Hospital Malnutrition: Assessment and Intervention Methods

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Despite hospital malnutrition being identified over three decades ago, it still may be overlooked today. The reality is that too often routine nutrition screening, assessment and intervention practices are not uniformly a part of medical care. Thus, malnutrition – a state of inadequate or unbalanced nutrition - can often be unrecognized in clinical settings. Research consistently demonstrates that malnutrition is a hidden cause of poor health outcomes, rising health care costs, increased utilization of resources, and length of hospital stays, in addition to contributing to morbidity and mortality.[1-4]

Scope of the Problem

Many organizations worldwide are attempting to address the issue of hospital malnutrition. For example, The Committee of Ministers of the Council of Europe adopted a resolution on Food and Nutritional Care in Hospitals in November 2003, after studying the severity of malnutrition in hospitals.[5-7] This resulted in a network of experts designing the "Nutrition Day in European Hospitals," which is an annual one-day cross-sectional multicentre audit with an evaluation of nutrition related outcome data.[8] As far back as 1984, the Joint Commission on Accreditation of Healthcare Organizations in the United States included "Quality and Appropriateness Standards for Support Services" of which monitoring and evaluating a patient's nutritional care, and later, continuous quality improvement of nutrition services, became part of the review process for hospitals.[9,10] Then in 1996, all patients were to have a nutritional screen within 24-hours of admission to better evaluate performance important to patient care.[11] In 1993, Coats reported, in a 12-year reevaluation of hospital-associated malnutrition in the same teaching hospital, that although the likelihood of malnutrition worsening during the hospital stay had improved by 16% from 1976 to 1988, it still pointed to the need for improvement

in nutritional assessment and intervention processes, as the prevalence of malnutrition upon admission was still 38%.[12] To aid the identification of malnourished patients, the British Association for Parenteral and Enteral Nutrition (BAPEN) recommended that all patients should be routinely screened on admission to hospitals, at regular intervals throughout their stay and during outpatient and General Practioner appointments.[13] In 1995, a report by a BAPEN Working Party concluded that health care workers were not routinely screening patients on admission to hospital and made recommendations to address the issue.[14] Four questions and two measurements were proposed as the minimum required for identifying patients with nutritional problems and possibly requiring referral for specialist nutrition advice (BAPEN4):

BAPEN recommendations[14]

Every patient should be asked the following questions on admission to hospital:

* Have you unintentionally lost weight recently?
* Have you been eating less than usual recently?
* What is your normal weight?
* How tall are you?

All patients should be weighed and have their height measured.

The answers to the four questions and the results of the two measurements should always be clearly recorded in the case notes.

Definition

First, understand that the malnutrition seen in hospitals usually occurs as some form of protein-energy malnutrition (PEM). Primary PEM results from an acute or chronic deficiency of both protein and calories. Secondary PEM, or cachexia, results from a disease or medical condition such as cancer or gastrointestinal disease that alters requirements or impairs utilization of nutrients.

Prevalence

The prevalence of hospital malnutrition varies depending on a number of factors, including patients' diagnoses, age, the nutrition parameters, and the screening and assessment tools used. Many studies across continents have cited the prevalence of malnutrition, with malnutrition risk ranging from 15% to 54%.[15-21] The prevalence is particularly high among older adults and those with specific diseases known to affect nutritional intake and status.[22]

J. Kondrup of Denmark reported at the 2007 European Society for Clinical Nutrition and Metabolism Symposium that malnutrition is common in European hospitals, and the average prevalence is 35%, with a range from 10 - 85%. In The Netherlands, Meijers found that hospital malnutrition is almost 24%, which may be higher than home-care and nursing home settings, accounting for malnutrition in one of five patients.[23] Stratton's research in the United Kingdom found that malnutrition was common in 58% of patients and was associated with longer hospital stays and poor outcomes.[24] More recently, Edington et al[25] in 2000 reported malnutrition rates for the United Kingdom to be 20% - 40% upon hospital admission.[25] In Vietnam hospitals during 2002 - 2004, Pham et al[26] found admission malnutrition rates of almost 56% for patients admitted for elective abdominal surgery. Brazilian hospitals were found by Correia[1] to have malnutrition rates at hospital admission of 34%.

The Dutch dietetic organization has screened for malnutrition in 7600 patients. About 25% of all patients in all medical categories were either moderately or severely malnourished. Despite all efforts to address hospital malnutrition over the past 30 years, almost 50% of the malnourished patients in this study were still not referred to a dietitian for nutritional interventions.[27]

Economic and Human Costs

The economic and human costs of malnutrition are avoidable through routine nutrition screening, assessment, and intervention. This process of identifying at-risk patients has been proven to be cost-effective, improve outcomes and reduce health care costs.[28-30] While the preferred methodology and

screening tools may vary, experts concur that the process is essential to addressing malnutrition in clinical settings. Van Bokhorst-de van der Schueren[31] in 2005 concluded that malnutrition is difficult to recognize in a nonspecific hospital population and that these patients do not present with unique symptoms indicating malnutrition, and therefore to require that simply screening the nutritional status of all newly admitted patients is necessary to correctly identify all malnourished patients.

A multitude of studies from the United States and other countries, have verified that malnourished patients are at increased morbidity and mortality risk.[32] In addition, malnutrition reduces quality of life (QOL), especially in frail older adults, in whom it can have devastating effects on daily function.[33,34] One meta-analysis of 90 cohort studies showed that low albumin was a strong independent predictor of poor outcomes. For each 10-g/L decline in albumin, the odds of mortality increased by 137%, morbidity increased by 89%, prolonged ICU stay by increased by 28%, prolonged LOS by 17%, and increased resource utilization by 66%.[35] Research by Cederholm et al[36], of 205 older adult patients hospitalized for conditions other than cancer, found that over a 9-month follow-up period, the mortality was 44% among the malnourished patients compared to only 18% among the nourished patients, and also discovered that for those with congestive heart failure, the mortality was 80%. The BAPEN report also found that malnourished patients had more:

- General Practioner visits (65% increase)
- Hospital admissions (82% increase)
- >30% longer Length of Stay
- Greater likelihood of admission to care homes

These increases can account for many of the additional costs of care reported in the BAPEN report, in which the annual expenditure on managing patients with medium or high risk of disease-related malnutrition was estimated to be about £7.3 billion to £10.5 billion. Over half was spent on hospital care and a similar proportion on individuals over 65 years of age.[37]

Problem Approach

A tiered approach to identifying patients who are at highest risk for increased morbidity and mortality associated with malnutrition is the most cost effective approach.[38-40] Screening tools such as the Malnutrition Screening Tool (MST), the DETERMINE Check List, the Malnutrition Universal Screening Tool (MUST), and the Nutrition Risk Index (NRI) can quickly flag high-risk patients for further assessment. Thorough assessments can be completed efficiently using tools such as the Subjective Global Assessment (SGA), and the results can help personnel design appropriate nutrition intervention plans. Assessment tools such as the SGA provide a more complete picture of nutritional status beyond biochemical or anthropometric markers alone, both of which can be affected by factors other than nutrition. Continuing research strives to identify the single biological marker that is most closely associated with anthropometric markers, such as leptin concentration in elderly patients as reported recently by Bouillanne.[41] While such studies look promising, the complexity of the problem involves assimilating various indices for accurate malnutrition identification.

Screening and Assessment Tools

In order to quickly identify and address hospital malnutrition, numerous nutrition screening and assessment instruments have been validated and are readily available. Here is a brief description of the more commonly used tools.

Screening Tools:

The Malnutrition Screening Tool (MST) is a simple, quick, valid, and reliable tool for identifying patients at risk of malnutrition. The tool has only two questions related to weight loss and decreased appetite. A score of $\geq$2 means that the patient is at risk for malnutrition and warrants further assessment.[42]

MST

1. Have you lost weight recently without trying?

No	0
Unsure	2

If Yes, how much weight have you lost?

2 - 13 lb.	1
14 - 23 lb.	2
24 - 33 lb.	3
>33 lb.	4
Unsure	2

Weight Loss Score: ☐

2. Have you been eating poorly because of a decreased appetite?

No	0
Yes	1

Appetite Score: ☐

MST Score (weight loss and appetite scores): ☐

The DETERMINE Check List has been developed and distributed by the Nutrition Screening Initiative to screen older adults. DETERMINE is an acronym for warning signs of poor nutritional health: **D**isease, **E**ating poorly, **T**ooth loss/mouth pain, **E**conomic hardship, **R**educed social contact, **M**ultiple medicines, **I**nvoluntary weight loss/gain, **N**eeds assistance in self-care, **E**lder years above age 80. The tool consists of a one-page checklist and an information page for the person being screened. A score of 3 - 5 indicates moderate nutrition risk, and a score of ≥6 indicates high risk.[43]

Determine Your Nutritional Health

The warning signs of poor nutritional health are often overlooked. Use this checklist to find out if you or someone you know is at nutritional risk.

Read the statements below. Circle the number in the yes column for those that apply to you or someone you know. For each yes answer, score the number in the box. Total your nutritional score.

	YES
I have an illness or condition that made me change the kind and/or amount of food I eat.	2
I eat fewer than two meals per day.	3
I eat few fruits or vegetables, or milk products.	2
I have three or more drinks of beer, liquor or wine almost every day.	2
I have tooth or mouth problems that make it hard for me to eat.	2
I don't always have enough money to buy the food I need.	4
I eat alone most of the time.	1

I take three or more different prescribed or over-the-counter drugs a day.	1
Without wanting to, I have lost or gained 10 pounds in the last six months.	2
I am not always physically able to shop, cook and/or feed myself.	2

TOTAL _____

Total your nutritional score. If it's--

0 - 2	Good! Recheck your nutritional score in six months.
3 - 5	You are at moderate nutritional risk. See what can be done to improve your eating habits and lifestyle. Your office on aging, senior nutrition program, senior citizens center or health department can help. Recheck your nutritional score in three months.
6 or more	You are at high nutritional risk. Bring this checklist the next time you see your doctor, dietitian or other qualified health or social service professional. Talk with them about any problems you may have. Ask for help to improve your nutritional health.

Remember that warning signs suggest risk, but do not represent diagnosis of any condition.
The Nutrition Checklist is based on the warning signs described below. Use the word DETERMINE to remind you of the warning signs.

Disease

Any disease, illness or chronic condition that causes you to change the way you eat, or makes it hard for you to eat, puts your nutritional health at risk. Four out of five adults have chronic diseases that are affected by diet. Confusion or memory loss that keeps getting worse is

estimated to affect one out of five or more of older adults. This can make it hard to remember what, when or if you've eaten. Feeling sad or depressed, which happens to about one in eight older adults, can cause big changes in appetite, digestion, energy level, weight and well-being.

Eating Poorly

Eating too little and eating too much both lead to poor health. Eating the same foods day after day or not eating fruit, vegetables and milk products daily will also cause poor nutritional health. One in five adults skips meals daily. Only 13% of adults eat the minimum amount of fruits and vegetables needed. One in four older adults drinks too much alcohol. Many health problems become worse if you drink more than one or two alcoholic beverages per day.

Tooth Loss/Mouth Pain

A healthy mouth, teeth and gums are needed to eat. Missing, loose or rotten teeth or dentures that don't fit well or cause mouth sores make it hard to eat.

Economic Hardship

As many as 40% of older Americans have incomes of less than $6,000 per year. Having less--or choosing to spend less--than $25 to $30 per week for food makes it very hard to get the foods you need to stay healthy.

Reduced Social Contact

One-third of all older people live alone. Being with people daily has a positive effect on morale, well-being and eating.

Multiple Medicines

Many older Americans must take medicines for health problems. Almost one half of older Americans take multiple medicines daily. Growing old may change the way we respond to drugs. The more medicines you take, the greater the chance for side effects such as increased or decreased appetite, change in taste, constipation, weakness, drowsiness, diarrhea, nausea and

others. Vitamins or minerals when taken in large doses act like drugs and can cause harm. Alert your doctor to everything you take.

Involuntary Weight Loss/Gain

Losing or gaining a lot of weight when you are not trying to do so is an important warning sign that must not be ignored. Being overweight or underweight also increases your chance of poor health.

Needs Assistance in Self Care

Although most older people are able to eat, one of every five has trouble walking, shopping, buying and cooking food, especially as they get older.

Elder Years Above Age 80

Most older people lead full and productive lives. But as age increases, risk of frailty and health problems increase. Checking your nutritional health regularly makes good sense.

The Malnutrition Universal Screening Tool (MUST) is a tool for screening adult patients. The clinician measures height and weight to determine Body Mass Index (BMI), then determines the percent of unintended weight loss over the last 6 months, and estimates the effect of illness on nutrition intake. These scores are combined to derive an overall malnutrition score. A score of 1 indicates medium risk and a score of $\geq$2 indicate high risk. Based on that score, the clinician develops a patient care plan.[44,45]

Nutritional Risk Screening (NRS 2002) is a tool based on the concept that nutritional support is indicated in patients who are severely ill with increased nutritional requirements, or who are severely undernourished, or who have certain degrees of severity of disease in combination with

degrees of undernutriiton. Degrees of severity of disease and undernutrition are defined as absent, mild, moderate or severe and assigned a numeric score. These are combined with questions regarding BMI, recent reduced oral intake, and recent weight loss. This screen is currently recommended by ESPEN for nutritional screenings in European hospitals.[46]

Assessment Tools:

Subjective Global Assessment (SGA) is a validated nutrition assessment tool that includes both a medical history and a physical examination. The medical history focuses on changes in weight, dietary intake, gastrointestinal symptoms persisting more than 2 weeks, and functional capacity. Key indicators of malnutrition are weight loss greater than 5% in the last 3 months or greater than 10% in the last 6 months. The physical exam includes an evaluation of subcutaneous fat, muscle wasting, ankle and sacral edema, and ascites. Patients are assigned a nutrition rating of SGA-A (well-nourished), SGA-B (moderately or suspected malnourished), or SCA-C (severely malnourished). Some clinicians now use a 7-point scale instead of the original 3-point scale.[47]

The Mini Nutritional Assessment (MNA) was designed for use with older patients and includes anthropometric measurements including calf and arm circumferences, BMI, and weight loss. In addition, the MNA assesses lifestyle, mobility, and medication usage. The MNA contains a dietary questionnaire to measure food and fluid intake and autonomy of feeding. The clinician has to make a subjective assessment of the patient's perception of his or her health and nutrition status. Once complete, the patients are categorized into one of three levels: satisfactory, risk of malnutrition, or PEM.[48,49]

The Nutrition Risk Index (NRI) is derived from albumin concentration and the ratio of actual to usual weight:[50,51]

NRI = (1.519) ALB (g/L) +(41.7) (present weight/usual weight)

Scores fall into one of four categories: not malnourished >100; mildly malnourished 97.5- ≤100; moderately malnourished 83.5 -<97.5; and severely malnourished <83.5.

Intervention

After identifying what patients are at risk for malnutrition, the next step is completion of a nutritional assessment, which then guides the nutritional intervention plan. Providing nutritional support to patients identified to be at risk for developing malnutrition in addition to those that already present with altered nutrition, has the potential to decrease morbidity and mortality, improve quality of life and/or functioning, as well as decreasing length of hospital stay, use of resources, and costs of care.

Oral supplementation or "sip-feeds" are usually provided first to those with functional GI tracts to promote GI functionality and integrity, as well as being cost effective. Stratton completed a meta-analysis of five randomized controlled trials of 1224 older adult patients that showed oral nutritional supplementation can significantly reduce the risk of developing pressure ulcers by 25% in this population.[52] Smedley randomly provided oral supplementation to the lower gastrointestinal track in surgical patients in the United Kingdom and found those who received pre- and post-operative supplementation had significantly fewer minor complications.[53] In another study, 84 studies were reviewed on the use of oral nutritional supplements by people with chronic conditions. The results showed that supplementation typically had a positive effect on functioning, ie, improved muscle strength, walking distance and well-being in patients with chronic obstructive pulmonary disease. Additional results were the reduction of falls and increased ability to perform Activities of Daily Living in older adults.[54] Beattie et al[55] followed 101 hospitalized patients for 10 weeks that had received oral

nutritional supplementation after surgery, instead of the standard post-operative care, and found that the treatment group had a significantly improved nutritional status, and quality of life measures.

Economics of Addressing Hospital Malnutrition

Not to be forgotten are the potentially enormous cost savings of addressing hospital malnutrition. One hospital developed a comprehensive program, which resulted in a savings of $2.4 million over a 2-year period due to decreased LOS; the savings were estimated at $1,000 for each patient at high risk of malnutrition.[56] Complication rates and mortality have also been reported to be significantly reduced.[57] A. Milne et al[58] reviewed 62 randomized and quasi-randomized controlled trials of oral protein and energy supplementation in older people, excluding those recovering from cancer treatment or in critical care. They concluded that with the 10,187 randomized participants, supplementation produces a small but consistent weight gain in older people, and mortality may be reduced in older people who are undernourished. There may also be a beneficial effect on complications which needs to be confirmed through additional well-designed randomized, controlled research.[58]

In Summary

A vast amount of research reveals the high prevalence and poor outcomes of hospital malnutrition. Research also indicates that these poor outcomes and increased costs can be minimized or avoided by appropriate nutrition interventions. While health care costs and resource utilization are ever increasing, health care professionals should not ignore this simple method to reduce the economic and human costs of malnutrition—screen patients for malnutrition upon admission to hospitals, assess those found to be at risk, intervene with appropriate nutrition in those who can benefit, and monitor their progress in order to make necessary appropriate changes to the nutritional intervention.

References

1. Correia MITD, Waitzberg DL: The impact of malnutrition on morbidity, mortality, length of hospital stay and costs evaluated through a multivariate model analysis.

Clin Nutr 2003;22 (3): 235-239.

2. Sullivan DH, Sun S, Walls RC: Protein-energy under-nutrition among elderly hospitalized patients: a prospective study. *JAMA* 1999;47:2013-2019.

3. Persson MD, Brismar KE, Katzarski KS, et al: Nutritional status using Mini Nutritional Assessment and Subjective Global Assessment predict mortality in geriatric patients.

J Am Geriatr Soc 2002; 50:1996-2002.

4. Sullivan D, Bopp M, Roberson P: Protein–energy undernutrition and life-threatening complications among hospital elderly. *J Gen Intern Med* 2002;17:923-932.

5. Committee of Ministers. Resolution ResAP (2003)3 on Food and Nutritional Care in Hospitals. Strasbourg: Council of Europe; 2003.

6. Beck Am, Balknas UN, Camilo Me, et al: Practices in relation to nutritional care and support—report from the Council of Europe. *Clin Nutr* 2002;21(4):351-354.

7. Beck Am, Ovesen L: At which body mass index and degree of weight loss should hospitalized elderly patient be considered at nutritional risk? *Clin Nutr* 1998;17(5):195-198.

8. Research Project: *Nutrition Day in European Hospitals.* Available at: www.nutritionday.org. Accessed January 29, 2009.

9. The American Dietetic Association Council on Practice Quality Assurance Committee (Learning the language of quality care). *J Am Diet Assoc.* 1993;93:531–532.

10. Joint Commission on Accreditation of Healthcare Organizations: 1984 Accreditation Manual for Hospitals, Chicago: Joint Commission on Accreditation of Healthcare Organizations, 1983.

11. Joint Commission on Accreditation of Healthcare Organizations: Comprehensive Accreditation Manual for Hospitals Assessment of Patients. PE. 1.2 and PE. 1.6.,1996. Oakbrook Terrace, IL; 1995.

12. Coats, KG, Morgan S, Bartolucci AA, et al: Hospital-association malnutrition: a reevaluation 12 years later. *J Am Diet Assoc* 1993;93:27-33.

13. Sizer T: *Standards and guidelines for nutritional support of patients in hospital. A report by a working party of the British Association for Parenteral and Enteral Nutrition,*1996.

14. Lennard-Jones JE, Arrowsmith H, Davison C, et al. Screening by nurses and junior doctors to detect malnutrition when patients are first assessed in hospital. *Clin Nutr* 1995;14:336–40.

15. Robinson MK, Trujillo EB, Morgensen KM, et al: Improving nutritional screening of hospitalized patients: The role of prealbumin. *JPEN* 2003;27(6):389-395.

16. Vecchiarino P, Bohannon RW, Ferullo J, et al: Short-term outcomes and their predictors for patients hospitalized with community-acquired pneumonia. *Heart Lung* 2004;33(5):301-307.

17. Chima CS, Barco K, Dewitt MLA, et al: Relationship of nutritional status to length of stay, hospital costs, discharge status of patients hospitalized in the medicine service.
J Am Diet Assoc 1997;97:975-978.

18. Corish CA, Kennedy NP: Undernutrition in hospitals. *Br J Nutr* 2001;85:509-510.

19. Edington J, Kon P: Prevalence of malnutrition in the community. *Nutrition* 1997;13:238-240.

20. McWhirter JP, Pennington CR: Incidence and recognition of malnutrition in hospital. *Brit Med J* 1994;308:945-948.

21. Pirlich M, Schutz T, Norman K et al: The German hospital malnutrition study. *Clin Nutr* 2006;25:563-572.

22. Sullivan Dh, Bopp MM, Roberson P K: Protein-energy undernutrition among elderly hospitalized patients: a prospective study. *JAMA* 1999;281(21):2013-2019.

23. Meijers J, Schols LMGA, van Bokhorst-de van der Schueren MAE, et al: Malnutiriton prevalence in The Netherlands: results of the Annual Dutch National Prevalence Measurement of Care Problems. *Brit J Nutr* 2009; 101:417-423

24. Stratton RJ, King DL, Stroud MA, et al: Malnutrition Universal Screening Tool predicts mortality and length of hospital stay in acutely ill elderly. *Brit J of Nutr* 200695:325-330

25. Edington J, Boorman J, Durrant ER, et al: Prevalence of malnutrition on admission to four hospitals in England. *Clin Nutr* 2000;19:191-195.

26. Pham N V, Cox-Reijvenb PLM, Grevec JW: Application of subjective global assessment as a screening tool for malnutrition in surgical patients in Vietnam. *Clin Nutr* 2006; 25:102-108.

27. Kruizenga HM, Wierdsma NJ, Van Bokhorst-de van der Schueren MAE, et al: Screening of nutrition status in the Netherlands. *Clin.Nutr* 2003;22:147-152.

28. Planas M, Audivert S, Pérez-Portabella C, et al: Nutritional status among adult patients admitted to a university-affiliated hospital in Spain at the time of genoma. *Clin Nutr* 2004; 23:1016-1024.

29. Bauer J, Capra S, Ferguson M: Use of the scored Patients-Generated Subjective Global Assessment (PG-SGA) as a nutrition assessment tool in patients with cancer. *Eur J Clin Nutr* 2002;56:770-785.

30. Braunschweig C, Gomez S, Sheean P: Impact of declines in nutritional status on outcomes in adult patients hospitalized for more than 7 days. *J Am Diet Assoc* 2000;100(11):1316-1322.

31. Bokhorst-de van der Schueren MAE, Klinkenberg M, Thijs A: Profile of the malnourished patient. *Eur J Clin Nutr* 2005; 59:1129-1135

32. Gallagher-Allred CR, Voss AC, Finn SC et al: Malnutrition and clinical outcomes: the case of medical nutrition therapy. *J Am Diet Assoc* 1996;96:361-366,369.

33. Crogan NL, Pasvogel A: The influence of protein-calorie malnutrition on quality of life in nursing homes. *A Biol Sci* 2003;58A(2):159-164.

34. Ravasco P, Monteiro-Grillo I, Vidal P, et al: Cancer: disease and nutrition are key determinants of patients' qualify of life. *Support Care Cancer* 2004;12:246-252.

35. Vincent JL, Dubois MJ, Navickis RJ, et al: Hypoalbuminemia in acute illness: is there a rationale for intervention? a meta-analysis of cohort studies and controlled trials. *Ann Surg* 2003;237:319-334.

36. Cederholm T, Jägrén C, Hellström K: Outcome of protein-energy malnutrition elderly medical patients. *Am J Med* 1995; 98:67-74.

37. Russell C: The impact of malnutrition on healthcare costs and economic considerations for the use of oral nutritional supplements. *Clin Nutr Supplements* 2007;2:25-32.

38. Corish CA, Flood P, Kennedy NP: Comparison of nutrition risk screening tools in patients on admission to hospital *J Hum Nutr Diet* 2004;17:133-139.

39. Jones, JM: The methodology of nutrition screening and assessment tools. *J Hum Nutr Diet* 2002;15:59-71.

40. Norman K, Pichard C, Lochs H, et al: Prognostic impact of disease-related malnutrition. *Clin Nutr* 2008.27:5-15.

41. Bouillanne O, Golmard L-L, Coussieu C, et al: Leptin a new biological marker for evaluating malnutrition in elderly patients. *EJCN* 2007;61:647-654.

42. Ferguson M, Capra S, Bauer M, et al: Development of a valid and reliable malnutrition screening tool for adult acute hospital patients. *Nutrition* 1999;15:458-464.

43. American Academy of Family Physicians and The Nutrition Screening Initiative: Determine Your Nutrition Health. http://www.aafp.org/afp/980301ap/edits.html. Accessed January 29, 2009.

44. Stratton FJ, Hackston A, Longmore D: Malnutrition in hospital outpatients and inpatients: prevalence, concurrent validity and ease of use of the 'malnutrition universal screening tool' (MUST) for adults. *Brit J Nutr* 2004;92:799-808.

45. Malnutrition Universal Screening Tool. Available at: http://www.bapen.org.uk/musttoolkit.html. Accessed January 29, 2009.

46. Kondrup J, Rasmussen HH, Hamber O, et al: Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. *Clin Nutr* 2003;22(3):321-336

47. Detsky A, McLaughlin J, Baker J, et al: What is subjective Global Assessment of nutritional status? *JPEN* 1987;11:8-13.

48. Gazzotti C, Arnaud-Battandier F, Parello M, et al: Prevention of malnutrition in older people during and after hospitalization: Results from a randomized controlled clinical trial. *Age Ageing* 2003; 32:321-326.

49. Guigoz Y, Lauque S, Vellas B: Identifying the elderly at risk for malnutrition: The Mini Nutrition Assessment. *Clin Geriatr Med* 2002;18:737-757.

50. Kondrup J, Rasmussen H H, Hamberg O, et al. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. *Clin Nutr* 2003;22(3):321-336.

51. Pablo AMR, Izaga MA, Alday LA: Assessment of nutritional status on hospital admission: nutritional scores. *Eur J Clin Nutr* 2003; 57:824-831.

52. Stratton FJ, Ek AC, Engfer M, et al: Enteral nutritional support in prevention and treatment of pressure ulcers: a systemic review and meta-analysis. *Ageing Res Rev* 2005;4:422-450.

53. Smedley F, Bowling T, James M, et al: Randomized clinical trial of the effects of preoperative and postoperative oral nutritional supplements on clinical course and cost of care. *Br J Surg* 2004;91:983-990.

54. Stratton FJ, Elia M: Are oral nutritional supplements of benefit to patients in the community? findings from a systematic review. *Curr Opin Clin Nutr Metab Care* 2000;3:311-315.

55. Beattie AH, Prach AT, Baxter JP, et al: A randomized controlled trial evaluating the use of enteral nutritional supplements postoperatively in malnourished surgical patients. *Gut* 2000;46:813-818.

56. Brugler L, DiPrinzio MJ, Bernstein L: The five-year evolution of a malnutrition treatment program in a community hospital. *J Qual Improve* 1999;25(4):191-206.

57. Brugler L: Hospital finds nutrition care pays off on all counts, cutting cost, complications, mortality. *Clin Res Man* 2000;1:183-186.

58. Milne AC, Potter J, Vivanti A, et al. Protein and energy supplementation in elderly people at risk from malnutrition. Cochrane Database of Systematic Reviews 2009, issue 2. Art. No.: CD003288. doi:10.1002/14651858.CD003288.pub3.