at p < .05
What to do next?

Lessons learned and challenges ongoing
Lessons learned

• SMILEkids tends to do better in detecting malnutrition in non-critically-ill hospitalized children when comparing with usual SGA but fails in detecting malnutrition in critically ill children.

• SMILEkids V2 were then developed, resulted in better detection of malnourishment than SMILEkids. Although not statistically significant between 3 classes of severity, but at least it could significantly separate those with and without risk of malnutrition.
Challenges

✓ **Collect the data** from routine practice to evaluate the efficacy of detecting malnutrition in the real situation and to revise indicators in the future (if need) for **better detecting power**.

✓ Compare with **published nutrition assessment tools** in pediatric to evaluate the efficacy as a further research.

✓ Based on the risk assessed using SMILEkids, New **pediatric nutrition protocol** based on malnutrition risk need to be developed to appropriately implement the nutrition intervention according to each severity.

✓ **Nutrition screening tool specific to BI pediatric populations** can also be made if the indicators used in assessment are revised.
Quality Improvement Team

Certified Dietitians (CDT)

Thanit Vinitchagoon
Chatchanok Pattanaboonyakorn
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References


Thank you ☺️