

## Original Article

**NutritionDay 2010 audit in Jinling hospital of China**

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Background: NutritionDay is an annual worldwide cross-sectional multicentre audit. This report aimed to describe the results of nutritionDay 2010 in Jinling hospital, providing a map of the prevalence of malnutrition and actual nutrition therapy practice in different units. The risk factors to malnutrition and length of hospital stay were also investigated. Methods: The data was collected from 233 inpatients from Jinling hospital on Nov 4th, 2010, using standardized questionnaires. Malnutrition was objectively defined as BMI <20 or unintentional weight loss >5% in the past three months. Risk factors for malnutrition and the impact of multiple factors on length of hospital stay were analyzed. Results: 233 inpatients participated in this audit (143 M: 90 F; mean±SD age 50.6±18.5 years). Of the patients, 42.5% were malnourished. Multivariable analysis revealed three risk factors for malnutrition: gender, food intake and length of hospital stay before audit. Longer length of hospital stay prevailed in patients aged ≥65 years ( $p<0.001$ ), and there was a positive and significant, but weak, correlation between length of hospital stay and age. Conclusions: The prevalence of malnutrition was high. Higher age may be the main contributor to longer length of hospital stay. This was the first study to obtain data from hospitalized patients' nutritional status in China during the nutritionDay audit and the valuable results could supply evidence for clinical nutrition support.

**Key Words: nutritionDay, malnutrition, food intake, length of hospital stay, nutrition support**

**INTRODUCTION**

Malnutrition is a widely spread problem in hospitals associated with illness or aging, the estimated prevalence of which ranges from 20% to 60% on hospital admission.<sup>1-3</sup> It was found in a recent study in Sweden that the prevalence of malnutrition varied from 22% to 34% in small, medium, and large hospitals.<sup>4</sup> It is surprising that only about 33% to 50% of these malnourished patients can be recognized due to lack of knowledge, unawareness of its importance and contemporary clinical practices, such as using inexactitude assessment, irregular and excessive medicine which is contrary to the guidelines.<sup>5,6</sup> Malnutrition leads to restriction in mobility, changes in the metabolism, poor ventilatory function, even increase the infection and complication rates. It is associated with unfavorable outcomes, including prolonged hospital stay, increased morbidity and mortality rates.

In 1936, Hiram Studley, an American surgeon had claimed that "weight loss was a basic indicator of surgical risk".<sup>7</sup> Similarly, in 1988, Windsor *et al* found that the patients with unintentional weight loss had significantly more postoperative and septic complications and a longer hospital stay.<sup>8</sup> A Europe-wide multicenter clinical study EuroOOPS studied more than 5000 patients in 26 hospitals,<sup>9</sup> and showed that the significantly longer hospital stays (9 vs 6 days;  $p<0.001$ ) and higher mortality (12% vs 1%) in at nutritional risk patients. A study in Germany used the subjective global assessment (SGA) as well as anthropometric measurements to investigate the

prevalence of malnutrition in 1886 consecutively admitted patients in 13 hospitals and found that malnutrition was associated with an 43% increase of hospital stay ( $p<0.001$ ).<sup>10</sup> Sullivan and his colleagues studied 102 elderly patients and found that in-hospital mortality of undernourished patients was up to 8 times higher than well-nourished patients and 90-day mortality was 2.9 times higher.<sup>11</sup>

The causes of malnutrition are multiple.<sup>12</sup> It may result from the complex interplay among inadequate or unbalanced nutrients, underlying medical conditions such as dyspepsia, malabsorption and excessive nutrient losses and disease-related metabolic changes. Several risk factors such as age, social background, variety of disease, degree of functional impairment, complex medication, and nutritional awareness have been proposed.<sup>12</sup>

NutritionDay is an international project with its coordinating center in Austria and coinvestigators including ESPEN (European Society for clinical nutrition and metabolism) National Council member, Medical

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Manuscript received 30 October 2012. Initial review completed 27 November 2012. Revision accepted 2 March 2013.

doi:10.6133/apjcn.2013.22.2.18

University Vienna, Austrian Society for Clinical Nutrition and the national societies for clinical nutrition, which is in line with the resolution on malnutrition and nutritional care in acute and long term care settings by the Council of Europe 2003, signed by 18 European countries nutritionDay is a worldwide cross-sectional multicenter audit performed annually in a single day with outcome evaluation. This audit would give a snapshot on the prevalence of malnutrition for an individual unit based on case-mix, structures and social environment and malnutrition according to risk factors, medical specialty, organizational structures and countries. It aims to improve knowledge and awareness of malnutrition by using a simple screening test for nutritional risk. It was the first time for China to participate in nutritionDay. Jinling hospital was the first and the only one in China which took part in this worldwide research. The first aim of our study was to determine the prevalence of malnutrition defined as BMI<20 and recent weight loss of more than 5% of bodyweight, as well as other nutrition related risk factors and nutrition intervention profile. The secondary aim was to determine which risk factors are associated with a prolonged length of stay (LOS).

## MATERIALS AND METHODS

NutritionDay is a one day worldwide cross-sectional audit annually conducted in in-hospital patients in all variety of units and managed with the help of four questionnaires (sheet1, sheet2, sheet3a-3b and sheet outcome) made by nutritionDay office of a coordinating center in Austria. This study in Jinling hospital, located in Nanjing of China, was carried out on Nov 4th, 2010. The nutritionDay audit was approved by the ethical committee of Jinling hospital. Each subject was asked to give his or her consent and each unit should signature pre-printed information sheet on a well visible place to announce the audit at least one week before the audit. The inclusion criteria was adult and elderly patients present within the unit from first nursing shift to the first nursing shift the next day, including admissions and discharges within that period. Patients who were younger than 18 years old or admitted and discharged during the same calendar day were excluded. All the subjects were voluntary and written informed consent was provided before the audit.

### Data collection procedure

In addition to those basic four questionnaires, the total length of hospital stay of all the subjects was also collected in this study. The collected data consists of five parts. Part 1 was the structural information of the individual unit filled in sheet1 by the physician and the nursing head. Part 2 were characters of all the patients including gender, age, height, weight, nutritional interventions, length of hospital stay before the audit day. Part 3 was filled in by patients. The patients completed a questionnaire that consisted of sheet 3a and 3b during the audit day. Patients documented their nutritional intake during the study period. Weight loss during the recent three months was classified as yes and no, if the answer is yes, the extent of weight loss was recorded. In addition, patients were asked to complete a questionnaire about changes in appetite and nutritional habits. The activities

which patients could do were also recorded. Part 4 (sheet outcome) was the individual patients' outcome on Dec 4th, 2010, including date of hospital discharge, site of discharge and health status. Part 5 was the total length of hospital stay of all subjects. Only 202 patients in this research had information on outcome, because this information from the other 31 patients was lost in follow-up. All data were sent to the nutritionDay coordinating center to contribute to the whole picture of global malnutrition. We also ran an independent statistical analysis to complete our own survey.

### Definition of malnutrition

There are still no universal definitions for the terms malnutrition. In this study, malnutrition was objectively defined as BMI <20 or unintentional weight loss >5% in the last three months. According to the definition of the World Health Organization, BMI was calculated by dividing the weight by the square of the height.

### Statistical analysis

Descriptive analysis of all study variables was generated, including mean and standard deviation for continuous variables and relative frequencies for categorical variables. The chi-square test was used to compare the proportions of malnutrition in different groups. The non-parametric test was used to compare the LOS among different groups. The Mann-Whitney U test was used for 2 groups, and the Kruskal-Wallis H test was used for more than three groups. Spearman's correlation coefficient was used to verify the association between age and LOS, because the non-normal distribution of the data. With the effect of controlling other random variables like nutritional status and nutrition therapy, partial correlation coefficient was used to measure the degree of association between age and LOS.

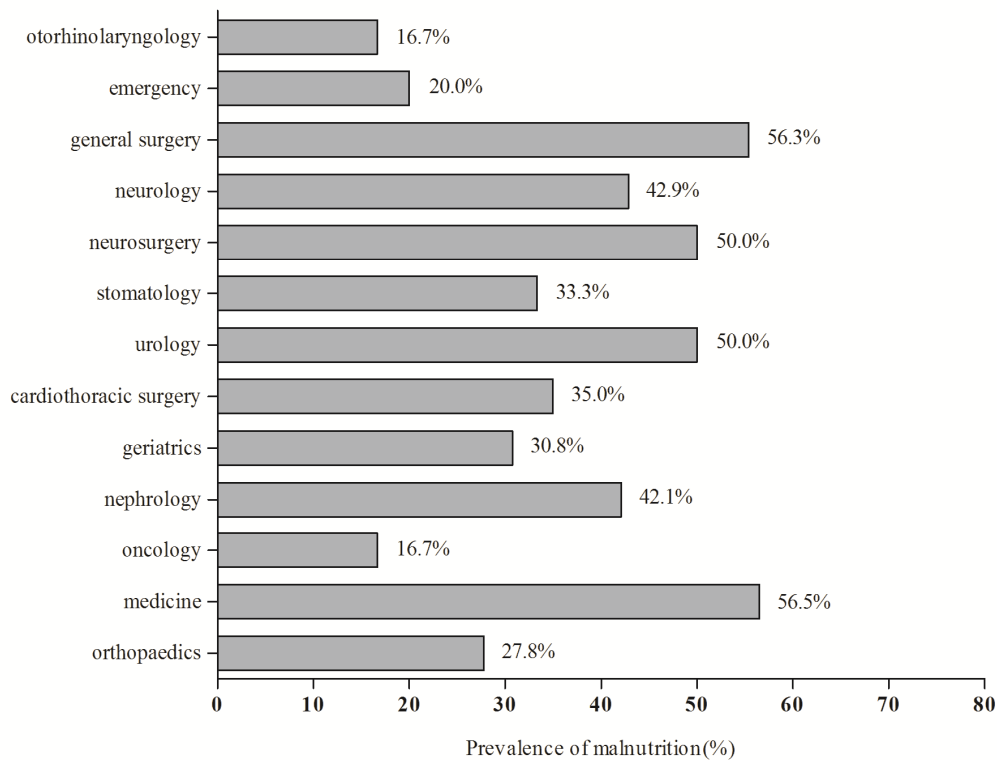
To identify independent risk factors for malnutrition, a binary logistic regression analysis was carried out. A backward stepwise regression model was performed. Variables which remained to be significant after backward selection are presented.

To identify the risk factors associated with LOS, we used multivariable Cox's regression model, and the relative risk (RR) and the respective 95% CI were calculated.  $p < 0.05$  was considered to be significant. Statistical analyses were performed with the software package SPSS version 17.0.

## RESULTS

The audit was carried out with an initial population of 241 patients. Of the patients, 8 children were excluded. The eligible study population was 233 consecutively admitted patients in 13 different departments. Sixty-five patients were included in general surgery. Other participating subjects were: orthopaedics (n=18), medicine (n=23), oncology (n=12), nephrology (n=19), geriatrics (n=26), cardiothoracic surgery (n=20), urology (n=6), stomatology (n=6), neurosurgery (n=20), neurology (n=7), emergency (n=5) and otorhinolaryngology (n=6).

The age in the study populations varied from 21 years old to 98 years old (mean  $\pm$  SD age was 50.6  $\pm$  18.5 years).



**Figure 1.** Prevalence of malnutrition in different units.

Of these, 67.0% ( $n=156$ ) of the patients were adults <65 years of age and 33.05% ( $n=77$ ) were aged  $\geq 65$  years. In addition, 38.6% ( $n=90$ ) were women and 61.4% ( $n=143$ ) men. Regarding the variables studied in the entire population, BMI was  $22.6 \pm 3.92$  kg/m<sup>2</sup>. From the self-assessed food intake in the interview form, 18.9% ( $n=44$ ) reported no appetite on audit-day, 18.0% ( $n=42$ ) of subjects eating less than normal, 23.6% ( $n=55$ ) of subjects eating less than half of normal and 20.2% ( $n=47$ ) of subjects eating less than quarter of normal in the previous week. On audit day, 65.7% ( $n=153$ ) inpatients could walk without help, and 18.0% ( $n=42$ ) of the inpatients had to lie in bed. The length of hospital stay before the audit-day ( $n=233$ ) was  $16.7 \pm 23.0$  days and the total length of hospital stay ( $n=202$ ) was  $29.6 \pm 42.5$  days.

Of all subjects, 45.5% ( $n=106$ ) were on enteral or parenteral nutrition on the audit day, and 54.5% ( $n=127$ ), 22.3% ( $n=52$ ), 13.3% ( $n=31$ ) of all the population were on oral nutritional supplements, EN only, PN only, respectively. In addition, 9.87% ( $n=23$ ) were on EN combined with PN. 36.6% ( $n=49$ ) of patients who had no risk of malnutrition were also given artificial feeding. Besides, 42.4% ( $n=42$ ) of malnutrition ( $n=99$ ) patients were not given any artificial nutrition support, and 42.3% ( $n=33$ ) of the patients ( $n=78$ ) who ate less than half or a quarter of their meal did not receive artificial nutrition support.

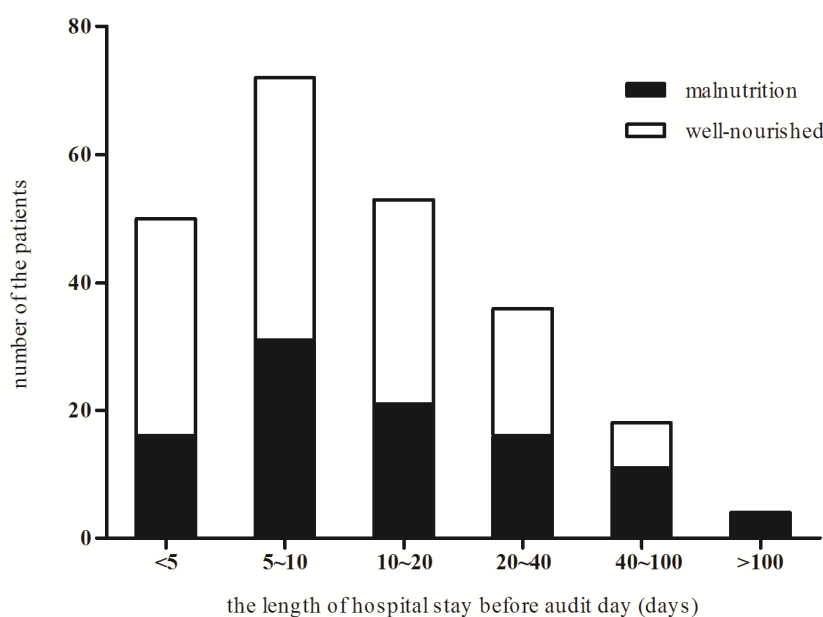
According to the definition used in this study, 42.5% ( $n=99$ ) of the subjects were undernourished in Jinling hospital. The prevalence of malnutrition in different units is shown in Figure 1. Because of the small size of some of the units, there was no significantly difference in the prevalence of malnutrition among these units. According to chi-square tests, the proportion of malnutrition increased with the length of hospital stay before audit-day

( $p=0.036$ , Figure 2). Binary logistic regression analysis was carried out to analyze the risk factors associated with malnutrition. Those analyzed factors included gender, age, appetite, locomotor activity of the subjects, how much the patient ate in the last week and the length of hospital stay before audit-day. The analysis revealed three independent risk factors: gender, how much the patient ate in the last week and the length of hospital stay before audit-day. Female patients are at a higher risk of malnutrition than male patients ( $p=0.002$ ). Eating less food than normal during hospitalization is likely to cause malnutrition ( $p=0.006$ ), so was prolonged length of hospital stay ( $p=0.046$ ).

Table 1 show the descriptive and comparison of the total length of hospital stay in relation to gender, age, body mass index, nutritional status and units. Length of hospital stay (LOS) was not significantly different between males and females. LOS was longer in those aged  $\geq 65$  years ( $p<0.001$ ). When the LOS and nutrition status were analyzed together, it showed that LOS of malnourished subjects was not longer than that of well-nutrition ones. There was a statistically significant difference between the different units ( $p<0.001$ ). According to Mann-Whitney test, the patients in the department of geriatrics had longer LOS than the department of medicine ( $p<0.001$ ).

Spearman's rank correlation coefficient method was used to study the relationship between LOS and age. A positive correlation was found for age ( $r=0.204$ ,  $p=0.004$ ). With the effect of controlling other random variables like nutritional status and nutrition therapy, partial correlation test was used to measure the degree of association between age and LOS. Similarly, a positive correlation was found for age ( $r=0.205$ ,  $p=0.004$ ).

Multivariable Cox's regression model was used to



**Figure 2.** Number of the patients: association with the length of hospital stay before audit day.

**Table 1.** Comparison of the total length of hospital stay in relation to gender, age, BMI, nutritional status and units used non-parametric test

Variables	The total length of hospital stay in days				p-value
	n	Median	Quartile1	Quartile3	
Gender					
Women	78	16.0	9.75	31.8	
Men	124	19.0	13.0	33.3	0.173 <sup>†</sup>
Age, y					
<65	156	16.0	11.0	26.8	
≥65	46	26.0	14.8	74.5	<0.001 <sup>†</sup>
BMI, kg/m <sup>2</sup>					
<20	38	20.5	12.8	49.3	
≥20	164	17.5	12.0	28.8	0.935 <sup>†</sup>
Nutritional status					
Malnutrition	77	19.0	13.0	40.0	
Well-nourished	125	18.0	11.0	29.0	0.262 <sup>†</sup>
Food intake					
Normal	84	14.0	9.00	21.8	
Less than normal	118	21.5	13.8	39.5	<0.001 <sup>†</sup>
Units					
Orthopaedics	18	15.0	11.8	21.0	
Medicine	22	18.0	10.0	28.0	
Oncology	12	13.5	9.50	19.0	
Nephrology	16	8.00	7.00	12.5	
Geriatrics	25	46.0	23.0	82.5	
Cardiothoracic Surgery	20	21.0	14.3	28.8	
Urinary Surgery	6	16.0	11.3	22.0	
Stomatology	6	24.0	10.8	39.3	
Neurosurgery	18	16.5	14.8	24.0	
Neurology	7	23.0	13.0	34.0	
General surgery	41	21.0	10.0	49.0	
Emergency	5	12.0	7.00	28.5	
Otorhinolaryngology	6	15.5	11.3	19.5	<0.001 <sup>†</sup>

<sup>†</sup>: Mann-Whitney U test.

<sup>‡</sup>: Kruskal-Wallis H test.

assess LOS in the entire population with age, gender, BMI, food intake, appetite, activity, nutritional status and the nutrition support therapy, which showed that age, BMI and food intake (Table 2) had great influence on

LOS. Three risk factors for longer hospital stays are shown in Table 2. The older those patients were, the longer they stayed in hospital. The patients whose BMI was low, would have long hospital stays. Besides, how

**Table 2.** Risk factors associated with the total hospital length of stay, analyzed by multivariable Cox's regression model in the entire population

Variables	p-value	Relative risk	95% confidence interval
Age	0.000	0.986	0.979-0.993
BMI	0.047	1.04	1.00-1.08
Food intake	0.000	0.765	0.67-0.87

much food the patients took was also very important. The patients who had less food had longer LOS.

## DISCUSSION

### *The prevalence of malnutrition*

Hospital malnutrition has been the target of many studies in recent years. It was the first time that Jinling hospital of China participated in the nutritionDay audit, a large-scale cross-sectional multicenter study focusing on malnutrition in hospitalized patients. Based on the definition used in this study, 42.5% subjects were undernourished in Jinling hospital, which was similar to results reported from other studies. A survey in Brazil of 4000 patients shows a similar result (48.1%).<sup>13</sup> Studies in European hospitals showed that the prevalence of malnutrition ranged from 10% to 50%, depending on the department studied.<sup>14</sup> Of the patients, 27% were subjectively classified as being "at nutritional risk" in the 2007-2008 worldwide nutritionDay audit,<sup>15</sup> which was much lower than the result of this report. Because this report only showed the result from some departments of one hospital in China and maybe it was insufficient to represent the national situation. Besides, the definition of malnutrition was not exactly the same.

In this study, the prevalence figure of different units ranged from 16.7% to 56.3%, without significant difference. The numbers of patients in some units were very small. It is not surprising that the difference between the units in terms of malnutrition rates was not significantly different in this report. But this did not mean that there is no significant difference between these units. It is necessary to obtain more data from patients in these units in the future. The general surgery department had a higher prevalence (36/64) than those reported by other studies,<sup>1,16,17</sup> because of the specificity of diseases in this department of Jinling hospital. Most of the patients accepted in this unit had Crohn's disease, ulcerative colitis, pancreatitis, intestinal fistula or irradiation colitis who had often suffered from multiple bowel resections and originally intestinal dysfunction. Their resultant functional intestinal length, intestinal function and the history of prior dietary adjustments must have impact on the nutritional status.

As reported by other studies, a high prevalence of malnutrition was found among the old subjects.<sup>18</sup> The prevalence of malnutrition was 30.8% in the geriatric department in this audit, which is consistent with the annual national Dutch survey (32.9%).<sup>16,19</sup> However, the definitions of malnutrition were a bit different between the two studies. In a German study assessed by subjective global assessment (SGA), the prevalence figure in the geriatric departments was much higher (56.2%).<sup>10</sup> Elderly patients are more likely to be malnourished as they

frequently have multiple pathologies, and poor food intakes.

A low prevalence of malnutrition was observed in oncology (16.7%) department in this audit which was much lower than those in other studies.<sup>10</sup> It is known that the prevalence of malnutrition can vary according to the diagnostic criteria used, the patients' characteristics or studied institution.<sup>20</sup> Most of the patients in the present study were not at the terminal stage of malignant diseases. These factors might have the impact on the prevalence.

### *Nutrition support therapy*

In this survey, about half of the participates had nutrition support therapy on audit-day, which was much more than the result of Luzia Valentini's survey.<sup>21</sup> In his survey, 5.9% and 1.2% residents were on tube feeding or parenteral nutrition, respectively. One quarter of the subjects in this audit were patients from the general surgery department. Because of the specificity in variety of diseases in our general surgery, Most of the patients need nutrition support. Maybe the high usage of nutrition support was closely related to this issue. In the report of nutritionDay audit 2006,<sup>22</sup> more than half of the subjects who ate less than a quarter of their meal did not receive artificial nutrition support, which is similar to our result. This decreased food intake not only was a risk factor for longer LOS in our report, but also represented an independent risk factor for hospital mortality.<sup>22</sup> However, food intake was not stratified and neither nutritional status nor recent changes in nutrition behavior were taken seriously. Another observation in this audit was that there was a higher rate of nutrition support abuse. In our daily clinical work, we should learn and follow the guidelines and give the patients personalized treatments as much as possible.

### *The risk factors for malnutrition*

Several independent factors, such as increased age, malignant diseases and polypharmacy, are associated with malnutrition or being at risk of malnutrition.<sup>10</sup> These identified factors provide valuable information and may consequently facilitate to detect patients with poor nutritional status. The present study revealed three independent risk factors: gender, how much the patient ate in the last week and the length of hospital stay before the audit day. Decreased food intake is not only a risk factor for malnutrition, but also could lead to bad outcomes. The patients who did not eat their full meal stayed longer in hospital than the patients who ate normal meal. The nutritionDay survey 2006 found that the decreased food intake was associated with a progressive increase of 30-day mortality.<sup>22</sup> Multiple medical conditions such as malignant disease, COPD, pneumonia

may have a negative influence on the appetite and lead to decreased food intake. Patients with diseases such as crohn's disease, intestinal fistula and severe abdominal trauma may not consume enough energy by mouth. If adequate nutritional therapy was not provided, it might make them more susceptible for malnutrition. Many guidelines indicated that, not only should patients be assessed the possible risk of nutritional deficiency, but the food intake of the patients should also be documented especially if they have been shown to be at such risk.<sup>23</sup> In the present study, the length of hospital stay before audit was a risk factor for malnutrition. However, the impact on it was rather low (OR=1.26; 95% CI: 1.00-1.57). In a few studies a longer hospital stay was correlated with being malnourished.<sup>24-26</sup> But Meyers, *et al*<sup>27</sup> found no significant association with time since admission. The risk of malnutrition did not increase with age and malignant diseases in this study. Many factors can explain these differences. This may be due to the heterogeneity of the medical conditions. The subjects were collected from 13 different departments and the numbers of subjects in various departments were different. The definition of malnutrition in this study which was different from other studies may also contribute to this result.

#### **Associated indicators of longer LOS**

Malnutrition has showed negative influence on convalescence, disease complications and even to increase mortality.<sup>14,27</sup> Some studies showed that malnutrition may contribute to a longer LOS and others found a weak correlation between SGA and LOS.<sup>2,28,29</sup> This report found a significant but weak correlation between low BMI and LOS (RR=1.04,  $p=0.047$ ). When LOS and the age of the subjects were analyzed, there was a significant but weak positive correlation among these parameters ( $r=0.986$ ,  $p<0.000$ ). This study found that patients aged  $\geq 65$  years had significantly greater LOS. Some studies reported a similar finding.<sup>20</sup> This study also found that enough food intake may contribute to the shorter LOS. It showed the importance of diet on malnourished patients and the patients who had at risk of malnutrition.

#### **Limitations**

There were several limitations in this study. Firstly, the definition of malnutrition was not very strict. BMI is not sensitive to acute illness patients who have unintentional weight loss, so BMI is rarely used to detect hospitalized patients. According to the guideline of ESPEN, NRS-2002 should be used to assess the nutritional status. Secondly, the sample sizes of some units are just too small to be representative of the entire units. Another limitation is whether the participating departments were truly representative in Jinling hospital. They were mainly recruited on a voluntary basis which probably resulted in these units with a special interest in clinical nutrition. Besides, Jinling Hospital was the only one hospital in China that took part in this 2010 nutritionDay audit, so these results may not closely represent the nutritional status of hospitalized patients in China. Next time, we would like to disseminate the nutritionDay audit and cooperate with other Chinese hospitals to obtain more

relevant data. Furthermore, there were heterogeneous diseases in each unit without similar severity and the numbers of different units had great disparity. Finally, there was not a standardized criterion of discharging from hospital.

#### **Conclusions**

In conclusion, this study reported a similarly high prevalence of malnutrition in a Chinese hospital, as found in previous studies.<sup>10,13</sup> Gender, decreased food intake and increased time since admission were found to be the independent risk factors to hospital malnutrition. Decreased food intake is not only a risk factor for malnutrition; it also could lead to longer LOS. Elder patients had a longer hospital length of stay and age was an associated indicator of longer LOS. More attention is needed on nutrition support therapy within daily clinical practice in order to optimize the clinical outcome of patients with malnutrition or being at risk of malnutrition. This nutritionDay audit in Jinling hospital showed that the audit is feasible in Chinese hospital and it is very meaningful. In order to gain insight in the problem of malnutrition in Chinese hospital, it would be important to perform a prevalence study in this setting. Although we cannot exclude a possible positive recruitment bias due to the voluntary participation, we believe that active participation could lead to positive action and increased malnutrition awareness in physicians and nurses.

#### **ACKNOWLEDGMENTS**

The nutritionDay audit was organized and supported by Medical University Vienna, the Austrian Association for Clinical Nutrition (AKE) and the European Society for Clinical Nutrition and Metabolism (ESPEN). This study would not have been possible without the support of the entire nutritional team staff. Xinying Wang organized the implementation and communication with nutritional team staff. Li Zhang was in charge of data collection, online data entries, data management and the data analysis. Ning Li, Nanhai Peng and Yong Gao were responsible for center recruitment. All authors provided their expertise in the explanation and discussion of the results and made important suggestions on the study. What is most important, we express our gratitude to all participating departments for their substantial amounts of time and effort.

#### **AUTHOR DISCLOSURES**

All authors have clearly declared no conflict of interest related to the authorship of the submitted paper. Our work was supported by National Natural Science Foundation of China (81070282), Natural Science Foundation of Jiangsu Province (BK2010460) and The Six Personnel Peak of Jiangsu Province (079).

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## Original Article

**NutritionDay 2010 audit in Jinling hospital of China**

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**中国金陵医院 2010 年世界营养日**

背景：“世界营养日”是一项全球范围内多中心住院患者的营养现况调查的项目，每年举行一次。本报告的目的在于总结中国金陵医院 2010 年“世界营养日”项目调查结果，描绘本医院住院患者营养不良的现况及实际的营养支持治疗实施情况。同时，分析患者存在营养不良及住院时间延长的危险因素。方法：本调查于 2010 年 11 月 4 日在金陵医院进行，共有 233 名患者参与此次调查并完成了规范化问卷。体质指数低于 20 或者在过去的三个月内无意识的体重下降超过 5% 的患者，被定义为存在营养不良。本报告对营养不良的风险因素及住院时间延长的多种影响因素进行了分析。结果：参与了此次调查项目的 233 名(143 名男性及 90 名女性；平均年龄 50.6±18.5 岁)住院患者中，42.5% 的患者存在营养不良。多变量分析显示性别、食物摄入量及调查前的住院时间为营养不良的风险因素。调查显示，尽管相关性稍弱，但年龄越大的患者住院时间显著延长。与年龄不超过 65 岁的患者相比，年龄大于 65 岁的患者总住院时间明显延长( $p < 0.001$ )。结论：住院患者营养不良比例高，而年龄大的患者可能住院时间较长。这是中国的医院首次参加“世界营养日”项目调查多中心住院患者的营养状况，可为临床营养支持治疗提供一定的理论依据。

**关键字：**世界营养日、营养不良、食物摄入量、住院时间、营养支持