



Original article

The financial burden of malnutrition in hospitalized pediatric patients under five years of age



Kulnipa Kittisakmontri*, Onwaree Sukhosa

Department of Pediatrics, Faculty of Medicine, Chiang Mai University, Chiang Mai, 50200, Thailand

ARTICLE INFO

Article history:

Received 1 June 2016

Accepted 4 June 2016

Keywords:

Malnutrition
Hospitalized children
Under-five
Financial burden
Hospital cost

ABSTRACT

Background: Under-five children are a medically fragile group which is compromised by hospitalization. Malnutrition in those patients not only increases complications and mortality but also affects hospital resource utilization. Therefore, this study was conducted to clarify the impact of malnutrition on hospital expenditures.

Methods: This prospective cohort study was performed at a tertiary hospital in Thailand. Under-five children who were admitted to general pediatric wards were included. Demographic data, the length of stay (LOS), and anthropometric measurements at admission were recorded. The classification of wasting and stunting were defined according to the World Health Organization (WHO) classification. Moreover, all hospital expenses were calculated directly based on the actual billing including the total hospital cost, cost of bed, enteral formula, medications, medical apparatus and procedures, nursing care, investigations and surgery.

Results: One-hundred and five patients with a mean age of 26.8 ± 1.8 months were included. The majority of them were males (61%) with the leading cause of infectious disease. According to the prevalence of malnutrition, the percentage of patients who had only stunting or wasting were 24.8% and 10.5%, respectively while 15.2% of all patients had both stunting and wasting. Regardless of stunting, the wasting patients had a significantly higher cost of bed, enteral formula, nursing care, and medical apparatus. Particularly, the highest costs of all expenditures including the total hospital cost were found in patients who were both stunted and wasting. Apart from the financial burdens, the wasting patients stayed longer in the hospital and the LOS also significantly correlated with the total hospital cost ($r = 0.84$, $p = 0.01$).

Conclusions: The present study underscores the high prevalence of malnutrition in under-five pediatric patients. The malnourished patients, in particular the wasting group, had longer LOS and consequently had increased hospital expenses.

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1. Introduction

Globally, acute wasting affects 66 million children who are under five years of age [1]. However, after the World Health Organization (WHO) provided several policies for the prevention and

treatment of malnourished infants and children, the overall rates of childhood malnutrition have been declining [1]. On the other hand, the prevalence of malnutrition in hospitalized children has been unchanged according to a large number of studies that have been performed during the last 30 years [2]. The percentage of acute malnutrition in hospitalized children is between 6.1 and 14% in New Zealand, European countries and North America [3–5]. While, the prevalence in Asia, Africa and South America are higher being reported as 13.4–54% in these regions [6–13].

Noticeably, the state of malnourishment at time of admission might be aggravated by acute or chronic illness during the period of hospitalization. The diseases may contribute to decreased food intake due to anorexia, feeding difficulty, effects of medication, and

Abbreviations: LOS, Length of Hospital Stay; WAZ, Weight for Age Z-Score; WHZ, Weight for Length/Height Z-Score; HAZ, Height for Age Z-Score; MUAC, Mid-Upper Arm Circumference; BMI, Body Mass Index.

* Corresponding author. Present address: Department of Pediatrics, Faculty of Medicine, Chiang Mai University, 110 Inthawaroros Road, Mueang Chiang Mai District, Chiang Mai, 50200, Thailand. Tel.: +66 5393 5412; fax: +66 5393 6461.

E-mail address: kulnipa.k@cmu.ac.th (K. Kittisakmontri).

a hypermetabolic state based on an underlying disease [14]. Consequently, there are several pieces of evidence showing the adverse outcomes of malnourished patients such as a generalized muscle loss causing physical deterioration, depressed immunity, increased risk of infection, and cognitive impairment [15]. Furthermore, the body of research has demonstrated that malnutrition not only has an impact on morbidity and mortality but it also has been found to exact a large economic burden from the societal perspective [16].

In adults, several studies have documented that malnutrition increases the cost to the health care service [17–20]. The direct medical costs increase between 24% and 102% [19,20] as well as the indirect economic burdens (e.g., an impact on gross domestic product (GDP), labor or productivity loss, and the reduction in the investment in human capital formation) are rising. Although, the pediatric patients are not directly associated with macroeconomics, their parents are involved in those burdens. Therefore, the “cost-of-illness” in children could affect the national economic system as well.

To our knowledge, there is no published research clarifying how much the direct hospital expenditures are for the malnourished pediatric patients, particularly, in under-five children who are known as the most vulnerable group. This study aimed to investigate the financial burden of hospitalized children who are under-five and also highlight the impact of malnutrition on the other outcomes.

2. Methods

A prospective cohort study was performed at Chiang Mai University Hospital, a tertiary center in Northern Thailand. Pediatric patients from 1 to 59 months old in all general pediatric wards were included. The data were collected from June 1, 2015 to August 31, 2015. The exclusion criteria were patients who were admitted less than 24 h, and critically-ill patients. Regarding re-admitted patients, the overall data were analyzed separately in each admission as a new patient. The research proposal was approved by the Ethics Committee of the Faculty of Medicine, Chiang Mai University in May, 2015.

The demographic data including age, gender, nationality, reason for hospitalization and underlying disease were recorded. In addition, the anthropometric measurements were collected on date of admission as weight, length or height, mid-upper arm circumference (MUAC), and body mass index (BMI). The calculation of the weight for age z-score (WAZ), weight for length/height z-score (WHZ), and height for age z-score (HAZ) used the software “WHO Anthro” (version 3.2.2 January 2011). According to WHO classification of malnutrition; chronic malnutrition (stunting), acute malnutrition (wasting) and under-weight were defined as HAZ < -2 standard deviation (SD), WHZ < -2 SD, and WAZ < -2 SD, respectively. For patients who had ascites, organomegaly or large abdominal tumors, the wasting was classified if the MUAC was less than 125 mm.

All direct expenditures which occurred during hospitalization were calculated individually based on actual billing from the hospital financial office. These expenses included the cost of bed, enteral formula, medications, medical apparatus, medical procedures, nursing care, investigations (e.g., laboratory tests, radiological imaging and diagnostic procedures), and surgery. In particular, the charges without any discounting for subsidy were used for analysis. Apart from the financial outcomes, the mortality and length of hospital stay (LOS) were recorded.

Statistical analysis was performed using the IBM SPSS Statistics program (version 16.0; SPSS Inc., IBM Company, Chicago, IL, USA). Categorical variables were expressed as number and percentage;

while continuous variables were expressed as mean \pm SD or median (range) as indicated. All variables were tested for normal distribution using a Kolmogorov–Smirnov test. Chi-square or Fisher's exact test were used for comparing qualitative data while the quantitative data were compared by using an appropriate tool. The correlation between LOS and total direct hospital cost was performed using Spearman correlation test. A p-value of less than 0.05 was considered as statistically significant.

3. Results

3.1. Demographic data and the prevalence of malnutrition

One hundred and five patients with mean age of 26.8 ± 1.8 months old were included. More than half of them were male while only 13.3% were non-Thai (i.e., Hill-Tribal, Burmese or others). The leading problem for admission was an infectious disease while diagnosis with congenital heart disease was the most common underlying disease in the study with nearly 80% of these patients being scheduled for elective surgery. According to the number of readmissions, only seven patients (6.7%) had a second hospitalization and no child was readmitted more than once. The prevalence of malnutrition in terms of stunting and/or wasting was 50.5% while the percentage of patients who had only stunting or wasting were 24.8% and 10.5%, respectively. Moreover, there were 15.2% of all patients that had both stunting and wasting. On the other hand, there were only four cases (3.8%) that were overweight and there were no obese children in this study. The averages of all anthropometric measurements are shown in Table 1.

When comparing well-nourished and malnourished patients in terms of stunting, wasting and both stunting and wasting, there were no significant differences according to age, gender, disease category and plan of admission. However, the nationality was

Table 1
Demographic data of the patients who aged under-five.

Demographic characteristics	Total (n = 105)
Age (months), Mean \pm SD	26.8 \pm 1.8
Gender, male number (%)	64 (61)
Nationality, Thai numbers (%)	91 (86.7)
Surgical patients, numbers (%)	21 (20.0)
Disease category, numbers (%)	
- Infectious diseases	27 (25.7)
- Cardiology	24 (22.9)
- Oncology	19 (18.1)
- Endocrinology	8 (7.6)
- Neurology	7 (6.7)
- Gastroenterology	6 (5.7)
- Nephrology	5 (4.8)
- Hematology	2 (1.9)
- Pulmonary	1 (1.0)
- Others	6 (5.7)
Plan for admission, numbers (%)	53 (50.5)
Re-admission, numbers of patients (%)	7 (6.7)
Anthropometrics assessment (Mean \pm SD)	
- WFA z-score	-1.5 \pm 1.5
- WFH z-score	-0.9 \pm 1.5
- HFA z-score	-1.6 \pm 1.7
- MUAC (cm.)	14.2 \pm 1.8
- BMI (kg/m ²)	15.1 \pm 1.9
Nutritional status, numbers (%)	
- Overall malnutrition	53 (50.5)
- Chronic malnutrition (Stunting)	26 (24.8)
- Acute malnutrition (Wasting)	11 (10.5)
- Both of wasting and stunting	16 (15.2)
- Overweight	4 (3.8)
Length of hospital stay (days) Median (range)	5 (1–82)
Mortality, numbers (%)	1 (1)

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