

# Analysis of the Prevalence and Risk Factors of Malnutrition among Hospitalized Patients in Busan

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**ABSTRACT:** This study investigated the prevalence of and risk factors for malnutrition in hospitalized patients in Busan, Republic of Korea. 944 patients (440 men and 504 women) were hospitalized in four Busan general hospitals from March through April, 2011. Nutritional status was assessed on admission by the Nutritional Risk Screening 2002. Data were collected from the electronic medical records system for the characteristics of the subjects, clinical outcomes, biochemical laboratory data, and nutrition support states. Clinical dietitians interviewed the patients using structured questionnaires involving data on weight loss and problems related to oral intakes. Malnourished patients were significantly older ( $P<0.001$ ) than well-nourished patients, but the values for BMI, serum albumin, total cholesterol, TLC, hemoglobin, and hematocrit were significantly lower ( $P<0.001$ ) for malnourished than for well-nourished patients. Logistic regression indicated that the main determinant factors for nutritional status were the age, length of stay, BMI, serum albumin, and total cholesterol. In order to increase therapeutic effects of hospitalized patients, clinical dietitians need to offer proper nutritional intervention based on the results of nutrition assessment and identification of malnutrition.

**Keywords:** malnutrition, length of stay, risk factor

## INTRODUCTION

Malnutrition is a broad term that can be used to describe any imbalance in nutrition—from over-nutrition often seen in the developed world to under-nutrition seen in many developing countries—but it is also prevalent in hospitals and residential care facilities in developed nations (1). In 1974, Butterworth wrote his controversial paper, 'The skeleton in the hospital closet', in which he exposed the problems of malnutrition in hospitalized patients (2). Twenty-five years later, despite immense advances in medical science and diagnostic techniques, little has changed on the nutrition front. In 1994, McWhirter and Pennington found that 40% of patients admitted to five different specialties at Ninewells Hospital in Dundee were malnourished (3). Furthermore, 78% of patients who were malnourished on admission deteriorated further during their hospital stay (3). The frequency of under-nutrition on admission to four hospitals in England was 20% and under-nutrition was associated with increased length of stay, more prescriptions, and a higher

rate of infections (4). Another study showed that 40% of the patients were under-nourished at admission, and that about 75% of these lost further weight during hospitalization (5). Evidence is increasing that the use of nutrition support in hospitals reduces mortality, decreases the rate of complications, and shortens the hospital stay (6).

Malnutrition is independently responsible for an increased rate of hospital morbidity including infections, weight loss, immune system disorders, pressure ulcers, and delays in wound healing (7,8). Severely malnourished patients, in particular, are subject to a high rate of infectious complications and increased mortality rates. Complications secondary to malnutrition directly increase lengths of stay and hospital costs and indirectly affect the cost of patient rehabilitation (9,10).

The Joint Commission for Accreditation of Healthcare Organization (JACHO) recommends that a nutritional assessment be completed within 24 hours of admission (11,12). If someone has nutritional problems, a dietitian should evaluate the patient by nutritional screening and then devise a nutritional treatment plan for the patient

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(13). Since 2000, several hospitals have used the nutrition screening index and program in Korea. Evaluation of the Healthcare Organizations' regulations has included a measurement element for 'Nutrition screening and management of the malnourished patient' to evaluate hospitals since 2007. Recently, the Korean Accreditation for Healthcare Organization has focused on an initial nutrition screening system for in-patients.

Nutrition screening is defined as "the process of identifying characteristics known to be associated with nutrition problems with the purpose of identifying individuals who are malnourished or at nutritional risk" (14). The purpose of nutrition screening is to differentiate individuals who are at high nutritional risk or who have poor nutritional status (10). The objective of nutritional assessment, on the other hand, is to provide an accurate definition of the nutritional status of the patient, to define clinically relevant malnutrition, and to monitor changes in nutritional status (14). A number of nutritional screening and assessment tools have been developed to assess nutritional risk (15-18). The Nutritional Risk Screening Tool 2002 (NRS 2002) is a sensitive and specific predictor for identifying at-risk patients and endorsed by the European Society for Clinical Nutrition (ESPEN) (18). However, little research has been carried out in Korea, even though malnutrition in hospitalized patients is a significant problem.

Therefore, the primary objective of this study was to estimate the prevalence of malnutrition in patients admitted to four general hospitals in Busan using the NRS 2002. A secondary objective was to assess the relationship between normal patients and those at risk for malnutrition in terms of anthropometric measurements, biochemical tests, and lengths of stay in hospitals.

## SUBJECTS AND METHODS

### Subjects

For our study, subjects included a total of 944 in-patients (440 males and 504 females). The data were collected from four general hospitals in Busan from March 7 to April 4, 2011.

### Survey content and methods (individual interview)

The questionnaire was distributed throughout the hospitals, and in-patients directly answered the questions using the instructed methods. The survey contents included weight loss, changes of weight and dietary intake, problems of diet, family type, and education level. All these data were needed to analyze the NRS 2002 scores.

### Anthropometric and biochemical measurements

The data of anthropometric and biochemical measure-

ments were collected from electronic medical records (EMR). Anthropometric measurements included the height and weight. The results of biochemical measurements included albumin, total lymphocyte count, total cholesterol, hemoglobin, and hematocrit. Biochemical data were examined by an automatic chemical analyzer (Hitachi 7600-100, Hitachi, Tokyo, Japan).

### Statistics analysis

The collected data were used to calculate the percentage or mean and standard deviation using the SPSS (Statistical Package for the Social Sciences) WIN 18.0 program (SPSS Inc., Chicago, IL, USA). The differences between groups (normal and malnutrition) were analyzed using Student's *t*-test. Differences among groups (nutritional screening data and NRS 2002 scores) were analyzed using one-way analysis of variance, followed by Duncan's multiple-range test. Differences with  $P < 0.05$  were considered significant. The frequency difference between the groups for age, departments, and specialties was analyzed using the  $\chi^2$ -test. The Pearson's correlation analysis was performed in order to examine the relationship between NRS 2002 scores and risk factors of malnutrition. Logistic regression analysis was conducted to determine the effectiveness for risk factors of malnutrition with the odds ratios (ORs) and 95% confidence intervals (CIs).

## RESULTS

### General information of subjects

General information of subjects is shown in Table 1. Patients over 70 years old and 50 years old accounted for 22.4% and 21.4% of the total, respectively, and were the largest proportions among the subjects. In departments and specialties of the subjects, medical, surgical, and other departments accounted for 47.2%, 44.9%, and 8.0% of the patients, respectively. Total length of stay was  $9.7 \pm 9.1$  days, while patients in the surgical department required  $10.0 \pm 9.0$  days for treatment; a significant difference was evident among the groups ( $P < 0.05$ ), and similar differences were reported in previous research on in-patients from Seoul, Korea (19).

The average age of the subjects was  $53.4 \pm 18.3$  years old and the mean age of the medical department group ( $57.6 \pm 17.4$  years old) showed that these patients were significantly older than the surgical patients ( $50.3 \pm 18.4$  years old) and other groups ( $46.4 \pm 17.0$  years old). The mean height and weight of surgical department patients was  $164.5 \pm 9.5$  cm and  $63.4 \pm 12.4$  kg, respectively, which were significantly higher ( $P < 0.01$ ) than measurements obtained for the medical and other patient groups. The BMI were the lowest levels for in-patients in the medical

**Table 1.** General information of subjects (N=944)

	Medical	Surgical	Etc.	Total	$\chi^2$ /F-value
Gender					
Male	210 (47.7) <sup>1)</sup>	196 (44.6)	34 (7.7)	440 (46.6)	NS
Female	235 (46.6)	228 (45.2)	41 (8.2)	504 (53.4)	
Age (yrs)					
≤29	35 (31.3)	64 (57.1)	13 (11.6)	112 (11.9)	$\chi^2=48.177^{***}$
30~39	40 (33.3)	63 (52.5)	17 (14.2)	120 (12.7)	
40~49	66 (45.8)	69 (47.9)	9 (6.3)	144 (15.3)	
50~59	94 (46.5)	90 (44.6)	18 (8.9)	202 (21.4)	
60~69	78 (50.3)	65 (41.9)	12 (7.8)	155 (16.4)	
70≤	132 (62.6)	73 (34.6)	6 (2.8)	211 (22.4)	
Mean (yrs)	57.6±17.4 <sup>2)</sup>	50.3±18.4 <sup>b</sup>	46.4±17.0 <sup>a</sup>	53.4±18.3	24.317 <sup>***</sup>
Anthropometric					
Height (cm)	162.2±8.5 <sup>a</sup>	164.5±9.5 <sup>b</sup>	163.9±9.1 <sup>ab</sup>	163.3±9.1	6.938 <sup>**</sup>
Weight (kg)	60.7±12.7 <sup>a</sup>	63.4±12.4 <sup>b</sup>	62.7±10.1 <sup>ab</sup>	62.1±12.4	5.322 <sup>**</sup>
BMI (kg/m <sup>2</sup> ) <sup>3)</sup>	23.0±3.9	23.3±3.4	23.3±3.0	23.2±3.6	NS
Biochemical					
Albumin (g/dL)	3.9±0.6 <sup>a</sup>	4.2±0.4 <sup>b</sup>	4.1±0.5 <sup>b</sup>	4.0±0.5	48.831 <sup>***</sup>
Total lymphocyte count (cell/mm <sup>3</sup> )	1,650.3±821.9 <sup>a</sup>	1,913.4±790.5 <sup>b</sup>	1,752.2±786.7 <sup>ab</sup>	1,759.1±815.7	9.587 <sup>***</sup>
Total cholesterol (mg/dL)	162.4±44.7 <sup>a</sup>	177.6±38.7 <sup>b</sup>	167.7±44.4 <sup>a</sup>	168.4±43.1	10.697 <sup>***</sup>
Hemoglobin (g/dL)	12.6±2.3 <sup>a</sup>	13.5±1.8 <sup>b</sup>	13.3±2.1 <sup>b</sup>	13.1±2.1	23.697 <sup>***</sup>
Hematocrit (%)	37.5±6.9 <sup>a</sup>	40.3±5.3 <sup>b</sup>	39.9±6.4 <sup>b</sup>	38.9±6.3	21.460 <sup>***</sup>
Length of stay (days)	9.8±9.5 <sup>b2)</sup>	10.0±9.0 <sup>b</sup>	7.2±6.9 <sup>a</sup>	9.7±9.1	3.059 <sup>*</sup>

<sup>1)</sup>N (%).

<sup>2)</sup>Mean±SD.

<sup>3)</sup>BMI: body mass index {weight (kg)/ height (m)<sup>2</sup>}.

<sup>a-c</sup>Superscripts with different alphabets in a row are significantly different by Duncan's multiple range test.

\**P*<0.05, \*\**P*<0.01, \*\*\**P*<0.001.

NS: not significant.

department but the difference was not statistically significant comparable to surgical department.

The biochemical data showed the significantly lowest levels, on average, for the medical department group (*P*<0.001). The patient mean for albumin levels was 4.02±0.52 g/dL while individual averages for the medical, surgical, and other groups were 3.9±0.6 g/dL, 4.1±0.5 g/dL, and 4.2±0.4 g/dL, respectively. The patient mean for total lymphocyte count (TLC) was 1,759.1±815.7 cells/mm<sup>3</sup> while the highest levels occurred in surgical department patients (1,913.4±790.5 cells/mm<sup>3</sup>). The total cholesterol, hemoglobin, and hematocrit also showed similar trends, with the highest values occurring in surgical patients and the lowest in medical department patients.

#### Malnutrition prevalence and NRS 2002 score

Malnutrition prevalence of the subjects is shown in Table 2. The rate of malnutrition prevalence was 17.2% (162 subjects), which was similar to the level reported by Kim et al. (20), but lower than values reported in other studies that indicated a malnutrition prevalence of 30~40% (4,11,21). The average age of the group at risk for malnutrition prevalence was 66.7±17.8 years old and that of the group not at risk was 50.7±17.2 years old. A significantly higher proportion of the group at risk for malnutrition was over 70 years old (93 subjects, *P*<0.001).

The NRS 2002 consists of a nutritional score, a severity of disease score, and an age adjustment for patients >70 years (+1). The score is defined as 0~2 points for normal and ≥3 points for malnutrition. The mean of the NRS 2002 score was 3.9±1.1 for the at risk group and 0.5±0.8 for the not at risk group. The NRS 2002 score was the highest in patients aged 40 years old, followed by those over 70 years old and 50 years old in the patients at risk for malnutrition, although the differences were not statistically significant.

Malnutrition prevalence and the NRS 2002 score by department and specialties are provided in Table 2. The malnutrition prevalence rate was higher in the medical (76.6%) than in surgical (22.8%) department in the risk group, while the percentage of malnutrition prevalence in the normal group was significantly highest in the surgical department (49.5%), followed by the medical patients (41.0%), and others (9.5%). The malnutrition prevalence of in-patients showed statistically significant differences between the medical and surgical departments. A significantly higher NRS 2002 score was found in medical patients (0.63±0.85) than in surgical patients (0.35±0.68) in the normal group.

#### Anthropometric and biochemical data

Anthropometric and biochemical data by nutritional status are shown in Table 3. The average weights were 54.6±11.5 kg and 63.6±12.1 kg in the at risk and not at

**Table 2.** Malnutrition prevalence and NRS 2002 scores of subjects

Characteristics	Prevalence		NRS 2002 score	
	At risk N (%)	Not at risk N (%)	At risk	Not at risk
Gender				
Male	86 (19.5)	354 (80.5)	3.9±1.1 <sup>1)</sup>	0.4±0.7
Female	76 (15.1)	428 (84.9)	3.9±1.1	0.6±0.8
Sub-total	162 (17.2)	782 (82.8)	3.9±1.1	0.5±0.8
	NS	NS	NS	NS
Age (years)				
Mean	66.7±17.8	50.7±17.2	3.9±1.1	0.5±0.8
≤29	11 (13.1)	101 (86.7)	3.1±0.2	0.5±0.7
30~39	6 (5.0)	114 (95.0)	3.7±1.2	0.5±0.8
40~49	8 (5.6)	136 (94.4)	4.1±1.0	0.4±0.7
50~59	18 (8.9)	184 (91.1)	3.9±1.0	0.5±0.8
60~69	26 (16.8)	129 (83.2)	3.6±0.8	0.4±0.8
70≤	93 (44.1)	118 (55.9)	4.1±1.2	0.7±1.0
	$\chi^2=147.934^{***}$		NS	NS
Departments				
Medical	124 (27.9)	321 (72.1)	3.9±1.19	0.6±0.9 <sup>b</sup>
Sugical	37 (8.7)	387 (91.3)	3.8±1.0	0.4±0.7 <sup>a</sup>
Etc.	1 (1.3)	74 (98.7)	3.0±0.0	0.6±0.9 <sup>b</sup>
	$\chi^2= 70.301^{***}$		NS	F=12.367 <sup>***</sup>

<sup>1)</sup>Mean±SD.

<sup>a,b</sup>Superscripts with different alphabets in a column are significantly different by Duncan's multiple range test.

<sup>\*\*\*</sup> $P<0.001$ .

NRS (Nutritional Risk Screening) 2002 score: 0-2 not at risk,  $\geq 3$  at risk.

NS: not significant.

**Table 3.** Anthropometrics, biochemical data, and LOS by nutritional status

	At risk	Not at risk	t-value
Height (cm)	161.9±8.5 <sup>1)</sup>	163.6±9.2	NS
Weight (kg)	54.6±11.5	63.6±12.1	8.605 <sup>***</sup>
BMI (kg/m <sup>2</sup> ) <sup>2)</sup>	20.8±3.7	23.6±3.4	9.457 <sup>***</sup>
Albumin (g/dL)	3.6±0.6	4.1±0.5	12.912 <sup>***</sup>
Total lymphocyte count (cell/mm <sup>3</sup> )	1,458.6±886.8	1,825.8±784.4	5.010 <sup>***</sup>
Total cholesterol (mg/dL)	148.6±49.3	173.1±40.2	6.329 <sup>***</sup>
Hemoglobin (g/dL)	11.7±2.2	13.3±2.0	9.060 <sup>***</sup>
Hematocrit (%)	35.3±6.7	39.6±6.0	8.105 <sup>***</sup>
Length of stay (days)	12.4±11.2	9.2±8.6	-3.860 <sup>***</sup>

<sup>1)</sup>Mean±SD.

<sup>2)</sup>BMI: body mass index [weight (kg)/ {height (m)}<sup>2</sup>].

<sup>\*\*\*</sup> $P<0.001$ .

NS: not significant.

risk groups, respectively. The BMI was significantly higher in the not at risk than in the risk group ( $P<0.001$ ). The albumin, TLC, total cholesterol, hemoglobin, and hematocrit values were significantly lower for the risk group than for the not at-risk group ( $P<0.001$ ). Length of stay (LOS) was 12.4±11.2 days in the at risk group, which was higher compared to the 9.2±8.6 days seen for the not at risk group, and this showed a significant difference by nutritional status (t-value=-3.860,  $P<0.001$ ). This result was similar to that reported by Rha et al. and Robinson et al. who found an LOS of 10 days (19,22). The LOS for the patients at risk for malnutrition was 34% higher than that of the well-nourished group, which was lower than the value reported by Rha et al.

(60%) and Robinson et al. (56%). Our present study, like others, found an increased length of stay in malnourished patients (4,6,23-30).

#### Logistic regression analysis

Logistic regression analyses of nutritional risk factors by nutritional status are shown in Table 4. Age (OR 1.043) and LOS (OR 1.007) affected the nutritional risk factor significantly, whereby age was the most important contributor to the nutritional risk factor. The albumin (OR 0.994,  $P<0.01$ ) and total cholesterol (OR 0.444,  $P<0.05$ ) also affected the nutritional status, while TLC, hemoglobin, and hematocrit had no significant effects. Similarly, Singapore studies reported that elderly, cancer, and gen-

**Table 4.** Odds ratio for nutrition risk by nutritional status

	OR	95% CI	P
Age (years)	1.043	1.027~1.058	<0.001
BMI (kg/m <sup>2</sup> ) <sup>1)</sup>	0.782	0.722~0.847	<0.001
Albumin (g/dL)	0.444	0.267~0.737	<0.01
Total lymphocyte count (cell/mm <sup>3</sup> )	1.000	1.000~1.000	NS
Total cholesterol (mg/dL)	0.994	0.988~1.000	<0.05
Hemoglobin (g/dL)	0.893	0.600~1.331	NS
Hematocrit (%)	1.012	0.887~1.155	NS
Length of stay (days)	1.007	0.984~1.030	<0.001

OR: odds ratio, NS: not significant.

<sup>1)</sup>BMI: body mass index [weight (kg)/ {height (m)}<sup>2</sup>].

eral medical patients were predictive of malnutrition occurrence (31). Vanderwee et al. reported a high malnutrition prevalence in the elderly (32). Pirlich et al. also documented an association of higher malnutrition rate with increasing age and number of prescriptions (26).

#### Nutrition consults and support for patients at risk for malnutrition

In the present study, the eating problems of the patients at risk for malnutrition were anorexia and vomiting (31.8% and 10%, respectively), which are the main symptoms of eating disorders. A concern raised by this study is that although a high rate of malnutrition was identified, a dietitian was only referred to 6.8% of the patients at risk of malnutrition at the time of their admission, and only 29.2% of the patients at risk for malnutrition were treated with nutritional interventions such as oral and non-oral therapy by a dietitian.

## DISCUSSION

This study was conducted to provide basic research data for the management of patients at risk for malnutrition using the correlation with malnutrition prevalence and nutritional markers as affected by nutritional status. The general characteristics of the subjects in this study revealed that the highest proportion of the subjects were >70 years old. The mean age of subjects was 53.4±18.3 years old; medical patients had a mean age of 57.6±17.4 years and surgical patients had a mean age of 50.3±18.4 years. Lower levels of biochemical measurements in medical patients compared with surgical patients corresponded with their shorter LOS.

Malnutrition prevalence in hospital settings has been widely documented in the literature, between 20% and 50%, depending on the patient population and the definitions and criteria used for diagnosis (1,26). In our research, the mean malnutrition prevalence was 17.2% and patients over 60 years old accounted for 12.6% of the malnutrition prevalence. In comparison, the percentage of malnutrition prevalence for German patients over

70 years old was 16.7% versus. 7.8% in those 30 years old (26). A similar rate was also found in the study of Korfali et al. from Turkey, who showed a malnutrition prevalence of 25% in patients over 60 years old versus 9.3% in patients less than 60 years old (28).

In this study, the LOS of patients at risk for malnutrition (12.4±11.2 days) was longer than that of the group not at-risk (9.2±8.6 days) with a significantly higher rate (34%; *P*<0.001). The literature shows that malnutrition is associated with a significantly increased length of hospital stay (6,22,23) by 4.5 days compared to well-nourished patients (33). One study conducted in the United States looked at adult patients hospitalized for more than 7 days and examined the impact of nutritional decline on patient outcomes, including LOS (34). The patients who were admitted with some degree of malnutrition, and those patients who experienced a decline in nutritional status during their admission, had significantly longer hospital stays (by an average of 4 days) than did patients both admitted and discharged as well nourished. Similarly, a study conducted in Australia found a significantly greater difference of 5 days between the LOS of malnourished and well-nourished patients (35). The findings from the present study confirmed this association between LOS and malnutrition.

The purpose of nutritional screening is to identify those patients who are at nutritional risk and at a higher risk for complications. Early detection of nutritional risk would allow for early intervention and this could prevent later complications. As Kyle et al. showed, the NRS 2002 appears to be a better clinical screening tool than the MUST (Malnutrition Universal Screening Tool) or NRI (Nutritional Risk Index), when compared to the SGA (Subjective Global Assessment) (10). The higher specificity of the NRS 2002 may be because it allows for the gradation of disease effects (scores 1~3). One advantage of the NRS 2002 screening tool is that it depends less on examiner training than do the other nutritional assessment tools.

The NRS 2002 screening tool revealed that the over 70 year old group had the highest score in the not at-risk group. Although not surprising to have a high score in

an elderly group, the screening revealed that the 40 year old group had the highest score, followed by the over 70 year old and 50 year old groups. Patients with malnutrition tend to stay longer in the hospital because of their underlying medical or surgical problems or because of the effects of malnutrition itself. These patients require nutrition interventions, which can include either provision of oral nutrition therapy or specialized nutrition support, and they also need nutrition counseling and appropriate follow-up arrangements. In other words, if patients have a high NRS 2002 score on admission, they should undergo nutrition counseling and nutrition therapy.

Vanderwee et al. reported that three factors were rather strongly associated with malnourishment, namely swallowing difficulties, taste difficulties, and being transferred from a nursing home. Among these factors, having swallowing difficulties had the most powerful relationship with malnourishment (32). Therefore, patients at risk for malnutrition were recommended to undergo appropriate treatments with nutrition consults and support, but only a small proportion of the patients at risk for malnutrition received nutritional consults (6.8%) and support (29.2%). In Danish hospitals, one study found a nutrition plan in 14.2% of the records and reported that 32.8% of patients at nutritional risk had a nutrition plan (36). Another study carried out on 750 randomly selected patients found inadequate nutritional care in hospitals and reported that 22% of the patients were nutritionally at-risk, and that only 25% of these patients received an adequate amount of energy and protein (18). Results from a Brazilian national survey showed that although there was a high prevalence of malnutrition (48.1%), only a small minority of patients (7.3%) were treated (5). In addition, more than half of the patients who received nutritional support did not receive it for an adequate amount of time.

Several possible reasons can explain the provision of inappropriate levels of nutritional support, including the lack of a nutritional support and screening policy for patients at nutritional risk. The clinical practice is possibly not evidence-based or nutritional support may have a low priority. The assignment of responsibility for nutritional support could also be unclear or the institutions might lack the necessary clinical procedures and guidelines regarding nutritional support (5,18). Therefore, a guideline or protocol needs to be in place and routinely used in clinical practice.

Studies have revealed that when a multidisciplinary team approach was taken regarding nutritional support, the patients received nutritional support, had enough energy, were well monitored, and suffered fewer complications (37-41). However, when physician awareness of malnutrition was low, nutrition therapy was underpre-

scribed (5). Therefore, education on nutrition screening and support is very important for health care professionals and hospital management.

Malnutrition is prevalent around the world and is a burden on patients and health care facilities. Despite numerous advances in medicine and clinical care, the simple treatment of a patient's nutritional status appears to be overlooked or not considered as a sufficient medical priority and hospital policy. The treatment of malnutrition first requires identification of the patient as malnourished via nutrition screening or some type of assessment tool. This should be done at admission, and should preferably be made mandatory by a health care accrediting team or department. This can only be achieved if dietitians have the confidence and knowledge to detect malnutrition, which ideally would be done using a validated assessment tool such as the NRS 2002.

In conclusion, the prevalence of malnutrition was high in hospitalized patients in Busan, South Korea. Although only patients from selected general medical and general surgical wards were recruited in the present study, the overall feeling was that the group was a good representation of the hospitals' inpatients. Malnutrition rate increased with longer hospital stays and the NRS 2002 could be used successfully to assess malnutrition. Therefore, two areas require further improvement. First, health care professionals in hospitals and in the community have to be educated to recognize malnutrition and to use nutritional screening and assessment to identify those patients who require nutritional treatment. This will assure that malnutrition is treated appropriately. Second, systematic nutritional screening and intervention programs should be adopted by general hospitals. This would help to reduce hospital costs, lengths of stay in the hospital, patient complications, and morbidity.

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## AUTHOR DISCLOSURE STATEMENT

The authors declare no conflict of interest.

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