ORIGINAL

# Evaluation of 14 questions detecting malnutrition in newly hospitalized patients

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**Abstract : Malnutrition of patients is an important factor of poor prognosis and outcome and long stay in hospital. Nutrition screening is of course necessary for detecting under- and malnutrition. However, appropriate rapid and easy screening tools for only acute and emergent hospitalized patients are not known. In this study, 14 questions composed with reported and new items were prepared and the utility of those questions for detecting malnutrition in novel hospitalized patients was evaluated. Combined questions on disturbance of swallowing, diarrhea and fever, and also on ageing, food intake and history of fall are very important for detecting malnutrition in newly hospitalized patients, although further study will be absolutely required. J. Med. Invest. 60 : 138-145, February, 2013**

***Keywords*** **:** *malnutrition, screening tool, question*

## INTRODUCTION

The prevalence of malnutrition has been estimated to be as high as 50% among acutely hospitalized adults, depending on the definition employed and the population assessed (1-3). Malnutrition tends to worsen during hospitalization (4) and malnourished patients are at increased risk for complications. Associations have also been reported between preoperative weight loss and increased postoperative complications (5) and mortality (6). Identification of malnourished individuals and those at increased risk for malnutrition is the essential first step of a comprehensive nutrition care program. Thus, patients should be routinely screened for nutritional risk and risk for complications at hospital admission (7).

Screening tools vary with regard to the risk parameters used and their ability to determine nutritional risk. (8, 9). There are distinct similarities among tools, with most including recent changes in weight and food intake and some accounting for body mass index (BMI) and acute disease (10-17). The Simplified Nutritional Appetite Questionnaire (SNAQ) (10) and the Rapid Screen (11) were developed in community-dwelling populations but have not yet been validated in the hospital setting. Therefore, an efficient and simple screening system for determining the nutrition status of hospitalized patients with acute diseases and emergency is necessary. This study aimed to prepare a line of questions composed with reported items and new items derived from our clinical experiences and to evaluate utility of those questions for detecting

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malnutrition in novel hospitalized patients.

## MATERIALS AND METHODS

*1) Patients*

All adult patients newly admitted to Tokushima Red Cross Hospital between October 2005 and January 2006 were eligible for participation in this study. Hospital guidelines stipulate that inpatients are to undergo screening to determine their nutritional status. Nutritional screening is performed for patients who are to be hospitalized for at least 1 week. The following patients were excluded from this study : those aged < 20 years, those hospitalized for childbirth, and those hospitalized for < 1 week. Nutritional status of total 268 inpatients who met the screening criteria (mean age 70.1 ± 12.9 years ; 145 men, mean age 67.0 ± 12.3 years ; 123 women, mean age 73.7 ± 12.7 years) were nutritionally assessed. This study was approved by the Medical Care Council of the Ethics Committee at Tokushima Red Cross Hospital before initiation, and informed consent was obtained from all subjects.

*2) Anthropometric and biochemical analysis*

Patients were weighed on the scale in the department in which they were hospitalized. Height was measured using the height rod on the department's balance scale. All height measures were recorded to the nearest 0.5 cm and weight to the nearest 0.5 kg. Body mass index (BMI) was calculated as weight (kg)/height ($m^2$). Blood samples were drawn from all patients on admission and were analyzed in the core lab of the Hospital for peripheral blood and serum biochemistry.

*3) Assessment of malnutrition by questions*

The 14 items of the questionnaire for detecting patients with malnutrition were prepared (Table 1) and their utility was studied by comparing with the levels of objective biomarkers such as BMI, serum albumin and total cholesterol (TC) concentrations and blood hemoglobin (Hb) concentration and total lymphocyte count.

To compare the accuracy of each screening question to detect malnutrition, the sensitivity and specificity, were calculated. Sensitivity was defined as the proportion of malnourished correctly identified as such, whereas specificity was the proportion of well nourished who were correctly identified as well nourished.

Table 1 The 14 questions for malnutrition screening

| | |
|---|---|
| Q1. | Are you aged 70 years or older? (Yes/No) |
| Q2. | Have you eaten insufficient meals in the past 2 weeks? (Yes/No) |
| Q3. | Have you felt nausea in the past 2 weeks? (Yes/No) |
| Q4. | Have you had diarrhea in the past 2 weeks? (Yes/No) |
| Q5. | Have you had trouble swallowing in the past 2 weeks? (Yes/No) |
| Q6. | Has your weight decreased by 2 kg or more in the past month? (Yes/No) |
| Q7. | Have you undergone surgery under general anesthesia in the past month? (Yes/No) |
| Q8. | Have you had a fever of 37°C or higher in the past 2 weeks? (Yes/No) |
| Q9. | Have you fallen in the past year? (Yes/No) |
| Q10. | Do you eat meat once a day? (Yes/No) |
| Q11. | Did you have meals alone before hospitalization? (Yes/No) |
| Q12. | Were you able to go out alone before hospitalization? (Yes/No) |
| Q13. | Do you eat fish once a day? (Yes/No) |
| Q14. | Have you had sufficient water intake in the past 2 weeks? (Yes/No) |

*4) Statistical analysis*

Data were recorded on paper documents and uploaded to Exel Spreadsheet for storage. SPSS v. 11.0 (SPSS Inc., Chicago > IL, USA) was used for all statistical analyses. Student's *t*-test was used to determine differences in BMI, serum albumin and cholesterol concentrations and blood Hb concentration and total lymphocyte count between patients who answered "Yes" and those who answered "No" for each question.

Sensitivity, specificity and predictive values for each nutrition screening tool were calculated by the use of the combined index, which was considered the criterion of true malnutrition of any degree, as follows : Sensitivity=A/A+B ; Specificity=D/C+D ; Positive predictive value=A/A+C ; Negative predictive value=D/B+D, where A=malnourished patients by each question and each biomarker, B=malnourished by each biomarker but not each question, C=malnourished by questions but not by biomarkers, and D=not malnourished either by questions or by biomarkers. The p value less than 0.05 was considered a significant difference.

## RESULTS

*1) Strength of 14 questions for detecting malnutrition in each biomarkers*

The values (means ± 2SD) in subjects answered 'YES' and 'NO' to each questions were compared to identify useful questions. As shown in Table 2,

Table 2 Biomaker values of subjects answered 'YES' and 'NO' in each question

| Questions | Biomarkers | Answered 'Yes' | Answered 'No' | p-value |
|---|---|---|---|---|
| Q1 | Number (patients) | 157 | 111 | |
| | BMI (kg/m$^2$) | 23.0± 3.5 | 23.9± 3.3 | < 0.05 |
| | Albumin (g/dL) | 3.69± 0.60 | 3.85± 0.61 | < 0.05 |
| | Hb (g/dl) | 11.6± 2.2 | 12.5± 2.8 | < 0.05 |
| | TLC (mm$^3$) | 1386± 872 | 1793± 1061 | < 0.001 |
| | TC (mg/dl) | 181± 38 | 185± 44 | n.s. |
| Q2 | Number (patients) | 48 | 218 | |
| | BMI (kg/m$^2$) | 21.3± 3.1 | 23.8± 3.4 | < 0.01 |
| | Albumin (g/dL) | 3.18± 0.70 | 3.88± 0.51 | < 0.001 |
| | Hb (g/dl) | 10.3± 2.6 | 12.3± 2.3 | < 0.001 |
| | TLC (mm$^3$) | 1235± 892 | 1617± 983 | < 0.05 |
| | TC (mg/dl) | 179± 34 | 184± 42 | n.s. |
| Q3 | Number (patients) | 9 | 257 | |
| | BMI (kg/m$^2$) | 23.5± 2.9 | 23.4± 3.5 | n.s. |
| | Albumin (g/dL) | 3.58± 0.79 | 3.76± 0.60 | n.s. |
| | Hb (g/dl) | 10.3± 2.1 | 12.0± 2.5 | < 0.05 |
| | TLC (mm$^3$) | 1150± 697 | 1569± 983 | n.s. |
| | TC (mg/dl) | 140± 59 | 184± 40 | < 0.05 |
| Q4 | Number (patients) | 15 | 251 | |
| | BMI (kg/m$^2$) | 23.5± 4.4 | 23.4± 3.4 | n.s. |
| | Albumin (g/dL) | 2.79± 0.74 | 3.81± 0.55 | < 0.001 |
| | Hb (g/dl) | 9.3± 2.6 | 12.1± 2.4 | < 0.001 |
| | TLC (mm$^3$) | 1202± 607 | 1575± 991 | n.s. |
| | TC (mg/dl) | 156± 50 | 184± 40 | n.s. |
| Q5 | Number (patients) | 20 | 246 | |
| | BMI (kg/m$^2$) | 20.6± 4.5 | 23.6± 3.3 | < 0.01 |
| | Albumin (g/dL) | 3.06± 0.69 | 3.81± 0.57 | < 0.001 |
| | Hb (g/dl) | 9.9± 2.2 | 12.1± 2.4 | < 0.001 |
| | TLC (mm$^3$) | 918± 519 | 1602± 987 | < 0.01 |
| | TC (mg/dl) | 196± 54 | 183± 40 | n.s. |
| Q6 | Number (patients) | 30 | 236 | |
| | BMI (kg/m$^2$) | 22.2± 4.0 | 23.5± 3.4 | n.s. |
| | Albumin (g/dL) | 3.28± 0.57 | 3.82± 0.59 | < 0.001 |
| | Hb (g/dl) | 10.5± 2.6 | 12.1± 2.4 | < 0.001 |
| | TLC (mm$^3$) | 1383± 683 | 1577± 1006 | < 0.001 |
| | TC (mg/dl) | 172± 38 | 184± 41 | n.s. |
| Q7 | Number (patients) | 21 | 245 | |
| | BMI (kg/m$^2$) | 22.8± 2.7 | 23.5± 3.5 | n.s. |
| | Albumin (g/dL) | 3.74± 0.77 | 3.76± 0.60 | n.s. |
| | Hb (g/dl) | 11.8± 1.8 | 12.0± 2.5 | n.s. |
| | TLC (mm$^3$) | 1215± 506 | 1581± 999 | n.s. |
| | TC (mg/dl) | 173± 43 | 184± 41 | n.s. |
| Q8 | Number (patients) | 31 | 236 | |
| | BMI (kg/m$^2$) | 22.2± 3.9 | 23.5± 3.4 | n.s. |
| | Albumin (g/dL) | 3.04± 0.66 | 3.85± 0.54 | < 0.001 |
| | Hb (g/dl) | 10.0± 2.9 | 12.2± 2.3 | < 0.001 |
| | TLC (mm$^3$) | 1026± 636 | 1613± 990 | < 0.01 |
| | TC (mg/dl) | 172± 48 | 184± 40 | n.s. |
| Q9 | Number (patients) | 59 | 207 | |
| | BMI (kg/m$^2$) | 21.4± 3.4 | 23.9± 3.3 | < 0.01 |
| | Albumin (g/dL) | 3.58± 0.66 | 3.81± 0.59 | < 0.05 |
| | Hb (g/dl) | 11.2± 2.2 | 12.2± 2.5 | < 0.01 |
| | TLC (mm$^3$) | 1073± 594 | 1711± 1026 | < 0.001 |
| | TC (mg/dl) | 180± 43 | 184± 40 | n.s. |
| Q10 | Number (patients) | 57 | 209 | |
| | BMI (kg/m$^2$) | 24.4± 3.3 | 23.1± 3.4 | < 0.05 |
| | Albumin (g/dL) | 3.89± 0.52 | 3.72± 0.63 | n.s. |
| | Hb (g/dl) | 12.6± 2.7 | 11.8± 2.2 | < 0.05 |
| | TLC (mm$^3$) | 1832± 1163 | 1479± 908 | < 0.05 |
| | TC (mg/dl) | 186± 48 | 183± 38 | n.s. |
| Q11 | Number (patients) | 52 | 215 | |
| | BMI (kg/m$^2$) | 22.8± 3.2 | 23.5± 3.5 | n.s. |
| | Albumin (g/dL) | 3.67± 0.66 | 3.78± 0.60 | n.s. |
| | Hb (g/dl) | 11.5± 2.2 | 12.1± 2.5 | n.s. |
| | TLC (mm$^3$) | 1332± 993 | 1609± 966 | n.s. |
| | TC (mg/dl) | 186± 48 | 183± 40 | n.s. |
| Q12 | Number (patients) | 219 | 47 | |
| | BMI (kg/m$^2$) | 23.6± 3.2 | 21.9± 4.4 | < 0.01 |
| | Albumin (g/dL) | 3.82± 0.58 | 3.44± 0.66 | < 0.001 |
| | Hb (g/dl) | 12.1± 2.5 | 11.1± 2.1 | < 0.01 |
| | TLC (mm$^3$) | 1617± 935 | 1279± 1122 | < 0.05 |
| | TC (mg/dl) | 185± 41 | 172± 38 | n.s. |
| Q13 | Number (patients) | 122 | 144 | |
| | BMI (kg/m$^2$) | 23.8± 3.5 | 23.0± 3.4 | n.s. |
| | Albumin (g/dL) | 3.90± 0.50 | 3.64± 0.67 | < 0.001 |
| | Hb (g/dl) | 12.4± 2.4 | 11.5± 2.5 | < 0.01 |
| | TLC (mm$^3$) | 1642± 850 | 1476± 1080 | n.s. |
| | TC (mg/dl) | 183± 42 | 183± 40 | n.s. |
| Q14 | Number (patients) | 183 | 83 | |
| | BMI (kg/m$^2$) | 23.7± 3.5 | 22.8± 3.3 | n.s. |
| | Albumin (g/dL) | 3.80± 0.58 | 3.66± 0.66 | n.s. |
| | Hb (g/dl) | 12.2± 2.4 | 11.4± 2.5 | < 0.05 |
| | TLC (mm$^3$) | 1572± 957 | 1517± 1030 | n.s. |
| | TC (mg/dl) | 182± 37 | 187± 50 | n.s. |

BMI, albumin, Hb, TLC and TC levels are presented as mean± SD ; n.s.= not significant.

Q1, Q2, Q5, Q9 and Q12 could discriminate subjects answered 'YES' from subjects answered 'NO' in 4 of 5 objective biomarkers and Q6, Q8 and Q10 could do them in 3 of 5 biomarkers. This indicated that Q3, Q4, Q7, Q11, Q13 and Q14 had too weak power to detect malnutrition.

*2) Association between questions and biomarkers*

The rate of BMI below 18.5 kg/m$^2$ was only 6% (14/232) among enrolled patients and too small number to evaluate as malnutrition biomarker. Differences of cholesterol level in patients answered 'YES' and 'NO' could be detected by only Q3. Therefore, both BMI and serum cholesterol levels were excluded.

The difference of albumin concentrations and blood Hb levels and total lymphocyte counts in patients answered 'YES' and 'NO' were consistently detected by Q1, Q2, Q5, Q6, Q8, Q9 and Q12 (Table 2). The potential questions detecting low albumin, Hb and TLC were Q1, Q2 and Q9. In contrast, the potential questions detecting normal albumin, Hb and TLC levels were Q5, Q6 and Q8 (Table 3).

*3) Sensitivity and specificity of question combinations*

The rates of low and normal albumin, Hb and TLC levels in subjects answered 'YES' in Q1, Q2 and Q9 were shown in Table 4. The number of subjects answered 'YES' in either 2 or 3 of Q1, Q2 and Q9 seems to be powerful to discriminate malnutrition

Table 3 The rate and percent values of lower and normal biomarkers in subjects answered 'YES' in each question

| Question | Albumin concentration | | Hemoglobin concentration | | Total lymphocyte counts | |
|---|---|---|---|---|---|---|
| | Less than 3.5 g/dl | More than 3.5 g/dlB | Less than 11.0 g/dl | More than 11.0 g/dl | Less than 1,000/mm$^3$ | More than 1,000/mm$^3$ |
| Q1 | 41/61 (67.2) | 91/207 (44.0) | 56/87 (64.4) | 80/181 (44.2) | 52/72 (72.2) | 80/169 (47.3) |
| Q2 | 28/61 (45.9) | 185/207 (89.4) | 30/87 (34.5) | 161/181 (88.9) | 15/72 (20.8) | 144/169 (5.2) |
| Q5 | 14/61 (23.0) | 201/207 (97.1) | 14/87 (16.1) | 175/181 (96.7) | 10/72 (13.9) | 163/169 (96.4) |
| Q6 | 15/61 (24.6) | 192/207 (92.8) | 18/87 (20.7) | 169/181 (93.4) | 8/72 (11.1) | 152/169 (89.9) |
| Q8 | 20/61 (32.8) | 196/207 (94.7) | 21/87 (24.1) | 171/181 (94.5) | 13/72 (18.1) | 158/169 (93.5) |
| Q9 | 22/61 (36.1) | 170/207 (82.1) | 24/87 (27.6) | 146/181 (80.7) | 29/72 (40.3) | 140/169 (82.8) |
| Q12 | 21/61 (34.4) | 179/207 (86.5) | 24/87 (27.6) | l156/181 (86.2) | 20/72 (27.8) | 144/169 (85.2) |

Table 4 Numbers and percent values of subjects with low and normal biomarker data and answered 'YES' in Q1, Q2 and Q9

| Numbers answered 'YES' in Q1, Q2 and Q9 | Albumin | | Hemoglobin | | Total lymphocyte | |
|---|---|---|---|---|---|---|
| | Low concentration | Normal concentration | Low concentration | Normal concentration | Low count | Normal count |
| 0 | 8 (13.1) | 81 (39.1) | 19 (21.8) | 70 (38.7) | 17 (23.6) | 66 (39.1) |
| 1 | 21 (34.4) | 80 (38.6) | 32 (36.8) | 69 (38.1) | 18 (25) | 68 (40.2) |
| 2 | 26 (42.6) | 43 (20.8) | 30 (34.5) | 39 (21.5) | 33 (45.8) | 30 (17.8) |
| 3 | 6 (9.8) | 3 (1.4) | 6 (6.9) | 3 (1.7) | 4 (5.6) | 5 (3.0) |

patients from well nourished patients. Sensitivity of this combination detecting low albumin, Hb and TLC levels were 52.5%, 41.4% and 51.4%, respectively. In contrast, specificity of this combination detecting normal albumin, Hb and TLC levels were 22.2%, 23.2% and 20.8%, respectively.

The rates of low and normal albumin, Hb and TLC levels in subjects answered 'YES' in Q5, Q6 and Q8 were shown in Table 5. The number of subjects answered 'YES' in 3 questions seems to be powerful to discriminate well nourished patients from malnourished patients. Sensitivity of this combination detected low albumin, Hb and TLC levels were 50.8%, 57.5% and 70.8%, respectively. In contrast, specificity of this combination detecting normal albumin, Hb and TLC levels were 85.5%, 87.3% and 82.8%, respectively.

*4) Strength of combined questions to detect malnutrition*

The rates of subjects answered 'YES' in 2 or 3 of Q1, Q2 and Q9 with low albumin, Hb and TLC levels were 58% (18/31), 61.3% (19/31) and 57.7% (15/26) in subjects answered 'YES' in zero to two of Q5, Q6 and Q8 (Table 6). The rates of subjects answered 'YES' in all Q5, Q6 and Q8 with normal albumin, Hb and TLC levels were 89.4% (144/161), 79.5% (128/161) and 80% (116/145) in subjects answered 'YES' in zero or one of Q1, Q2 and Q9 (Table 7). Thus, the combinations of Q5, Q6 and Q8 for the detection of well nourished patients were more powerful than the combinations of Q1, Q2 and Q9 for the detection of malnourished patients.

Table 5 Numbers and percent values of subjects with low and normal biomarker data and answered 'YES' in Q5, Q6 and Q8

| Numbers answered 'YES' in Q5, Q6 and Q8 | Albumin | | Hemoglobin | | Total lymphocyte | |
|---|---|---|---|---|---|---|
| | Low concentration | Normal concentration | Low concentration | Normal concentration | Low count | Normal count |
| 0 | 5 (8.2) | 0 (0) | 4 (4.6) | 1 (0.6) | 3 (4.2) | 0 (0) |
| 1 | 9 (14.8) | 2 (1) | 8 (9.2) | 3 (1.7) | 4 (5.6) | 5 (3.0) |
| 2 | 16 (26.2) | 28 (13.5) | 25 (28.7) | 19 (10.5) | 14 (19.4) | 24 (14.2) |
| 3 | 31 (50.8) | 177 (85.5) | 50 (57.5) | 158 (87.3) | 51 (70.8) | 140 (82.8) |

Table 6 The number of patients answered 'YES' in Q5, Q6 and Q8 among subjects answered 'YES' in more than 2 of Q1, Q2 and Q9

| Number of 'YES' in Q5, Q6 and Q8 | Albumin | | Hemoglobin | | Total lymphocyte | |
|---|---|---|---|---|---|---|
| | Low concentration | Normal concentration | Low Concentration | Normal Concentration | Low count | Normal count |
| 0 | 5 | 0 | 4 | 1 | 3 | 0 |
| 1 | 5 | 1 | 4 | 2 | 2 | 3 |
| 2 | 8 | 12 | 11 | 9 | 10 | 8 |
| 3 | 14 | 33 | 17 | 30 | 22 | 24 |

Table 7 The number of patients answered 'YES' in Q1, Q2 and Q9 among subjects answered 'YES' in all Q5, Q6 and Q8

| Number of 'YES' in Q1, Q2 and Q9 | Albumin | | Hemoglobin | | Total lymphocyte | |
|---|---|---|---|---|---|---|
| | Low concentration | Normal concentration | Low Concentration | Normal Concentration | Low count | Normal count |
| 0 | 5 | 75 | 14 | 66 | 15 | 60 |
| 1 | 12 | 69 | 19 | 62 | 14 | 56 |
| 2 | 13 | 30 | 15 | 28 | 21 | 21 |
| 3 | 1 | 3 | 2 | 2 | 1 | 3 |

## DISCUSSION

The present study prepares 14 questions to identify malnutrition in newly hospitalized patients and to evaluate the strength and the utility of questions. This represents the first step towards developing a comprehensive nutrition care protocol in the framework of the hospital accreditation process. This survey suggests that serum albumin, blood hemoglobin and total lymphocyte levels are good biomarkers to detect malnourished patients with acute disease or emergent problems because their levels show differences by answer 'YES' or 'NO' to the questions for nutrition screening. In contrast, body mass index and serum total cholesterol concentration are not valid as malnutrition biomarker in these patients. The rates of malnutrition of the patients in this study are 22.7%, 32.5% and 29.9% when serum albumin level, blood hemoglobin level and total lymphocyte counts are used as biomarkers, respectively. The prevalence of malnutrition reported in recent years ranged from 20% to 62% (4, 18) and depends on the type of hospital, patient population and evaluation criteria used. Malnourished patients have higher complication rates including infections and organ failure, slower recovery, and higher rates of psychosocial difficulties (19-21).

This study also suggests that Q5, Q6 and Q8 are the important and strong questions to discriminate well nourished patients and malnourished patients. Thus, disturbance of swallowing (Q5), reduced body weight (Q6) and fever (Q8) might be strong factors proceeding to hospitalization. The combinations of Q5, Q6 and Q8 are stronger utility than each separate question for nutrition screening. Although Q1, Q2, Q9 and their combinations are weaker questions than those of Q5, Q6, Q8 and their combinations, these also powerful questions to detect malnutrition. This indicates that the ageing (Q1), food intake (Q2) and history of fall (Q9) are very important factors of malnutrition and hospitalization. Although the combinations of Q5, Q6 and Q8 are highly specific, they had a lower sensitivity, meaning more well-nourished patients would be identified for assessment. Conversely, the combination of Q1, Q2 and Q9 is highly sensitive but had a low specificity (20.8%-23.2%), indicating that many malnourished patients could be missed using these questions. These results stress out the importance of combining objective and subjective information on estimating nutritional status, in an easy and quick way to perform.

Because it is important that nutritional screening should be quick and easy and completed by anyone such as nursing staff, medical staff, allied health assistants, or patients themselves (22). We should always bear in mind that estimation of nutritional risk is indicative of the danger of malnutrition, but only close monitoring of the patients' needs and disease state during hospitalization can reassure its early detection and successful treatment. This study demonstrates an absence of single and very strong question to identify patients at risk of malnutrition and supports the concept of two discrete nutritionally at-risk groups for which different nutritional care processes are required malnutrition screening to identify existing malnutrition and close monitoring of food intake to identify inadequate nutritional intake. Although various assessment tools such as subjective global assessment (SGA) and mini nutritional assessment (MNA) are widely used by health professionals and the research community to diagnose malnutrition, there is no single objective measurement of malnutrition against which to validate the screening tools. An important part of assessing the performance of a screening tool is to consider the reliability of the tool. Because members of nutrition support team performed all the screenings and assessments in this study, the reliability of measurements is decreased. Furthermore, we are unable to comment more generally on the reliability of the questions or the performance of the questions when used by non-members of nutrition support team.

We did not classify patients by diagnosis or hospital service, because of considerable variability in diagnosis, severity of disease and medical service. We also did not control for the presence of chronic disease, such as cancer or diabetes, or complications related to investigational or therapeutic procedures. Future studies should evaluate the association between nutritional risk, risk for complications and assessment during hospitalization, as well as risk associated in subgroups of patients. A further limitation of this study is that nutritional risk assessment was not sufficiently performed at hospital admission and then periodically during hospital stay, which would have allowed to appreciate the progression of nutritional risk during hospital stay. Future studies should also include outcome and morbidity/mortality data. Thus, the present study indicates the quite limited usefulness of the 6-item questions and those combinations as the screening tool for acute disease and emergency patients.

## CONFLICT OF INTEREST

The authors declare no conflict of interest relevant to this manuscript.

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