Original Article

# Prevalence and risk factors for pediatric acute and chronic malnutrition: A multi-site tertiary medical center study in Thailand

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**Background and Objectives:** Malnutrition is a major public health concern that increases morbidity and mortality in hospitalized patients, particularly those in developing countries. This study aimed to investigate its prevalence, risk factors, and impact on clinical outcomes in hospitalized children and adolescents. **Methods and Study Design:** We conducted a prospective cohort study in patients aged 1 month to 18 years who were admitted to four tertiary care hospitals between December 2018 and May 2019. We collected demographic data, clinical information, and nutritional assessment within 48 hours of admission. **Results:** A total of 816 patients with 883 admissions were included. Their median age was 5.3 years (interquartile range 9.3). Most patients (88.9%) were admitted with mild medical conditions (e.g., minor infection) or noninvasive procedures. The prevalence of overall malnutrition was 44.5%, while that of acute and chronic malnutrition was 14.3% and 23.6%, respectively. Malnutrition was significantly associated with age ≤2 years, preexisting diseases (cerebral palsy, chronic cardiac diseases, and bronchopulmonary dysplasia), and muscle wasting. Additional risk factors for chronic malnutrition included biliary atresia, intestinal malabsorption, chronic kidney disease, as well as inability to eat and decreased food intake for >7 days. Malnourished patients had a significantly longer hospitalization duration, higher hospital cost, and nosocomial infection rates than did well-nourished patients. **Conclusions:** Patients with chronic medical conditions on admission are at risk for malnutrition. Therefore, determination of admission nutritional status must be assessed, and its management are requisites for improved inpatient outcomes.

**Key Words: adolescent, children, malnutrition, nutritional status, risk factors**

## INTRODUCTION

Malnutrition in children is a global health issue, with high prevalences of stunting and wasting in children aged <5 years. According to the World Report on Nutrition 2019, approximately 24.7% of children in this age group living in Southeast Asia suffer from stunting. Wasting and severe wasting are evident in 8.2% and 3.6% of children, respectively. In addition, low-income and lower-middle-income countries (LMICs) have higher wasting and stunting prevalences than upper-middle-income and high-income countries.[1]

Malnutrition is more common in hospitalized children and adolescents than in community settings, especially in LMICs, including Thailand. Patients with severe malnutrition suffer from muscle weakness, impaired tissue healing, and cellular immunity and phagocytic cell function suppression, as well as alterations in gastrointestinal structure and function that favor bacterial translocation. Furthermore, body system impairment leads to increased hospital mortality and morbidity.[2,3]

Patients with malnutrition have a higher rate of infectious complications, increased mortality, longer hospitalization duration, higher hospital costs, and increased likelihood of post discharge home care than those with normal nutritional status.[4-7] Both the short- and long-term consequences of malnutrition negatively affect the physical, mental, and cognitive development of children and

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adolescents, and the impact is evident for a lifetime.[8-10]

To prevent unfavorable sequelae of malnutrition, we need to identify the risk factors associated with acute and chronic malnutrition in children and adolescents upon admission through appropriate nutritional assessment and intervention. However, in LMICs, nutrition specialists may be insufficient in number, while the non specialists may have limited time or resources for malnutrition risk screening. To better understand this entity and improve the quality of care, we need to identify the risk factors of malnutrition in the LMIC population. Thus, this study aimed to determine the prevalence, risk factors, and clinical outcomes of malnutrition on admission in hospitalized children and adolescents in Thailand, which could represent an LMIC country.

## METHODS

This study is a part of a multicenter prospective study that focused on hospital-acquired malnutrition,[11] while this cross-sectional study aimed to identified malnutrition on admission. As we described previously,[11] we enrolled patients aged 1 month to 18 years admitted between December 2018 and May 2019 in four tertiary care hospitals (Supplementary Figure 1). The following data were collected within 48 hours from admission: demographic data, preexisting medical conditions, food intake, ability to eat, gastrointestinal problems, physical signs of malnutrition, current medical conditions, hospital course, and anthropometric measurements. Meanwhile, we excluded patients with potentially implausible anthropometric assessment. Patients' illness was categorized as mild (grade 1), moderate (grade 2), or severe (grade 3), as described by Sermet-Gaudelus et al.[12]

The anthropometric data were calculated and converted into z-scores, using the WHO Anthro software version 3.2.2 (for <5 years old)[13] or the WHO AnthroPlus software (for 5–18 years old).[14] In this study, a weight-for-age z-score (WAZ) <−2 standard deviation (SD) indicated underweight, a weight-for-height z-score (WHZ) <−2 SD indicated wasting, which we considered as acute malnutrition, and a WHZ <−3 SD indicated severe wasting or severe acute malnutrition. Chronic malnutrition or stunting was defined as a height/length-for-age z-score (HAZ) <−2 SD of the median of the NCHS/WHO international reference. Moreover, a WHZ >2 SD indicated childhood overweight, whereas a WHZ >3 SD indicated obesity. Apart from WHZ, mid-upper-arm circumference (MUAC) was used as another indicator of malnutrition in children aged 6–59 months; MUAC <115 mm indicated severe acute malnutrition.[15,16]

The outcome variables were hospitalization duration, total hospital expenses (medical services, laboratory services, medication, and nutrition intervention), and incidence of nosocomial infection.[17]

All statistical data were analyzed using STATA® software version 10.1 (StataCorp LP). Descriptive statistics were computed with frequencies, percentages, median, and interquartile range (IQR). The association between possible nutritional risk factors and nutritional status was first assessed by simple logistic regression. Variables with a $p<0.25$ in the bivariate analysis were further analyzed by multiple logistic regression with backward elimination method. The strength of association was determined by the adjusted odds ratio at a 95% confidence interval, and $p<0.05$ was used for showing the association between independent variables and the presence of acute and chronic malnutrition. Of note, $p<0.05$ indicated statistical significance.

The study protocol has been reviewed by the Khon Kaen University Ethics Committee for Human Research (HE611373) and also approved by the institutional review board of all involved institutes. Written informed consent was obtained by the parents or guardians of all included children and adolescents.

## RESULTS

### *Demographic and nutritional status among pediatric patients*

We assessed 883 admissions from 816 patients. Table 1 shows the baseline characteristics of the study population. Half (51%) of the patients were <5 years. Approximately two-thirds (65.9%) of all patients had preexisting chronic diseases, with cancer as the most prevalent (29.7%), followed by chronic cardiac disease (13.4%) and epilepsy (9.5%). Majority (88.9%) of the patients were admitted with mild clinical conditions (e.g., minor infection, scheduled chemotherapy cycles, non-invasive procedures), followed by those with moderate pathologic conditions (10.2%) and severe conditions (0.9%). The hospitalization duration was 2–89 days, with a median of 4 days (IQR 4.5) (Table 2).

The prevalence of overall malnutrition was 44.5%, while that of underweight, stunting, wasting, and overweight and obesity was 20.2%, 23.6%, 14.3%, and 11.3%, respectively. Figure 1 illustrates the prevalence of malnutrition by age group. Noticeably, patients <2 years old had the highest prevalence of underweight, stunting, and wasting. Conversely, adolescents showed the highest prevalence of overweight and obesity. According to the study's weight-for-height criteria and the WHO classification,[18] 40 (4.6%) patients had severe acute malnutrition; however, when based on the cutoff point of MUAC <115 mm, 14 (4.4%) patients aged 6–59 months had severe acute malnutrition. Stunting prevalence was highest in patients aged <2 years followed by the adolescents.

In addition, stunting was more prevalent in patients with long-term corticosteroid treatment than in those without (14.9 vs 7.3%, $p=0.001$). The prevalence of severe stunting (HAZ <−3 SD) was 10.6%, with the highest among children aged <5 years (60%). Anemia (Hb <11g/dL) was detected in 32.7% of patients without underlying hemolytic disorder or cancer and 66.7% (156/234) of those diagnosed with cancer.

### *Acute malnutrition*

The prevalence of acute malnutrition was 14.3%. In the acute malnutrition group, children with multiple underlying conditions (≥2 underlying diseases) were significantly more than those without or single underlying condition (56.5% vs. 39.2%, $p=0.009$); likewise, those with a history of weight loss in 1 month or inappropriate weight gain ($p<0.001$) and those admitted with grade 2 (moderate) to grade 3 (severe) medical illness ($p=0.004$) were significantly increased (Supplementary Table 1). In the multiple

**Table 1.** Baseline characteristics of pediatric patients

| Characteristics | Total (n=816) |
|---|---|
| Male, n (%) | 477 (58.5) |
| Age, median (IQR) (years) | 5.3 (9.3) |
| Age <5 years, n (%) | 416 (51.0) |
| Thai Nationality, n (%) | 792 (97.2) |
| Primary caregivers | |
| Parents, n (%) | 596 (73.0) |
| Grandparents, n (%) | 220 (27.0) |
| Monthly household income, median (IQR) (USD) | 694 (867) |
| Underlying diseases, n (%) | 538 (65.9) |
| Cancer | 160 (29.7) |
| Chronic cardiac disease | 72 (13.4) |
| Epilepsy | 51 (9.5) |
| Global developmental delay | 38 (7.1) |
| Metabolic syndrome | 32 (5.9) |
| Rheumatic autoimmune disease | 31 (5.8) |
| Asthma | 29 (5.4) |
| Prematurity (corrected age 2 up to years) | 28 (5.2) |
| Thalassemia/hemolytic anemia | 27 (5.0) |
| Biliary atresia | 26 (4.8) |
| Chronic liver disease | 21 (3.9) |
| Cerebral palsy | 19 (3.5) |
| Chronic kidney disease | 19 (3.5) |
| Chronic lung disease | 17 (3.2) |
| Intestinal malabsorption/intestinal failure | 11 (2.0) |
| Oromotor dysfunction | 11 (2.0) |
| Food allergy | 11 (2.0) |
| Bronchopulmonary dysplasia (maximum age 2 years) | 8 (1.5) |
| Depression/mood disorder | 6 (1.1) |
| Others[†] | 10 (1.9) |
| Patients with 2 or more underlying diseases, n (%) | 118 (21.9) |

IQR: interquartile range.
[†]Genitourinary tract anomaly, hemangioma, human immunodeficiency virus, hypothyroidism, lumbrosacral myelomeningocele.

logistic regression analysis, acute malnutrition was significantly associated with young age (≤2 years), preexisting diseases (cerebral palsy, chronic cardiac diseases, and bronchopulmonary dysplasia), and muscle wasting (Table 3). Moreover, patients with acute malnutrition had significantly higher hospital costs, longer hospitalization duration, and a higher rate of nosocomial infections (surgical wound infection, bloodstream infection, and CLABSI) than those with normal nutrition status (Table 4).

***Chronic malnutrition***

Chronic malnutrition was observed in 23.6% of patients, with the highest in those children aged <2 years (30.4%) and the lowest in those aged 5–12 years (16.3%) (Figure 1). In the multiple logistic regression analysis, chronic malnutrition was significantly associated with young age (≤2 years) and underlying diseases such as cerebral palsy, chronic cardiac disease, prematurity (corrected age <24 months), chronic lung disease, biliary atresia, intestinal failure or malabsorption, and end-stage renal disease (Table 3). Furthermore, the risk factors of chronic malnutrition included a history of limited food intake (<50% of the usual), inability to eat, and the presence of muscle wasting on examination (Table 3). Patients with chronic malnutrition had a longer hospitalization duration, higher hospital expenses, and increased nosocomial infections such as hospital-acquired pneumonia, bloodstream infection, and CLABSIs (Table 4). Patients with both underweight and stunting accounted for 13.3%. In fact, two patients with malnutrition died from a nosocomial infection (fungal septicemia, and severe pneumonia with respiratory failure).

## DISCUSSION

Nutrition is one of the basic needs for growth and development in children and adolescents, especially in those under stressful conditions and illnesses. Malnutrition, either undernutrition or overnutrition, is a common medical problem worldwide and associated with substantial medical and economic implications. According to our study conducted in Thailand, the prevalence of overall malnutrition in hospitalized children and adolescents was 44.5%, while that of acute malnutrition and chronic malnutrition was 14.3% and 23.6%, respectively. These study results support the evidence of a high prevalence of malnutrition in hospitalized children and adolescents, especially those aged <2 years. The prevalence of malnutrition in this study is similar to previous studies in LMICs, which obtained a prevalence of approximately 11%–38%.[19-22] A recent study reported that acute malnutrition was less prevalent than chronic malnutrition, consistent with the findings in Columbia (16.6% vs. 22.4%).[22] However, two reports from Spain and Italy obtained the opposite result.[23,24] This discrepancy may have resulted from having different risk factors. Majority of our study patients had chronic underlying diseases, contributing to the high prevalence of chronic malnutrition. Currently, advances in medical and surgical technology have resulted

**Table 2.** Demographic and clinical characteristics among 883 admissions

| Demographic characteristics | Total 883 admissions |
|---|---|
| Illness classification | |
| Grade 1: mild stress factor (%) | 785 (88.9) |
| Scheduled chemotherapy/immunosuppressive drug | 199 |
| Investigation for health problems | 155 |
| Respiratory tract infection (upper and lower tract) | 85 |
| Gastroenteritis | 65 |
| Viral infection | 58 |
| Surgery | 56 |
| Seizure | 38 |
| Gastrointestinal symptoms (e.g., abdominal pain, bleeding, constipation) | 24 |
| Anemia | 23 |
| Febrile convulsion | 18 |
| Urinary tract infection | 18 |
| Acute kidney disease | 16 |
| Respiratory symptoms (e.g., snoring, airway obstruction) | 10 |
| Meningitis | 5 |
| Others | 15 |
| Grade 2: moderate stress factor (%) | 90 (10.2) |
| Prolonged fever | 34 |
| Chronic diseases with acute episodic illness | 18 |
| Surgery | 17 |
| Severe pneumonia | 10 |
| Clinical sepsis with stable vital signs | 8 |
| Meningitis with complications | 3 |
| Grade 3: severe stress factor (%) | 8 (0.9) |
| Cardiac surgery | 5 |
| Severe sepsis with unstable vital signs | 2 |
| Abdominal surgery | 1 |
| Anthropometric assessment (IQR) | |
| WAZ | -0.70 (-1.3) |
| HAZ | -0.89 (-1.8) |
| WHZ | -0.19 (0.31) |
| BMIZ | -0.28 (0.44) |
| MUACZ (age 6-59 months) | 0.02 (0.16) |
| Hemoglobin, median (IQR) (g/dL) | 11.3 (2.6) |
| Hemoglobin <11 g/dL, n (%) (non-thalassemic/hemolytic disorder, non-cancer; n=208) | 68 (32.7) |
| Nutritional intervention during admission, n (%) | 95 (10.7) |
| Hospital outcome | |
| Length of stay, median (IQR) (days) | 4 (4.5) |
| <7 days, n (%) | 663 (75.1) |
| ≥7 days, n (%) | 220 (24.9) |
| Events of in-hospital complications, n (%) | 107 (12.1) |
| Hospital cost, median (IQR) (USD) | 457 (680) |

BMIZ: body mass index z-score; HAZ: height-for-age z-score; MUACZ: mid-upper-arm circumference z-score; WAZ: weight-for-age z-score; WHZ: weight-for-height z-score.

in longer life expectancy for patients with congenital or chronic diseases. These patients are highly at risk of developing malnutrition. Appropriate nutritional support is a major factor influencing a good health-related quality of life, which involves proper growth and development, optimal body functions, and prevention from infectious and noninfectious conditions. However, in real-life situations, only few patients have been assessed and received appropriate nutritional support.

Consistent with our study, Kittisakmontri et al reported in 2015 that the prevalence of stunting and/or wasting, acute malnutrition, and chronic malnutrition in pediatric patients was 50.5%, 10.5%, and 24.8%, respectively.[25] Despite the similar prevalence of overall malnutrition, our study had a higher proportion of overweight and obesity (11.3 vs 3.8%), partly because of the variation in participants coming from different regions. Our study population included those admitted in rural and urban hospitals as well as community- and university-based hospitals, providing a more realistic presentation of a double burden of malnutrition in a developing country. Our findings also emphasized the consistently high prevalence of pediatric malnutrition over the past 4 years.

Furthermore, we demonstrated the extensive consequences of acute and chronic malnutrition at admission on patients' outcomes; these consequences included prolonged hospitalization, increased hospital expenses, and increased nosocomial infections, similar to previous studies.[23,25,26]

However, this study has some limitations that need to be addressed. The gold standard for malnutrition diagnosis is based on the WHO criteria. We used WHZ <−2 SD to define acute malnutrition. Previously healthy children and adolescents exhibiting a significantly acute weight loss but having a WHZ not <−2 SD might have been misclassified as having a normal nutritional status. Patients

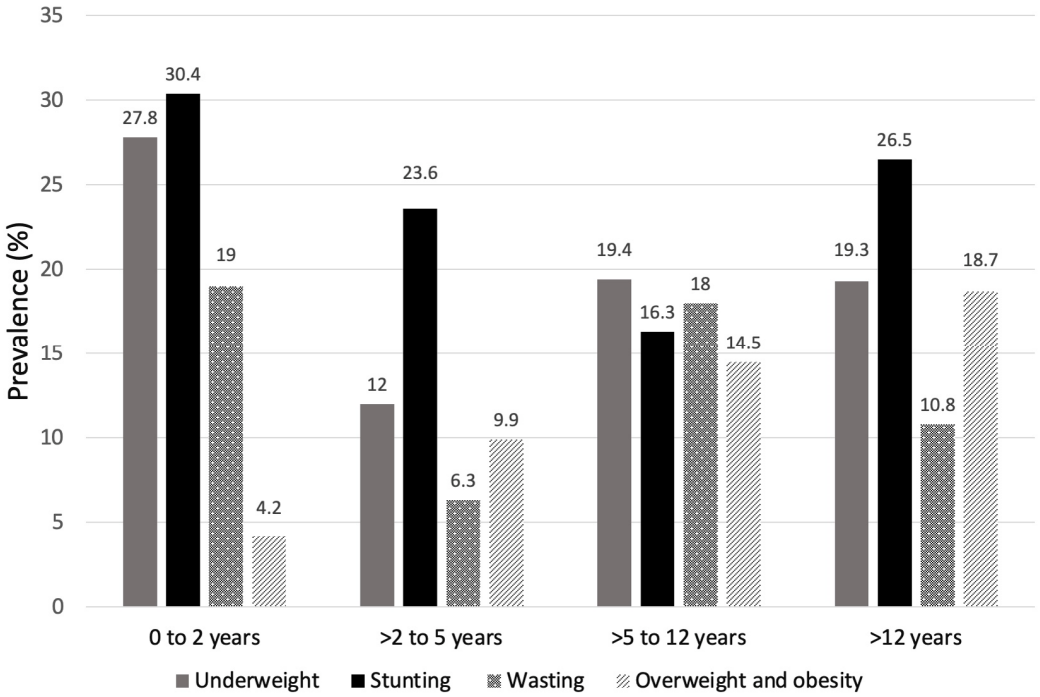
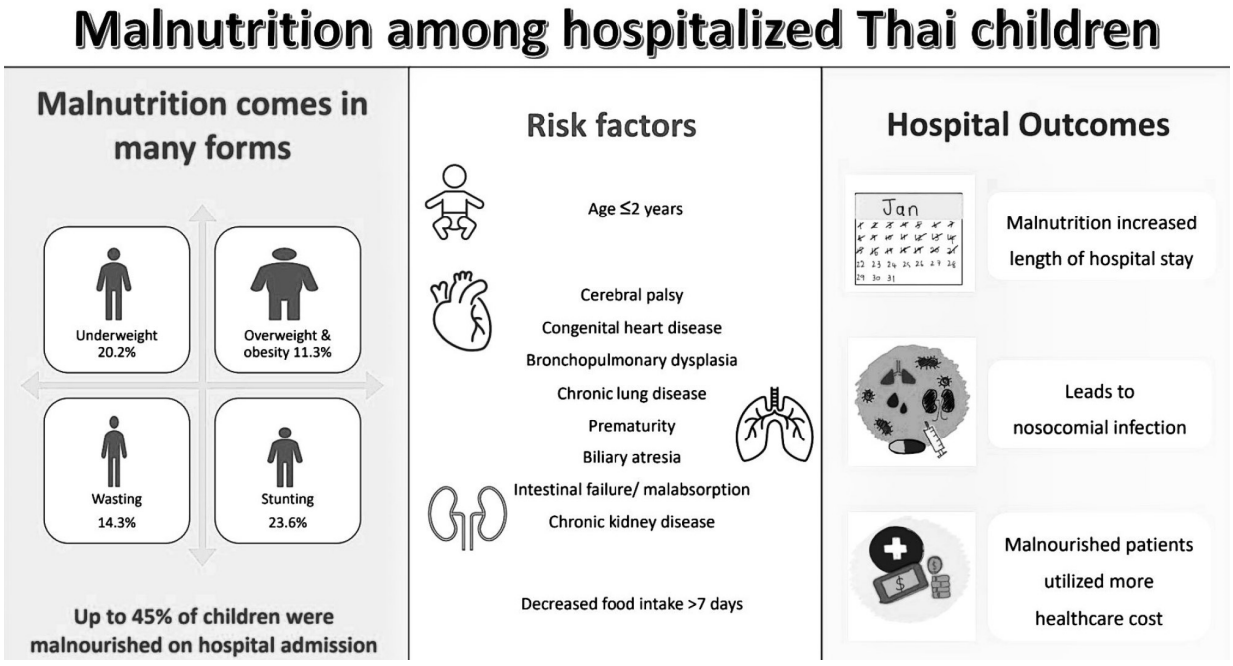



**Figure 1.** Prevalence of malnutrition by age (in years) among patients aged 0–18 years.




**Graphical abstract.** Malnutrition among hospitalized Thai children.

manifesting both stunting and wasting might have also been misinterpreted as having a normal nutritional status because of a WHZ between −2 and 2 SD. Furthermore, limitations such as underdiagnosis and failure to address the significant risk factors of acute malnutrition, such as weight loss, nausea, vomiting, diarrhea, and abdominal pain, would lead to bias and confound the results. Nonetheless, nutritional assessment and care plan were provided, as clinically indicated.

Most of the previous studies only investigated factors and mortality risks associated with either severe acute malnutrition in hospitalized children and adolescents or malnutrition in a community setting. However, the present study revealed the risk factors and clinical outcomes of acute and chronic malnutrition on admission in tertiary care hospitals both at the university and community levels, thereby representing a wide range of common and complicated diseases of children and adolescents in an LMIC country setting. All risk factors identified in our study could raise an awareness of malnutrition in physicians and healthcare professionals. In addition, the study results suggest that the nutritional status of hospitalized children and adolescents should be included during vital signs monitoring to provide prompt intervention for preventing adverse outcomes.

**Table 3.** Multiple logistic regression analysis of variables associated with acute and chronic malnutrition

| Variables | Acute malnutrition | | | | Chronic malnutrition | | | |
|---|---|---|---|---|---|---|---|---|
| | Crude OR (95% CI) | *p*-value | Adjusted OR (95% CI)† | *p*-value | Crude OR (95% CI) | *p*-value | Adjusted OR (95% CI) | *p*-value |
| Age | | | | | | | | |
| ≤2 years | 2.39 (1.34-4.10) | 0.001 | 1.79 (1.13-2.85) | 0.014 | 1.53 (1.06-2.21) | 0.024 | 1.69 (1.19-2.41) | 0.004 |
| Sex | | | | | | | | |
| Male | 0.88 (0.56-1.37) | 0.562 | - | - | 1.21 (0.87-1.69) | 0.255 | - | - |
| Preexisting disease | 1.22 (0.78-1.9) | 0.392 | - | - | 4.97 (2.92-8.65) | <0.001 | 3.55 (2.14-5.91) | <0.001 |
| Cerebral palsy | 3.74 (1.07-13.07) | 0.039 | 4.06 (1.53-10.76) | 0.005 | 3.71 (1.13-12.24) | 0.031 | 3.64 (1.20-11.04) | 0.022 |
| Global developmental delay | 1.64 (0.61-4.45) | 0.331 | - | - | 1.67 (0.70-3.97) | 0.249 | 1.93 (0.82-4.54) | 0.13 |
| Chronic cardiac disease | 3.58 (1.88-6.83) | <0.001 | 3.58 (2.06-6.24) | <0.001 | 1.44 (0.85-2.44) | 0.18 | 2.19 (1.19-4.03) | 0.012 |
| Bronchopulmonary dysplasia | 5.36 (0.99-29.05) | 0.051 | 6.27 (1.29-30.53) | 0.023 | 3.27 (0.57-18.79) | 0.185 | 4.20 (0.74-24.05) | 0.107 |
| Prematurity (corrected age up to 24months) | 1.38 (0.49-3.80) | 0.539 | - | - | 2.11 (0.89-4.97) | 0.088 | 2.54 (1.09-5.93) | 0.032 |
| Chronic lung disease | 1.11 (0.24-5.09) | 0.912 | - | - | 4.71 (1.12-20.15) | 0.034 | 4.86 (1.16-20.32) | 0.030 |
| Biliary atresia | 2.36 (0.68-8.13) | 0.175 | 1.86 (0.67-5.14) | 0.231 | 2.18 (0.86-5.49) | 0.100 | 3.84 (1.75-8.46) | <0.001 |
| Chronic liver disease | 0.92 (0.27-3.16) | 0.88 | - | - | 1.42 (0.52-3.87) | 0.496 | - | - |
| Intestinal malabsorption | 4.18 (0.92-19.07) | 0.065 | 4.02 (0.94-17.12) | 0.060 | 5.89 (1.12-30.89) | 0.039 | 7.77 (1.50-40.17) | 0.014 |
| Chronic kidney disease | 0.97 (0.28-3.36) | 0.96 | - | - | 2.17 (0.95-4.92) | 0.065 | 2.64 (1.14-6.13) | 0.023 |
| Grade 2 or 3 of classified illness | 1.57 (0.95-2.60) | 0.082 | 1.54 (0.93-2.54) | 0.093 | 1.08 (0.69-1.69) | 0.742 | - | - |
| Muscle wasting | 10.1 (6.35-16.00) | <0.0001 | 10.39 (6.61-16.33) | <0.0001 | 3.69 (2.44-5.59) | <0.001 | 3.59 (2.42-5.32) | <0.001 |
| Weight loss prior to admission | 1.72 (0.97-3.06) | 0.63 | 1.53 (0.93-2.46) | 0.094 | 0.914 (0.57-1.46) | 0.707 | - | - |
| Decreased food intake | 0.73 (0.40-1.30) | 0.282 | - | - | 0.48 (0.29-0.78) | 0.003 | 0.46 (0.30-0.71) | 0.001 |
| Inability to eat | 0.72 (0.29-1.83) | 0.492 | - | - | 2.36 (1.23-4.53) | 0.01 | 2.51 (1.32-4.79) | 0.005 |
| Nausea/vomiting | 1.01 (0.39-2.60) | 0.996 | - | - | 1.68 (0.79-3.54) | 0.172 | 1.79 (0.86-3.74) | 0.12 |
| Diarrhea | 1.01 (0.41-2.48) | 0.992 | - | - | 1.30 (0.66-2.56) | 0.444 | - | - |
| Abdominal pain | 0.77 (0.28-2.13) | 0.608 | - | - | 1.92 (0.91-4.04) | 0.087 | 2.05 (1.1-4.21) | 0.50 |

† Adjusted Odds ratio and 95% CI adjusted for all other variables in the table.

**Table 4.** Hospital outcomes associated with acute and chronic malnutrition among pediatric patients

| Outcome | Acute malnutrition | | | Chronic malnutrition | | |
|---|---|---|---|---|---|---|
| | WHZ <-2 (n=118) | WHZ -2 to 2 (n=649) | *p*-value | HAZ <-2 (n=208) | HAZ >-2 (n=673) | *p*-value |
| Length of stay, median (IQR) (day) | 5 (6) | 3.5 (4) | <0.001 | 5 (7) | 4 (4) | 0.027 |
| Events of in-hospital complications, n (%) | 29 (22.9) | 73 (11.3) | <0.001 | 34 (16.4) | 73 (10.8) | 0.034 |
| Hospital cost, median (IQR) (USD) | 587 (1703) | 443 (645) | 0.010 | 558 (838) | 420 (785) | 0.011 |

HAZ: height-for-age z-score; IQR: interquartile range; WHZ: weight-for-height z-score.

### *Conclusion*

The prevalence of malnutrition on admission is high among pediatric patients in the tertiary care hospitals. Patients with chronic medical conditions on admission are at risk for malnutrition. Weight, height, and nutritional status should be included in the vital signs recording to early detect malnutrition and promptly perform the necessary intervention to improve clinical outcomes and reduce hospital cost burden and hospitalization duration.

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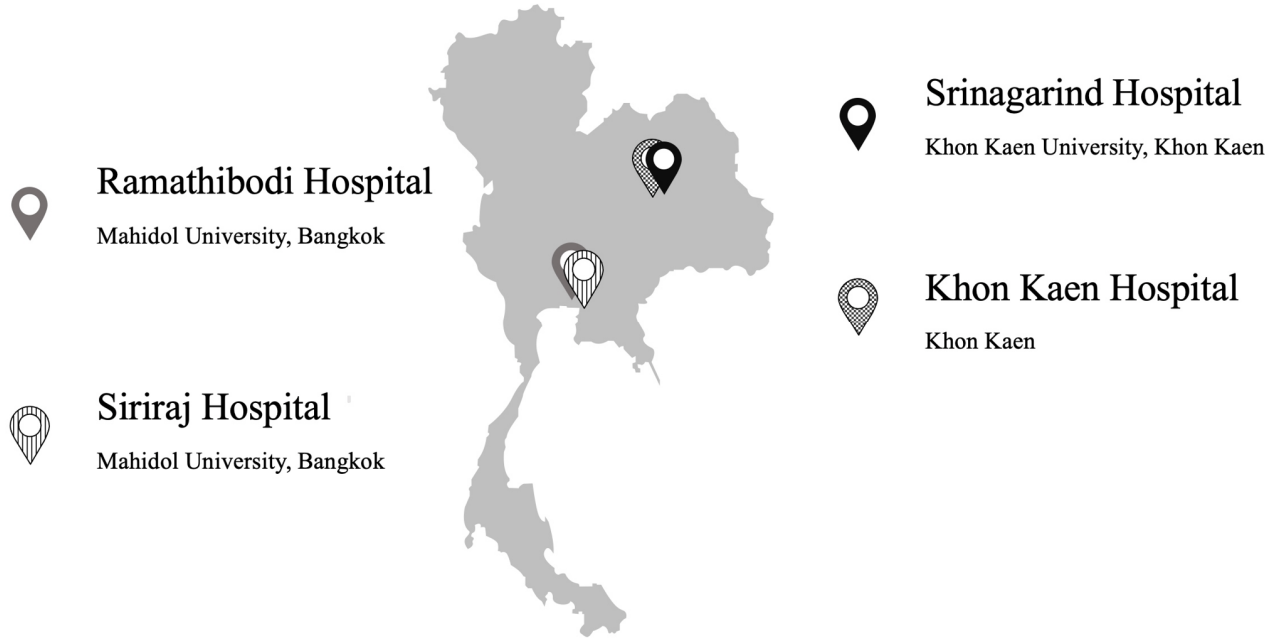


**Supplementary figure 1.** Location map of study areas.

**Supplementary table 1.** Symptom variables possibly associated with malnutrition

| Variables | Acute malnutrition | | | Chronic malnutrition | | |
|---|---|---|---|---|---|---|
| | Wasting N (%) (n=127) | Normal N (%) (n=653) | *p*-value | Stunting N (%) (n=208) | Normal N (%) (n=673) | *p*-value |
| Age | | | 0.093 | | | 0.003 |
| ≤2 years | 45 (35.4) | 183 (28.0) | | 73 (35.1) | 166 (24.7) | |
| >2 years | 82 (64.5) | 470 (72.0) | | 145 (64.9) | 507 (75.3) | |
| Illness classification | | | 0.004 | | | 0.199 |
| Grade 1 (mild) | 98 (77.1) | 586 (89.7) | | 178 (85.6) | 605 (89.9) | |
| Grade 2 (moderate) | 26 (20.5) | 62 (9.5) | | 27 (13.0) | 63 (9.4) | |
| Grade 3 (severe) | 3 (2.4) | 5 (0.8) | | 3 (1.4) | 5 (0.7) | |
| Weight loss | | | <0.0001 | | | 0.886 |
| Yes | 42 (33.1) | 121 (18.5) | | 42 (20.2) | 139 (20.7) | |
| No | 85 (66.9) | 532 (81.5) | | 166 (79.8) | 534 (79.3) | |
| Food intake | | | 0.421 | | | 0.028 |
| Decrease | 35 (27.6) | 158 (24.2) | | 38 (18.3) | 173 (25.7) | |
| Normal | 92 (72.4) | 495 (75.8) | | 170 (81.7) | 500 (74.3) | |
| Chewing problems/inability to eat | | | 0.126 | | | <0.001 |
| Yes | 12 (9.4) | 38 (5.8) | | 22 (10.6) | 28 (4.2) | |
| No | 115 (90.6) | 615 (94.2) | | 186 (89.4) | 645 (95.8) | |
| Nausea/vomiting | | | 0.233 | | | 0.067 |
| Yes | 10 (7.9) | 34 (5.2) | | 16 (7.7) | 30 (4.5) | |
| No | 117 (92.1) | 619 (94.8) | | 192 (92.3) | 643 (95.5) | |
| Diarrhea | | | 0.354 | | | 0.094 |
| Yes | 10 (7.9) | 38 (4.3) | | 17 (8.2) | 36 (5.3) | |
| No | 117 (92.1) | 625 (95.7) | | 181 (91.8) | 637 (94.7) | |
| Abdominal pain | | | 0.613 | | | 0.045 |
| Yes | 8 (6.3) | 30 (4.6) | | 15 (7.2) | 26 (3.9) | |
| No | 119 (93.7) | 623 (95.4) | | 193 (92.8) | 647 (96.1) | |
| Muscle wasting | | | <0.0001 | | | <0.0001 |
| Yes | 72 (56.7) | 68 (10.4) | | 65 (31.3) | 77 (11.4) | |
| No | 55 (43.3) | 585 (89.6) | | 143 (68.7) | 596 (88.6) | |