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REGULAR ARTICLE

The STRONGkids nutritional risk screening tool can be used by paediatric nurses to identify hospitalised children at risk

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ABSTRACT

Aim: Hospitalised children have higher rates of undernutrition. Early detection of at-risk patients could lead to prompt preventative or corrective interventions. Several nutritional risk screening tools are available for screening hospitalised children including the STRONGkids tool. This study was designed to assess the usefulness of STRONGkids when applied by nurses rather than a paediatrician.

Methods: The STRONGkids questionnaire was simplified to enhance clarity with nursing staff. Trained nursing staff were asked to apply the tool to children, aged 1 month to 17 years, admitted to the Christchurch Hospital, New Zealand. Each patient was also assessed by a paediatrician. In addition, the current nutritional state of each patient was defined by measuring their weight and height.

Results: Of the 162 children enrolled, 11.7% were undernourished and 13% overnourished. STRONGkids recognised 84% of undernourished children when the tool was applied by nurses and 90% when the tool was applied by a paediatrician, indicating substantial agreement (kappa = 0.65). A minor simplification to the questionnaire improved its utility.

Conclusion: STRONGkids successfully recognised at-risk children, when applied by either nurses or a paediatrician. It was suitable and feasible for nursing staff to use it to screen for children at risk of nutritional deterioration.

INTRODUCTION

Children requiring hospitalisation have higher rates of malnutrition than healthy children, and altered nutritional status can have an adverse impact on morbidity during hospitalisation and the length of hospital stay (1,2). Early detection of nutritional deterioration in hospitalised children provides the opportunity to intervene and prevent further decline, resulting in potentially faster recovery (2,3).

In recent years, several nutritional risk screening tools have been developed to enhance the early identification of children at greater nutritional risk. One of the newly developed tools for hospitalised children is the Screening Tool for Risk On Nutritional status and Growth (STRONGkids), which was developed and validated in the Netherlands where it is now used widely by paediatric staff (4). A previous New Zealand study showed that STRONGkids was effective and reproducible in this setting (5). STRONGkids was able to identify 100% of currently undernourished children, and higher risk scores were associated with children aged <5 years of age and male. Undernourished children in that cohort had a longer hospital stay than well-nourished patients (5).

However, STRONGkids was designed to be applied by a physician rather than by nursing staff. Given the utility of STRONGkids in the NZ environment, we aimed to assess the practicality of this tool when applied by trained paediatric nursing staff rather than by a paediatrician, and a specific aim of this study was to compare the outcomes between the two groups.

PATIENTS AND METHODS

Population

Surgical and medical paediatric inpatients aged between 1 month and 17 years, admitted to the paediatric wards at

Key notes

- Hospitalised children have higher rates of undernutrition and early detection could lead to prompt intervention.
- This New Zealand study compared the use of a simplified STRONGkids nutritional screening tool by specially trained nurses and a paediatrician.
- STRONGkids proved to be a feasible tool for recognising hospitalised children who were at risk of malnutrition, and the inter-rater agreement was substantial when this tool was applied by nurses and a paediatrician (kappa = 0.65).

the Christchurch Hospital, Christchurch, NZ, were enrolled over a 2-month period from October 30, 2012. Patients admitted under a paediatric oncologist were excluded. The Paediatric Department at Christchurch Hospital provides secondary level paediatric care for Christchurch and the surrounding Canterbury region, together with multiple tertiary services for the South Island of New Zealand.

Patients were independently assessed during the first day of their admission by one of the 24 nursing staff and by a paediatrician. The order of assessment was unrestricted, and the paediatrician was not involved in the patients' treatment. Assessed patients were subsequently excluded from the study if they were discharged within the first 24 h.

Anthropometric measurements (weight and height) were undertaken, following previously defined methods (5). Body mass index (BMI), weight for height (WFH), weight for age (WFA) and height for age (HFA) z-scores were derived using the Epi Info nutrition calculator, version 3.5.3., 2011 (http://wwwn.cdc.gov/epiinfo/). The current nutritional state of each patient was defined using World Health Organisation criteria (6). Self-reported ethnicity and the length of hospital stay were recorded for each patient. Patients referred to a dietitian by treating ward physicians, who were not involved in the research project, were noted. The findings of formal dietetic assessment to evaluate the need for nutritional intervention were recorded and subsequently contrasted to the STRONGkids results.

The study was approved by the University of Otago Human Ethics Committee. At the time of enrolment, the protocol and nature of the study was explained in detail to parents or caregivers and children older than 10 years, and their written consent or assent was obtained. The opportunity to withdraw was given to each patient or parent.

Application of the STRONGkids questionnaire

The STRONGkids questionnaire was used as previously described (4). The questionnaire was simplified by changing the answers to a yes/no format and by providing Table 2 of the tool as a hierarchy. Before the onset of the study, training sessions were provided for the nursing staff to explain the STRONGkids questionnaire in detail and to teach the correct application of the tool.

Survey of nursing impressions of the STRONGkids tool

After the assessment, nursing staff were asked to provide their impressions of the application of the tool by answering a series of standard questions.

Statistical analysis

Sample size was calculated to be 160–180 subjects assuming an 80% power for a dichotomous variable – no risk compared to medium or high risk – and detected kappa (k) to be 0.7 (7). The results of the nursing staff evaluations were compared to the paediatrician's results and to the patients' current nutritional status. The inter-rater reliability of the STRONGkids tool was tested using Cohen's kappa agreement (8). SPSS 19-X software for Windows was used to perform the analysis. Epi Info software was used to calculate BMI, WFA, HFA and WFH z-scores. The level of significance was set at a p value of <0.05.

RESULTS

Subjects

Of the 355 patients admitted to the paediatric wards during the period of observation, 187 children were eligible for enrolment. Nine patients or parents refused to participate, and 16 were unable to be invited to the study, meaning that 162 children were enrolled. The majority (83%) of the patients were admitted under medical teams, while 17% were admitted for surgical reasons. A history of chronic underlying disease was present in 59 (36%) patients. The median length of hospital stay was 2.76 days (1–30 days). Additional background characteristics of the 162 children are summarised in Table 1.

Nutritional state of the patients

The prevalence of moderate/severe undernutrition was 11.7% (19 patients), while overnutrition, including both overweight and obesity, was seen in 13% (22) of the children. Overall, 63% of undernourished and 41% of overnourished patients were male. Overweight and obesity was more common in Pacific Island patients than New Zealand European children (25% versus 12%; $p = 0.02$).

A greater percentage of undernourished children stayed in hospital for more than 4 days than in the overnourished patient group (37% versus 22%, $p = 0.03$). More than two-thirds (68%) of the undernourished patients were younger than 5 years ($p = 0.0001$). An underlying chronic disease was observed in 58% of the undernourished children and 33% of the well-nourished children ($p = 0.0006$).

Outcomes of STRONGkids assessments

All 162 patients were assessed by both a nurse and a paediatrician. The nurses assessed a median of six children; however, the individual agreement between the assessors

Table 1 Patients' demographic and anthropometric characteristics

Number	162
Age (median, range)	1.85 (1 month-16.4 years)
Male (%)	77 (47)
Ethnicity (%)	
NZ European/European	122 (76)
Maori	23 (14)
Pacific Islander	7 (4)
Asian	3 (2)
Middle Eastern	2 (1)
African	4 (3)
Weight (kg, median, range)	11.9 (3.34–68.2)
Height (cm, median, range)	87.5 (51–177)
Weight for Age (WFA) z-score (median, range)	0.095 (−5.12 to 3.02)
Height for Age (HFA) z-score (median, range)	0.22 (−5.07 to 3.42)

was only obtained for the five nurses who assessed ten or more patients (Table 2). The overall agreement between the nursing and paediatrician assessments was substantial (k = 0.65).

When assessed by a paediatrician, 42 patients were classified as low risk, 102 as medium risk and 18 as high risk. When the nurses applied STRONGkids, 54 children were classified as low risk, 91 as medium risk and 17 as high risk. The paediatrician classified two of the 19 currently undernourished children to be at low risk, while nurses classified three of these children at low risk. Overall, the tool was able to recognise 84% and 90% of undernourished patients in the at-risk groups when applied by nurses and a paediatrician, respectively.

The answers to each of the STRONGkids questions were assessed individually, and the rate of disagreement between the assessors was evaluated. The greatest disagreement between assessors (n = 21; 13%) was seen with Question 3, which covers nutritional intake or losses. In contrast, the lowest rates of disagreements were seen with Question 1, which asks for a subjective assessment of nutritional state, and Question 2, which deals with the presence of high-risk diseases (n = 5 for both questions; 3%) (Table 3).

Table 3 Disagreements between the nursing and medical assessors

	Disagreements between the obtained answers	Disagreements between the final resultant risk category
Question 1	12	5
Question 2	5	5
Question 3A	17	1
3B	36	14
3C	20	4
3D	19	2
Question 4	25	11

The disagreements between the answers given by the patients to a paediatrician and twenty-four nurse participants for each individual question (and subquestions) for 162 assessed patients are shown, and the resultant final risk (low, medium and high) disagreements were determined.

STRONGkids score and assessment by a dietitian

Ward physicians referred 34 (21%) of the 162 patients to a dietitian for further evaluation and nutritional intervention. These dietetic reviews concluded that 29 (85%) of these children were at risk of malnutrition, while the STRONGkids tool identified 25 (86%) of these 29 children as being at risk.

Nursing staff survey results

The survey was completed by 15 of the 24 nurses who participated in the study. All the nurses found the tool easy to understand, with the exception of one nurse who felt that it was unclear for the first couple of times she applied the tool. Most of the nurses who filled in the questionnaire (12/15) indicated that they completed the tool in 1–5 min, while the other three nurses felt they needed 6–10 min to complete the tool. The tool was not felt to interfere with other nursing activities by eight of the respondents. However, the other seven nurses indicated that the tool was harder to complete during busy shifts.

Table 2 Agreement between assessments by paediatric nursing and medical staff

	Kappa value	Number of patients
Nurses (All)	0.65	162
Nurses (assessed ≥10 patients)		
Nurse A	0.51	20
Nurse B	0.65	17
Nurse C	0.8	16
Nurse D	0.74	14
Nurse E	0.83	10
Nurses (assessed <4 patients)	0.9	20

The kappa values assessing agreement between the paediatrician and all the nurses, and each nurse who assessed more than ten patients and the nurses who assessed <4 patients.

DISCUSSION

This study demonstrated that the STRONGkids tool was able to identify the majority of hospitalised children at risk of undernutrition when applied by either paediatric nurses or a paediatrician, and provided a quick and reliable assessment of that risk. As the application of this tool has been shown to enable health professionals to recognise malnutrition early, its use could now be considered when children first come into contact with paediatric staff when they are admitted to hospital.

In our previous studies in New Zealand (5) and in a developing country setting (9), STRONGkids proved to be an easy, quick and reliable tool to identify at-risk patients. In the current study, STRONGkids was also able to identify 86% of the patients who were deemed to be at risk of malnutrition by paediatric dietitians. In the same manner, the STRONGkids tool was able to identify 92% of undernourished children when applied in a British hospital (10). Furthermore, similar findings were obtained when the tool was also applied by a paediatric dietitian following a period of training (8).

A recent study in Belgium aimed to assess the feasibility and reliability of the STRONGkids tool in 365 hospitalised paediatric patients (11). When applied by nursing staff, the reported inter-rater reliability was substantial (k = 0.61). Similarly, there was substantial agreement between the nursing and medical assessments in the current study (k = 0.65).

This tool was originally designed to be used by physicians, mainly because the first question involves a subjective clinical assessment. However, disagreement between the assessors in their interpretation of this question of the STRONGkids tool occurred on just five occasions in the

current study. In contrast, the answers to the third question, which asked about recent nutritional intake and losses, were more frequently discordant. This question and the fourth question, which focused on recent weight loss or poor weight gain, are questions that any health provider should be able to ask. Furthermore, these two questions are similar to questions included in two other paediatric nutritional risk screening tools, the Screening Tool for the Assessment of Malnutrition in Paediatrics (12) and Paediatric Yorkhill Malnutrition Score (13), which are both designed for use by nursing staff.

The current study has indicated that more than 10% of children admitted to this hospital were undernourished. This is consistent with our previous report, which showed higher rates of undernutrition in hospitalised children than in well children recruited from the same local community (5). As has been reported in previous studies (1,4), undernutrition was more common in patients younger than 5 years. In the current study, more than two-thirds of the undernourished patients were younger than 5 years.

This study would have been strengthened by having a dietetic assessment for each patient, as a gold standard to validate the evaluations of the nursing staff and paediatrician. In this study, a single paediatrician who was experienced in the use of this tool independently assessed all the patients, which minimised the risk of error in comparison with assessments by multiple individuals. The nutritional risk screening tools that are currently available are designed to assess the risk of nutritional deterioration during the child's current hospital stay rather than the long-term nutritional progress of children. Ideally, all children included in this study would have had repeated complete anthropometric assessment during and at the end of their hospital stay but this was not feasible or practical.

In conclusion, the current study showed that STRONGkids tool was a valid tool for screening for nutritional risk in hospitalised children. It is important that children who are at risk of malnutrition are identified early during their hospital admission. Further studies are now required to confirm these results in other paediatric centres.

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References

1. Middleton MH, Nazarenko G, Nivison-Smith I, Smerdely P. Prevalence of malnutrition and 12 months incidence of mortality in two Sydney Teaching Hospitals. *Inter Med J* 2001; 31: 455–61.
2. Pawellek I, Dokoupil K, Koletzko B. Prevalence of malnutrition in paediatric hospital patients. *Clin Nutr* 2008; 27: 72–6.
3. Barker LA, Gout BS, Crowe TC. Hospital malnutrition: prevalence, identification and impact on patients and the healthcare system. *Int J Environ Res Public Health* 2011; 8: 514–27.
4. Hulst JM, Zwart H, Hop WC, Joosten KFM. Dutch national survey to test the STRONGkids nutritional risk screening tool in hospitalized children. *Clin Nutr* 2010; 29: 106–11.
5. Moeeni V, Walls T, Day AS. Nutritional status and nutrition risk screening in hospitalized children in New Zealand. *Acta Paediatr* 2013; 102: e419–23.
6. World Health Organisation. *Management of severe malnutrition: a manual for physicians and other senior health workers [Internet]*. World Health Organisation, 1999. Available at: whqlibdoc.who.int/hq/1999/a57361.pdf. (accessed on May 6, 2011).
7. Sim J, Wright C. The kappa statistic in reliability studies: use, interpretation, and sample size requirements. *Phys Ther* 2005; 85: 257–68.
8. Viera AJ, Garrett JM. Understanding interobserver agreement: the kappa statistic. *Fam Med* 2005; 37: 360–3.
9. Moeeni V, Walls T, Day AS. Assessment of nutritional status and nutritional risk in hospitalised Iranian children. *Acta Paediatr* 2012; 101: e446–51.
10. Ling RE, Hedges V, Sullivan PB. Nutritional risk in hospitalised children: an assessment of two instruments. *e-SPEN* 2011; 6: 153–7.
11. Huysentruyt KM, Alliet P, Muyshont L, Rossignol R, Devreker T, Bontems P, et al. The STRONGkids nutritional screening tool in hospitalized children: a validation study. *Nutrition* 2013; 29: 1356–61.
12. McCarthy H, McNulty H, Dixon M, Eaton-Evans MJ. Screening for nutrition risk in children: the validation of a new tool. *J Hum Nutr Diet* 2008; 21: 395–6.
13. Gerasimidis K, Keane O, Macleod I, Flynn DM, Wright CM. A four-stage evaluation of the Paediatric Yorkhill Malnutrition Score in a tertiary paediatric hospital and a district general hospital. *Br J Nutr* 2010; 104: 751–6.