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RESEARCH

Hospital-acquired malnutrition in children at a tertiary care hospital

Del-Rossi Sean Quadros[a*], Rose Kamenwa[a], Samuel Akech[a] and William M Macharia[a]

[a]*Department of Paediatrics and Child Health, Aga Khan University Hospital, Nairobi, Kenya.*
**Corresponding author, email: dellychka@hotmail.com*

Objectives: This study sought to investigate the incidence and factors associated with hospital-acquired malnutrition in children.
Design: A hospital-based longitudinal survey carried out between December 2013 and February 2014.
Setting: Aga Khan University Hospital, Nairobi, Kenya, a tertiary care hospital.
Subjects: One hundred and seventy children who met the inclusion criteria were included in the study.
Outcome measures: Anthropometry was done at admission and discharge. Incidence of hospital-acquired malnutrition was estimated from the total number of children showing a decrease in weight-for-height/length (WFH) or Body Mass Index (BMI) z-scores from the time of admission to discharge. Logistic regression analysis was performed to determine associations between selected variables and weight loss during hospitalisation.
Results: Albeit a borderline level of significance, a decrease in calculated z-scores occurred in 60.6% (Confidence Interval (CI) 53.1–67.6%) of children during hospitalisation with a mean weight decrease of 0.5 kg (Standard Deviation (SD) ± 3.37, $p = 0.055$). Children ≤ 60 months of age demonstrated a mean decrease in weight-for-height/length z-score of 0.145 (SD ± 0.73, $p = 0.042$); and those > 60 months, a mean decrease in BMI z-score of 0.152 (SD ± 0.39, $p = 0.004$). The majority with weight loss had been admitted with a diagnosis of gastroenteritis (81.2%), gastritis (64.3%) and pneumonia (55.6%). Weight loss was associated with duration of admission: 3 - 5 days (Odds Ratio (OR) 2.43, CI 1.46–4.03), 5 - 7 days (OR 4.67, CI 1.34–16.24), and > 7 days (OR 2.75, CI 0.88–8.64); score test for trend of odds is OR 1.37 (95% CI 1.11–1.69, $p = 0.003$).
Conclusion: This study found a high incidence of hospital-acquired malnutrition in children. The most affected were those with gastroenteritis, gastritis and pneumonia. Hospital-acquired malnutrition was associated with an increased duration of hospitalisation.

Keywords: anthropometric measurements, Body Mass Index z-scores, hospital-acquired malnutrition, weight-for-height z-scores

Introduction

Hospital-acquired malnutrition occurs as a result of reduction in food intake, increased dietary losses and an increased calorie requirement as a result of a disease-induced high catabolic state.[1] Deterioration of nutritional status has been demonstrated following admission of children to a hospital.[2] Children have limited energy reserves and an increased energy requirement to cater for higher metabolic and nutrient turnover rates when compared with adults. Furthermore, they have nutritional increased energy demands for growth and development. Thus, poor feeding in a sick child further increases unmet needs placing the children at risk of malnutrition.

Malnutrition is an important health problem in children of both resource rich and poor countries with a prevalence of 6–41%.[3] Approximately 9–13% of children admitted to a rural Kenyan hospital had severe acute malnutrition at admission.[4,5] According to the Kenyan Demographic and Health Survey (KDHS) of 2014, 26–29% of children in rural and 20% in urban areas were stunted (height-for-age z-score < −2 SD). Overall, 4% of children were wasted (weight-for-height z-score < −2 SD).[6] These data demonstrate that some of the children admitted to hospital already had pre-existing malnutrition. Therefore, even minimal nutritional depletion during the admission would lead to a worsening of the nutritional status.[2]

While nutritional risk of children with severe or chronic disease is usually anticipated, that of those with a less serious condition tend to be overlooked.[7,8] Children admitted with acute illnesses generally stay for a few days in hospital, unless there is an underlying problem or exacerbation of a chronic illness. During this brief stay attention is directed almost exclusively at the primary medical problem, with little attention to nutrition.

Traditionally the anthropometric indices used, as part of nutritional assessment, are weight-for-height/length (WFH), as a measure of wasting or acute malnutrition; height/length-for-age (HFA), as a measure of stunting or chronic under-nutrition; weight-for-age (WFA), as a measure of underweight or wasting and stunting combined; and, mid-upper arm circumference (MUAC), as a measure of wasting or acute malnutrition where weight or height cannot be measured accurately.[9,10]

Currently there is a lack of consensus on what the ideal method of assessing acute malnutrition occurring within the hospital setting should be. WFH z-scores and MUAC are the anthropometric indicators most often used to assess acute malnutrition in children aged 0–60 months; and, BMI z-scores are used to assess malnutrition in those aged > 60 months.[9,10] This study undertook to establish the incidence of hospital-acquired malnutrition, defined as decreases in WFH and BMI z-scores post admission.

Methods

A longitudinal survey was carried out at the Aga Khan University Hospital, Nairobi (AKUH, N), a 254-bed private tertiary institution. The paediatric ward is a 30-bed capacity unit, with a five-bed paediatric high-dependency unit and 25 general ward beds. The paediatric ward admits 1 100–1 450 patients annually. The hospital serves residents of Nairobi and occasionally receives referrals from elsewhere.

Children aged between 29 days and 15 years and who had a hospital stay ≥ 48 h were eligible for inclusion; but, those with oedematous malnutrition (presence of bilateral pitting oedema of nutritional origin) were excluded. Informed written consent was obtained from parents or accompanying guardians. Ethical approval for the study was obtained from the Aga Khan University Ethics Committee (*Ref*: 2013/REC-39/v4, 09/12/2013).

The principal investigator or an assistant trained in taking anthropometric measurements took all the weights at admission and discharge using a Seca® digital baby-weighing scale (United Kingdom) for children less than 15 kgs, measured to the nearest 10 g, or a Seca® standing weighing scale (United Kingdom) for children above 15, measured to the nearest 100 g. The same weighing scales were used for all the measurements. Participants were weighed naked if < 2 years and with minimal clothing for those > 2 years. In case of dehydration, weight was repeated after adequate rehydration (defined using World Health Organisation (WHO) criteria: child being alert, normal skin turgor, moist mucous membranes, flat anterior fontanel, eyes not sunken, warm extremities, capillary refill ≤ 2 sec) and the latter was considered as the baseline. Assessment for rehydration was done by the attending clinician.

The enrolled participants also had height/length taken by the principle investigator with the aid of a pre-trained assistant, at admission. Height/length was measured using a Seca® infantometer (United Kingdom) for those less than two years of age, measured to the nearest 0.1 cm, and a wall mounted Seca® stadiometer (United Kingdom) for those above two years of age, measured to the nearest 0.5 cm.

WFH (children aged 0–60 months) and BMI (children aged > 60 months) z-scores were calculated using the WHO software, WHO Anthro and WHO AnthroPlus.

All children admitted to the hospital underwent a routine initial nutritional assessment, planned by the hospital clinician and/or nutritionist and guided by the hospital's nutritional policy. The information on nutritional status was available to the clinical team from the medical records. All patients were followed up until discharge or death.

All biodata and the laboratory results of each patient were stored in a database using Microsoft Excel® using a unique serial number as its identifier, so as to maintain patient anonymity. Data were regularly backed up both on and off site and was anonymised. Access to the results was restricted to the principal investigator and co-investigators.

Data were collected from December 2013 to February 2014. Analyses were done using Stata data and statistical software (STATA 11.0®).

Categorical data were analysed using proportions and continuous data using means, medians, standard deviation (SD) and interquartile range (IQR).

For purpose of this study, hospital-acquired malnutrition was defined as a decrease in WFH z-scores in children aged 0–60 months and BMI z-scores in children aged > 60 months from the time of admission to discharge. Patients were grouped into two categories: those showing a decrease in WFH or BMI z-scores from the time of admission to discharge; and, those showing either no change or an increase in WFH or BMI z-scores. The incidence of hospital-acquired malnutrition was obtained from the total number of children showing a decrease in WFH or BMI z-scores from the time of admission to discharge. The incidence of hospital-acquired malnutrition was calculated by dividing the total number of patients showing a decrease in WFH or BMI z-scores by the total number of children studied, multiplied by one hundred. A degree of precision was determined using a 95% Confidence Interval (CI).

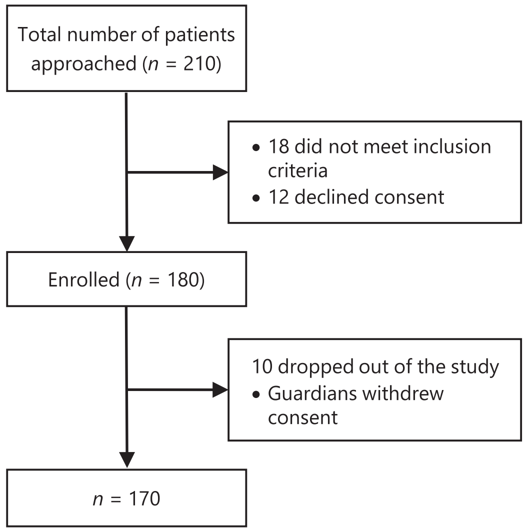

Figure 1: Flow chart of recruitment process.

Weight loss was summarised as WFH z-scores using WHO criteria as normal (z-score > −1 SD), mild wasting (−2 ≤ z-score < −1 SD), moderate wasting (−3 ≤ z-score < −2 SD) and severe wasting (z-score < −3 SD) and BMI z-scores using WHO criteria as thinness (z-score < −2 SD), normal (−2 ≤ z-score ≤ +1 SD), overweight (+1 < z-score ≤ +2SD) and obese (z-score > +2 SD). This data was illustrated in tabular form (Table 3 and 4).

Results

This study was conducted between 15th December 2013 and 15th February 2014. A total of 210 patients were approached for recruitment with 170 participants eventually enrolled, all of whom completed the study (Figure 1).

The median age of participants was 39.5 months (IQR 15–89 months). The majority (62.4%) of the patients were below the age of 60 months. Ninety participants (52.9%) were boys and 80 (47.1%) were girls, and the duration of hospital stay ranged from 2 to 25 days, with a median of 3 days (IQR 2–4). Conditions affecting the gastrointestinal system were the most common at admission followed by upper and lower respiratory tract and central nervous system conditions (Table 1).

Median weight at admission was 14.8 kgs (IQR 10.2–23.4), and median height was 97.0 cm (IQR 78–126). At discharge, the median weight dropped to 14.2 kgs (IQR 9.88–23.3). A mean drop of 0.5 kg (SD ± 3.37) from admission to discharge was observed. All age groups demonstrated a reduction in weight during hospitalization; however, it was more common in children aged 12–24 months (23/32, 71.9%), and lowest in those aged < 12 months (14/29, 48.3%). The greatest weight loss was observed among children diagnosed with gastroenteritis (26/32, 81.3%), gastritis (9/14, 64.3%) and pneumonia (10/18, 55.6%).

Table 1: General characteristics of patients admitted to Children's Ward, AKUH,N.

Variable n = 170	Frequency (%)
Sex (%)	
Male	90 (52.9)
Female	80 (47.1)
Age (months)	
1 to ≤ 12	29 (17.1)
> 12 to ≤ 24	32 (18.8)
> 24 to ≤ 60	45 (26.5)
> 60 to ≤ 144	47 (27.6)
> 144	17 (10.0)
Diagnosis on admission	
Gastrointestinal conditions	65 (38.2)
Respiratory conditions	48 (28.2)
Neurological conditions	27 (15.9)
Others (haemato-oncological, endocrinological, cardiac, surgical, nephrological)	30 (17.7)
Duration of hospital stay (days)	
2 to ≤ 3	66 (38.8)
> 3 to ≤ 5	72 (42.4)
> 5 to ≤ 7	17 (10.0)
> 7	15 (8.8)

Table 2: Comparison of change in z-score at time of admission and discharge.

Mean z-score	Admission	Discharge	Difference	t-test
WFH z-score (≤ 60 months)	0.093 (SD ±1.42)	−0.052 (SD ±1.38)	0.145 (SD ±0.73)	p = 0.042
BMI z-score (> 60 months)	−0.305 (SD ±1.57)	−0.457 (SD ±1.68)	0.152 (SD ±0.39)	p = 0.004

Notes: WFH = weight for height, BMI = body mass index.

There was a significant change in both WFH z-scores (mean difference 0.145, SD ± 0.73, p = 0.04), in those ≤ 60 months, and BMI z-scores (mean difference 0.152, SD ± 0.39, p = 0.004), in those > 60 months from admission to discharge (Table 2).

A total of 60.6% (CI 53.1–67.6%) (103/170) of patients showed a decrease in either their WFH z-scores in children age ≤ 60 months or BMI z-score in those aged > 60 months, 19.4% showed no change and 20.0% showed an increase.

According to WFH nutritional classification in children ≤ 60 months by WHO, 9% (n = 9) of children in the study were categorised as having worsened nutritional status. Notably, 7.8% (n = 7) of children moved from the normal to the mild category, a worsened nutritional status. Out of the eight children in the mild category at admission, 12.5% (n = 1) moved to the normal category and another 12.5% (n = 1) moved into the moderate category. Of the 10 children in the moderate category, 20% (n = 2) moved into the severe category and 10% (n = 10) moved into the mild category. The one child in the severe category at the time of admission moved to the moderate category by the end of hospitalisation. At discharge the frequencies in the normal, mild, moderate and severe categories were 77.1, 12.8, 8.3 and 1.8%, respectively (Fisher's exact; p < 0.001; Table 3).

Table 3: Comparison of nutritional status in children ≤ 60 months at time of admission and discharge using WHO's criteria.

Nutritional status	Admission	Discharge
WFH z-score	n (%)	n (%)
Normal z-score > −1 SD	90 (82.6)	84 (77.1)
Mild −2 ≤ z-score < −1 SD	8 (7.3)	14 (12.8)
Moderate −3 ≤ z-score < −2 SD	10 (9.2)	9 (8.3)
Severe z-score < −3 SD	1 (0.9)	2 (1.8)
Total	109 (100)	109 (100)

Notes: WHO = World Health Organisation, WFH = weight for height, SD = standard deviation.

Table 4: Comparison of nutritional status in children > 60 months at time of admission and discharge using WHO's criteria.

Nutritional status	Admission	Discharge
BMI z-score	n (%)	n (%)
Thinness z-score < −2 SD	9 (14.8)	11 (18.0)
Normal −2 ≤ z-score ≤ +1 SD	38 (62.3)	36 (59.0)
Overweight +1 < z-score ≤ +2 SD	10 (16.4)	10 (16.4)
Obese z-score > +2 SD	4 (6.5)	4 (6.5)
Total	61 (100)	61 (100)

Notes: WHO = World Health Organisation, BMI = body mass index, SD = standard deviation.

According to the WHO's BMI nutritional classification in children > 60 months, 3% (n = 2) of children had worsening nutritional status. At discharge, 5.3% (n = 2) of the children in the normal category shifted to the thinness category while the rest remained unchanged (Fisher's exact; p < 0.001; Table 4).

Duration of hospital stay was significantly associated with weight loss: 3 - 5 days (OR 2.43,CI 1.46–4.03), 5 - 7 days (OR 4.67, CI 1.34–16.24), and > 7 days (OR 2.75, CI 0.88–8.64); score test for trend of odds is OR 1.37 (95% CI 1.11–1.69; p = 0.003). Other factors that appear to show an association with weight loss included an age of 12–24 months, diagnosis of gastroenteritis with symptoms of diarrhea and vomiting, use of anticonvulsants, oral rehydrating solution (ORS) and zinc sulphate (Table 5).

Discussion

Hospital-acquired malnutrition has consequences on patient outcomes, healthcare costs and resource utilisation. As such, there is a need for hospitals to monitor its occurrence using cost-effective but accurate tools.

Table 5: Logistic regression analysis on associated factors for nutritional deterioration.

Variable	Total *n*	Weight loss *n* (%)	Odds (95% CI)	Score test for trend of odds		
				Odds (95% CI)	x^2	*p*-value
Hospital Stay (days)						
2 to 3	66	27 (40.9)	0.7 (0.4–1.1)			
> 3 to 5	72	51 (70.8)	2.4 (1.5–4.0)			
> 5 to 7	17	14 (82.4)	4.7 (1.3–16.2)	1.37 (1.1–1.7)	8.86	0.003
> 7	15	11 (73.3)	2.8 (0.9–8.7)			
Total	170	103 (60.6)				
Admission Diagnosis						
Constipation	14	7 (50.0)	1.0 (0.4–2.9)			
Febrile seizures	17	8 (47.1)	0.9 (0.3–2.3)			
Gastritis	14	9 (64.3)	1.8 (0.6–5.4)			
Gastroenteritis	32	26 (81.3)	4.3 (1.8–10.5)	1.07 (0.9–1.3)	0.94	0.333
Pneumonia	18	10 (55.6)	1.6 (0.5–3.2)			
Tonsillopharyngitis	20	10 (50.0)	1.0 (0.4–2.4)			
Others	85	57 (67.1)	2.0 (1.3–3.2)			
Total	197	127 (64.5)				
Age (months)						
1 to 12	29	14 (48.3)	0.9 (0.5–1.9)			
> 12 to ≤ 24	32	23 (71.9)	2.6 (1.2–5.5)			
> 24 to ≤ 60	45	28 (62.2)	1.7 (0.9–3.0)	0.9 (0.9–1.0)	0.01	0.934
> 60 to ≤ 144	47	28 (59.6)	1.5 (0.8–2.6)			
> 144	17	10 (58.8)	1.4 (0.5–3.8)			
Total	170	103 (60.6)				
Symptom						
Abdominal Pain	25	15 (60.0)	1.5 (0.7–3.3)			
Seizures	22	16 (59.1)	1.4 (0.6–3.4)			
Cough	30	17 (56.7)	1.3 (0.6–2.7)			
Diarrhoea	41	28 (68.3)	2.2 (1.1–4.2)			
Tachypnea	18	10 (55.6)	1.3 (0.5–3.2)	1.03 (0.9–1.1)	0.37	0.543
Headache	10	6 (60.0)	1.5 (0.4–5.3)			
Vomiting	57	44 (77.2)	3.4 (1.8–6.3)			
Others	136	83 (61.0)	1.6 (1.1–2.2)			
Total	339	219 (64.6)				
Medication						
ORS	31	24 (77.4)	3.4 (1.5–8.0)			
Anticonvulsants	10	9 (90.0)	9.0 (1.1–71.0)			
Laxatives	14	8 (57.1)	1.3 (0.5–3.8)			
Bronchodilators	15	9 (60.0)	1.5 (0.5–4.2)	0.9 (0.8–1.1)	1.13	0.287
Zinc sulphate	27	21 (77.8)	3.5 (1.4–8.7)			
Others	46	30 (65.2)	1.8 (1.0–3.4)			
Total	143	101 (70.6)				
Procedures requiring patients to starve						
Endoscopic	8	6 (75.0)	3.0 (0.6–14.9)			
Radiological	4	2 (50.0)	1.0 (0.1–7.1)	1.04 (0.9–1.2)	0.43	0.510
Surgical	11	8 (72.7)	2.7 (0.7–10.1)			
Total	23	16 (69.6)				

Besides drainage of calories that are essential for normal growth in children, many illnesses also interfere with proper feeding through anorexia, nausea or vomiting, thus predisposing to hospital-acquired malnutrition.[11,16] There is a further need to comply with hospital routines like scheduled times for meals and reduce interference by clinical processes, namely ward rounds and diagnostic procedures which withhold oral intake (nil by mouth) and compromise nutrient intake. Some drugs also cause anorexia, nausea and vomiting, or increase frequency of diarrhea or constipation, leading to a reduction in food intake and/or loss. In addition, failure to recognise malnutrition, lack of screening tools and staff to assist with feeding, failure to record daily intake of patients and lack of nutritional training for hospital staff can all contribute to under-nutrition in hospitalised patients.[11,16]

Campanozzi *et al.* described the problem of malnutrition in 496 children admitted to a public hospital in Foggia, Italy with mild clinical conditions.[12] They showed that the number of children leaving the hospital malnourished, measured as z-scores below 2 SD, were higher than those at admission.[12] Kazem *et al.* evaluated the nutritional status of children under five years of age, from admission to discharge, at Basrah Maternity and Child Hospital in southern Iraq.[11] Rocha *et al.* evaluated the effects of hospitalisation in 203 children under five years of age, admitted to a public hospital in Fortaleza, Brazil.[1] Sermet-Gaudelus *et al.* evaluated nutritional risk in 296 children admitted to Necker-Enfants Malades Hospital, France.[2]

Our study demonstrated a higher incidence of hospital-acquired malnutrition compared to those published by Kazem *et al*.[11] and Rocha *et al*.,[1] who demonstrated that 51.1% and 51.6% of patients lost weight during hospitalisation, respectively. However, Camponozzi *et al*.[12] and Sermet-Gaudelus *et al.*[2] demonstrated higher percentages of weight loss among hospitalised children with similar characteristics in age and clinical conditions. These differences may be attributed to the fact that both Kazem *et al.* and Rocha *et al.* evaluated children under five years of age only, while Sermet-Gaudelus *et al.* used a paediatric nutritional risk score to identify patients at risk of acute malnutrition during hospitalisation and Camponozzi *et al*. evaluated children with only mild clinical conditions.

In this study the mean loss of 0.5 kg corresponded to a 0.17% daily weight loss, which is the critical threshold for an adverse clinical outcome reported by Meritt and Blackburn.[13] In the study by Sermet-Gaudelus *et al.*,[2] the patients who lost > 2% of the reference weight had a daily loss of ≥ 1%, which is six times higher than this critical threshold reported. This difference may be explained by duration of hospital stay, where 65.0% of patients in the study by Sermet-Gaudelus *et al.*[2] had a hospital stay of more than five days. This is in contrast to the current study in which 18.8% had a hospital stay of more than five days.

Children who were well-nourished or mildly malnourished, according to the WHO nutritional classification, were the most affected by hospitalisation; those who were malnourished at admission remained malnourished at discharge. During a child's brief stay in hospital, attention is directed mainly towards the primary medical problem with little attention given to the nutritional management. Kazem *et al.* demonstrated that nutritional status of 293 children studied was mostly affected in those who were either well-nourished or mildly malnourished at admission.[11] Similar findings were reported by Rocha *et al.*[1] and Ozturk *et al.*[14] This underscores the need to have a nutritional plan for all hospitalised patients irrespective of their nutritional status at admission.

Since the risk of developing nutritional deficiencies while in hospital is largely unrecognised by healthcare workers, the nutritional management of the well-nourished is even more unappreciated; and is, therefore, likely to be omitted at admission. A survey done between 2010 and 2013, by the Canadian Malnutrition Task Force, found significant gaps between clinician's knowledge on optimal practices concerning nutritional issues among hospitalised patients and what was actually taking place. The survey demonstrated that doctors believed that nutrition assessments should be done at admission (87%), during hospitalisation (86%), and at discharge (78%). However, actual assessments during practice were much lower, at 33, 41 and 29% at admission, during hospitalisation, and discharge, respectively.[15]

In our study, the greatest weight loss was observed in children admitted with diagnoses of gastroenteritis, gastritis and pneumonia. Children with diarrhea and vomiting have significant nutrient loss from both poor retention, as well as physiological alterations in the integrity of the gastrointestinal mucosa, leading to mal-absorption of nutrients. Children with pneumonia have various degrees of respiratory distress that increase energy requirements causing an imbalance in caloric demands. Therefore, early identification of patients who require nutritional support is important in preventing hospital-acquired malnutrition.

Malnutrition has been widely reported to be associated with prolongation of hospital stay.[17] Length of hospital stay in our study was demonstrated to be the most significant risk factor for weight loss. Our results showed that children who had a hospital stay of more than five days demonstrated the highest percentages of weight loss (78%) compared to those who had a hospital stay of less than five days (56%). These findings are similar to those reported by Kazem *et al*.,[11] Camponozzi *et al.*,[12] and Rocha *et al.*[1]

Other studies have demonstrated that children less than 60 months of age are at higher risk of developing hospital-acquired malnutrition due to their higher caloric requirement per kilogram weight.[12,14] Our findings were in agreement with their observations as we demonstrated that 71.9% children aged 12 to 24 months lost weight followed by 62.2% of those aged 24 to 60 months. Children < 12 months were less affected, probably because this age group is dependent mostly on breast milk which is readily available and has a good caloric content to cater for a big proportion of their nutritional needs. This finding strengthens the importance of promoting and supporting breastfeeding even in children with various illnesses. The older age groups, above 12 months of age, are at higher risk of malnutrition as they are dependent on their guardians and hospital staff to provide adequate nutrient requirements. Therefore, clinicians should be aware of the risk of malnutrition in all hospitalised children.

In the current study, various medications were found to be associated with an increased likelihood of weight loss, including anti-convulsants, ORS and zinc sulphate. Children using anti-convulsants were almost nine times more likely to lose weight, as they are already at risk of malnutrition due to poor feeding related to swallowing in-coordination noted in these patients, especially those with cerebral palsy and severe convulsive disorders. However, in our study, children were three and a half times more likely to lose weight while on ORS and zinc sulphate due to the taste of these drugs precipitating nausea and vomiting, resulting in loss of appetite, inadequate feeding, as well as periods of dehydration during a child's illness. However, it should be noted that gastroenteritis – the main condition associated with weight loss – was the indication for use of these medications. More research is needed to confirm the mechanisms through which these medications contribute to weight loss.

Contrary to our expectation, various endoscopic, radiological and surgical procedures that required prior starvation of patients were not demonstrated to lead to weight loss. Many children were put on maintenance intravenous dextrose-containing fluids for a few hours, and none required multiple procedures that may have necessitated longer starving duration. The number of children who required these procedures was also relatively small, hence not well powered to demonstrate a true difference.

Conclusion

This study highlights the high incidence of hospital-acquired malnutrition which is often overlooked during inpatient care. Nutritional management thus forms an important part of overall care for admitted children. There is need for emphasis on importance of nutritional support during admission with introduction of relevant nutritional policies and management guidelines.

There is a need for further revision and reinforcement of the already existing hospital nutrition policy to prevent the high incidence of hospital-acquired malnutrition, with an assessment of nutritional risk as part of routine admission procedure.

A longer hospital stay significantly increases the risk of hospital-acquired malnutrition, while children less than 60 months of age and those with a diagnosis of gastroenteritis, gastritis and pneumonia at admission had a higher risk of developing malnutrition.

Further studies on the utility of various screening tools for identifying and monitoring patients at risk of hospital-acquired malnutrition at admission and during hospitalisation are needed.

Study limitations

A precision error of 7.5% was used for estimation of sample size, adopted due to limitations in financial resources and time of study available. However, estimation of 95% CI nevertheless provided an indicator on the estimated 'true range' for this study.

This study was not sufficiently powered to make conclusive statements on the associated risk factors for hospital-acquired malnutrition. Data including type and volume of feed were not analysed by the research team as a control was not performed for nutritional intake. This control was constantly under review and modified as needed on advice of the nutritionist and/or primary physician in an attempt to ensure all patients received optimum nutritional care.

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Conflicts of Interest – None declared

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