OBESITY AMONG OLDER PERSONS: SCREENING FOR RISK OF ADVERSE OUTCOMES

G.L. JENSEN[1-3]

1. Vanderbilt Center for Human Nutrition, 514 Medical Arts Building, Nashville, TN 37212, 2. Department of Medicine, Vanderbilt University Medical Center, Nashville, TN; 3. TN Valley VA GRECC, Nashville, TN. Contact: 615-926-1295 phone, 615-343-1587 fax, gordon.jensen@vanderbilt.edu

Abstract: A research overview is presented that highlights the growing prevalence of obesity among older persons and the associated risks for medical co-morbidity, healthcare resource use, functional decline and homebound status. Findings reveal that even for obese individuals poor diet quality and micronutrient deficiencies are relatively common concerns. Currently available nutrition risk screening instruments lack validity for overweight / obese older persons. Development and preliminary testing of a new Nutrition Health Outcomes Questionnaire (NHOQ) for this application are presented.

Key words: Obesity, function, elderly, malnutrition.

Introduction

Obesity (BMI ≥30) is growing in prevalence among older Americans (Table 1). NHANES III showed increases for both men and women in all age groups and for non-Hispanic whites, non-Hispanic blacks and Mexican-Americans (1). Excess weight and obesity are associated with serious medical co-morbidities, including hypertension, diabetes mellitus, dyslipidemia, metabolic syndrome, coronary artery disease, and destructive joint disease (2-7). High BMI among older persons is also associated with increased self-reported functional limitations, decreased measured physical performance, and elevated risk of subsequent functional decline (8-12). The incremental annual medical costs for obese Medicaid and Medicare recipients in comparison to those of desirable weight are $864 and $1,486, respectively (13).

Research Findings

Studies by our research team have focused upon a cohort of 21,643 rural older persons in central Pennsylvania as they age in place (9, 10, 14-23). The Geisinger Rural Aging Study (GRAS) is a collaborative undertaking of the Geisinger Healthcare System, the Pennsylvania State University, the Vanderbilt University Medical Center, and Tufts University. Supported by the US Department of Agriculture Agricultural Research Service, the project was initiated in 1994 to screen participants 65 years of age or greater for nutritional risk. The GRAS cohort has been characterized by large-scale mailing, telephone interviews, and by random sub-sampling to target smaller representative groups for more detailed home visits or clinic based encounters. Investigation has demonstrated the growing prevalence of obesity among community dwelling older persons and its strong associations with medical co-morbidities, functional decline, and healthcare resource use (9, 10,14, 15, 20, 23). Recent investigation with complete longitudinal follow-up on 12,834 cohort members over 3-4 years identified obesity as a significant predictor of risk for reporting homebound status (24).

We have also found that even for obese individuals poor diet quality and micronutrient deficiencies are relatively common concerns (19, 22). This was particularly true for obese older women living alone. Of particular note, B-vitamin deficiencies were detected by both dietary intake and blood test measures, specifically B-6, B-12, and folate (19). Fully 25% of a community-dwelling sample had low plasma B-12 levels. These deficiencies are in turn associated with elevated homocysteine and increased risk of cardiovascular disease, dementia, and osteoporosis (25-30).

Development and Preliminary Testing of Nutrition Health Outcomes Questionnaire

Currently available nutrition risk screening questionnaires for older persons have specifically focused upon recognition of under-nutrition, under-weight, and frailty (31-36). These instruments therefore lack established validity for overweight / obese persons and have not been systematically tested in this regard. Reliable body weights and circumferences can be difficult to obtain for obese persons. Such individuals may also suffer sarcopenic obesity and deconditioning without evident weight loss. Fluid retention and increased fat mass may mask erosion of muscle mass. Poor quality diets can result in micronutrient deficiencies among obese persons that are not detected by simple food frequency intake queries and may not have manifest physical examination findings.

Our research team has therefore systematically developed a self-report 14-item Nutrition Health Outcomes Questionnaire (NHOQ) (Figure 1) intended to identify overweight/obese persons at risk for functional decline and healthcare resource use. Exploratory items were also incorporated in regard to diet quality. Queries were chosen on the basis of associations with the desired outcomes in preliminary studies (Table 2). The NHOQ queries demographic, body weight/weight change,

dietary practice, food security, eating difficulty, medication/supplement use, obesity-related conditions, healthcare use, functional limitation, living environment, depression, and general health status components. Selected items were then tested in separate focus groups consisting of obese older persons and geriatric nutrition health professionals. Face validity and content validity were confirmed. Modifications were made to enhance comprehension and readability. Literacy level is 6th grade (Flesch-Kincaid). A scannable format has been developed and tested. We have successfully administered the NHOQ on a large scale via the US Mail with favorable response rates.

Table 1
Prevalence of Obesity - BMI ≥30, (%): NHANES 1988-1994 versus 1999-2000

Age (years)	Men 1988-1994	Men 1999-2000	Women 1988-1994	Women 1999-2000
20-29	12.5	21.1	14.6	23.3
30-39	17.0	26.0	25.8	32.5
40-49	23.1	26.3	26.9	35.4
50-59	28.9	32.2	35.6	41.2
60-69	24.8	38.1	29.8	42.5
70-79	20.0	28.9	25.0	31.9
80 or greater	8.0	9.6	15.1	19.5

Adapted from: Flegal KM, et al, JAMA 2002; 288:1723.

The NHOQ has been further tested in a pilot weight loss intervention study (37). Twenty-six obese (BMI 39 ± 6 kg/m2) older women aged 64 ± 4 years were enrolled in a 3-month weight reduction program with diet, behavior modification, and physical activity components. Among the 18 women who completed the full intervention, the mean weight loss was 4.3 ± 5.5 kg. There were significant improvements in total serum cholesterol and triglycerides, in measured physical performance for step climb and descent, and in self-reported physical functioning and energy levels. The NHOQ demonstrated reliability upon repeated administrations to participants. Each completed the questionnaire at baseline, visit 3, visit 5, visit 7, and 3-months. Those NHOQ items that would not be anticipated to change over the study period exhibited stability without any significant changes (Cochran Q test or Friedman test for repeated measures as appropriate). Proxy reports by family or caregivers were obtained at baseline and gave findings generally comparable to those of participants. Kappa statistics for proxy responses for NHOQ items included: weight loss - 0.86, edema - 0.43, diuretic use – 0.45, following weight reduction diet - 0.67, skip breakfast - 0.80, prescription drugs - 0.43, multivitamins - 0.44, coronary disease - 0.64, high blood pressure - 0.79, diabetes - 1.00, lung disease – 0.83, high cholesterol – 0.31, arthritis – 0.72, doctor visits – 0.62, hospitalized – 0.64, assistance walking – 0.45, live alone - 0.86,

assistance device – 0.64, flight of stairs – 0.48, television < 4-hours – 0.44, television 4 or more hours – 0.48, television with snacks – 0.39, tired lacking energy – 0.51, and takes anti-depressant – 0.42.

Shown in Table 3 are descriptive data for the first wave of n=1,324 GRAS participants who returned a mailed NHOQ in 2004 and shown in Table 4 are the striking associations revealed by univariate logistic regression at the upper range of BMI for adverse outcomes such as reporting increased physician visits, instrumental activities of daily living / activities of daily living (IADL/ADL) limitations, and co-morbid disease burden.

Exploratory factor analysis (EFA) of the NHOQ items was recently completed with this same data set (n=1,324 GRAS participants). Domains of interest were selected including general health status / cardiovascular disease; functional status; dietary quality; and weight reduction strategies. These domains were selected on the basis of clinical relevance to the obesity-related outcomes of interest. Some items were rarely endorsed and were not retained for analysis. A combined general health / cardiovascular disease scale included 10 variables (edema, coronary disease, congestive heart failure, angina, myocardial infarction, other heart attack, lung disease or breathing difficulties, knee arthritis, hospitalization, general health). Functional status included 11 variables (bathing, dressing, grooming, toileting, eating, walking, getting out of bed, travel, prepare food, housebound, assistance device). The overall quality of respondents' dietary intake was assessed by asking about frequency of consumption of cereal, fruit, vegetables and dairy foods (4 variables). Finally, strategies participants had employed to lose weight were assessed through queries of self-directed diet, dietitian counseling, focus on cutting calories, focus on eating less fat, focus on eating less carbohydrates, and increasing physical activity / exercise (6 variables).

A combination of theory-driven and exploratory factor analysis (EFA) was used to identify the items that provided reliable estimation of the latent characteristics of the instrument. Reliability was measured using coefficient H which evaluates the reliability of the latent construct such that $H = L' P^{-1} L$ where L is the vector of the p-indicators' standardized loadings for a single construct and P is the population correlation matrix that expresses the relationship among the indicators (38). Reliability estimates for the constructs ranged from 0.66 to 0.99. After identifying the items that measured each domain of interest, Item Response Theory (IRT) was applied to evaluate the item's measurement characteristics (39). A two-parameter IRT model (2PL) was used to estimate item discrimination and difficulty parameters (40). As described above, the domains of interest included cardiovascular disease, health care, functional status, diet quality, and weight reduction strategy. The IRT in conjunction with theory and EFA recommended the 19 items shown below be used to evaluate the 5 noted domains: <u>cardiovascular disease</u> (coefficient H = 0.87) – congestive heart failure, angina, and myocardial

infarction; general health (coefficient H = 0.66) – <u>general health</u>, overnight hospital stay, and physician / emergency room / clinic visits; <u>functional status</u> (coefficient H = 0.99) – toileting, housebound, assistance device, sad / depressed, and tired; <u>diet quality</u> (coefficient H = 0.70) – cereals, vegetables, fruits, and dairy; and <u>weight reduction strategy</u> (coefficient H = 0.94) – self-directed, cut calories, less fat, less carbohydrates, and physical activity / exercise.

Additional testing of the NHOQ is ongoing with administration to the entire GRAS cohort in relation to longitudinal outcome measures that include healthcare resource use, functional decline, and medical co-morbidity. For the next round of administration the NHOQ will be revised based on preliminary testing such that queries that lack validity in relation to desired outcome measures will be altered or deleted. Further evaluation of the impact of diet quality is proceeding with a representative subset of GRAS cohort members that are receiving the NHOQ and undergoing diet assessments and micronutrient blood testing. The NHOQ is also being administered to the University of Alabama-Birmingham Aging Study Cohort (41). This cohort of n= 1,000 community-dwelling older persons is 50% African-American. Diet quality will again be evaluated with diet assessments and micronutrient blood testing.

Conclusion

Obesity is a growing concern for older persons and is associated with adverse outcomes that include increased risks for medical co-morbidity, healthcare resource use, functional decline and homebound status. Poor diet quality and micronutrient deficiencies are relatively common among obese older persons. Currently available nutrition risk screening instruments lack validity for this population. Development and preliminary testing of a new Nutrition Health Outcomes Questionnaire (NHOQ) suggest that it may have utility for screening for risk for adverse outcomes.

Figure 1
Nutrition health outcomes questionnaire

Form filled out by: ❏ Self   ❏ Caregiver, Friend, or Relative

Please enter responses for the person to whom the survey was addressed.

ITEM #1
Enter your age / birth date, and check race / ethnic group and gender.
Age (years) _____
Birth date (month/day/year) ____ ____ ____
❏ Non-Hispanic White   ❏ Non-Hispanic Black   ❏ Mexican-American   ❏ Other;   ❏ Female   ❏ Male

ITEM #2
Please fill in your height and weight.
Height: _____ (in feet and inches)   ❏ I do not know my height.
Weight:_____ (in pounds)   ❏ I do not know my weight.

ITEM #3
Check each that apply to you: ❏ Have lost 10 or more pounds in the past six months.
                                   ❏ Have gained 10 or more pounds in the past six months.

ITEM #4
Have you been told by a doctor that you have or are being treated for the following conditions (check each that apply):
❏ Fluid (edema) in your legs, ankles, or feet?
❏ Take a diuretic (water pill) prescribed by a doctor.

ITEM #5
❏ You follow a weight reduction diet. If yes, check all those items that apply:
❏ Self-prescribed weight loss diet.   ❏ Doctor-prescribed weight loss diet.
❏ Received dietitian counseling.   ❏ Focus is on cutting calories.
❏ Focus is on eating less fat.   ❏ Focus is on eating less carbohydrates (example Atkins diet).
❏ Approach includes weight loss supplements or medications.   ❏ Approach includes increased physical activity / exercise.
❏ Other weight reduction diet (please specify): _____

❏ You follow a special diet for another medical problem (not for weight loss). If yes, check all those items that apply:
       ❏ Low cholesterol or low fat diet.   ❏ Diabetic diet.
       ❏ Low salt diet.   ❏ Another special diet (please specify):_____

Figure 1 (continued)

ITEM #6

Check each that apply to you:
- ❏ Frequently skip breakfast altogether.
- ❏ Often worry whether there will be enough money to spend on food.
- ❏ Have pain in mouth, teeth, or gums.
- ❏ Often worry whether there will be enough food to eat
- ❏ Have difficulty chewing or swallowing.

ITEM #7

Check each that apply to you:
- ❏ Use 3 or more prescription drugs per day.
- ❏ Take daily multivitamin supplements.
- ❏ Use herbal or other dietary supplements

ITEM #8

Have you ever had (check each that apply):
- ❏ Coronary heart disease?
- ❏ Angina?
- ❏ Any other heart attack?
- ❏ Heart failure?
- ❏ A myocardial infarction (MI)?

Have you been told by a doctor that you have or are being treated for the following conditions (check each that apply):
- ❏ High blood pressure (hypertension)?
- ❏ Diabetes or borderline diabetes?
- ❏ Lung disease or breathing problems (for example: emphysema, chronic bronchitis, sleep apnea, or asthma)?
- ❏ High blood cholesterol or fats?
- ❏ Arthritis of the knee(s) or knee replacement surgery?

ITEM #9

In the previous 12 months, how many times did you visit a physician, emergency room, or clinic? (check one answer)
- ❏ Not at all
- ❏ One time
- ❏ Two or three times
- ❏ Four to six times
- ❏ More than six times

In the previous 12 months, have you stayed overnight as a patient in a hospital? (check one answer)
- ❏ Not at all
- ❏ One time
- ❏ Two or three times
- ❏ More than three times

ITEM #10

Usually or always need assistance with: (check each that apply to you)
- ❏ Bathing
- ❏ Grooming
- ❏ Eating
- ❏ Getting out of bed or chair
- ❏ Preparing food
- ❏ Dressing
- ❏ Toileting
- ❏ Walking or moving about
- ❏ Traveling (outside the home)
- ❏ Shopping for food or other necessities

ITEM #11

Do you live: (Check one answer)
- ❏ Alone?
- ❏ With spouse?
- ❏ With a son or daughter?
- ❏ With other family member?
- ❏ Other? Explain: _____

Check each that apply:
- ❏ You are housebound (unable to leave home without assistance).
- ❏ Use an assistance device in daily activities (cane, walker or wheel chair).
- ❏ Have no one to provide assistance or care at home if needed.
- ❏ Must go up / down a flight of stairs in daily activities.
- ❏ Have a television available. If yes, you watch television:
  - ❏ Less than 4 hours daily.
  - ❏ 4 or more hours daily.
  - ❏ While eating snacks each day.
  - ❏ While eating at least one meal each day.

ITEM #12

Check each that apply to you:
- ❏ Feel depressed, sad, downhearted, "in the dumps", or blue.
- ❏ Feel tired, worn out, and lacking in energy.
- ❏ Take anti-depressant medication prescribed by a doctor.

ITEM #13

In general would you say your health is: (check one answer)
- ❏ Excellent
- ❏ Very Good
- ❏ Good
- ❏ Fair
- ❏ Poor

ITEM #14

Eat the following item(s) almost every day: (check each that apply)
- ❏ Breakfast cereal
- ❏ Two or more servings of vegetables other than potatoes
- ❏ Two or more servings of low-fat or non-fat dairy products
- ❏ Potatoes (including fried potatoes and French fries)
- ❏ Three or more servings of fruit
- ❏ Sweets (such as pies, cookies, cakes or donuts)

Table 2
Prevalence of malnutrition in elderly determined by the MNA®

Item	Justification	Selected References	Purpose
1. Demographics (age, race, gender)	Outcome differences in relation to age and gender observed for micronutrient deficiencies, diet quality, functional limitations, and healthcare resource use. There are important race / ethnic group differences in the prevalence of obesity that extend into older age groups.	1. Jensen GL, et al. Am J Clin Nutr 1997;66:819-28. 2. Jensen GL, et al. Am J Clin Nutr 2001;74:201-5. 3. Friedmann JM, et al. J Am Geriatr Soc 2001;49:398-403. 4. Jensen GL, et al. J Am Geriatr Soc 2002;50:918-23. 5. Ledikwe JH, et al. Am J Clin Nutr 2002; 77:551-8. 6. Ledikwe JH, et al. J Am Geriatr Soc 2004;52:589-95. 7. Flegal KM, et al. JAMA 2002; 288:1723-7.	Identify high-risk for micronutrient deficiencies, poor diet quality, resource use. functional decline, and healthcare
2. Height / weight	Outcome differences in relation to BMI observed for micronutrient deficiencies, diet quality, functional limitations, and healthcare resource use.	1. Jensen GL, et al. Am J Clin Nutr 1997; 66:819-28. 2. Jensen GL, et al. Am J Clin Nutr 2001; 74:201-5. 3. Friedmann JM, et al. J Am Geriatr Soc 2001; 49:398-403. 4. Jensen GL, et al. J Am Geriatr Soc 2002;50:918-23. 5. Ledikwe JH, et al. Am J Clin Nutr 2002;77:551-8. 6. Ledikwe JH, et al. J Am Geriatr Soc 2004;52:589-95. 7. Newby PK, et al. Am J Clin Nutr 2003;77:1417-25.	Identify high-risk for micronutrient deficiencies, poor diet quality, functional decline, and healthcare resource use.
3. Weight loss / gain	Outcome differences observed in relation to weight loss / gain for functional limitations and healthcare use.	1. Jensen GL, et al. Am J Clin Nutr 1997;66:819-28. 2. Fine JT, et al. JAMA 1999;282:2136-42. 3. Jensen GL, et al. J Am Geriatr Soc 2002;50:918-23. 4. Newby PK, et al. Am J Clin Nutr 2003;77:1417-25.	Identify high-risk for functional decline, and healthcare resource use. Explore possible relationships with micronutrient deficiencies and diet quality.
4. Edema / diuretic use	Edema and diuretic use were of high prevalence in focus groups and pilot investigations of questionnaire.	1. Lancaster KJ, et al. Ann Epidemiol 2003;13:525-9. 2. Stewart RB, et al. Am J Hosp Pharm 1983;40:409-13.	Exploratory queries to assist interpretation of body weight and weight loss / gain.
5. Weight reduction and other diets	High prevalence of self-imposed and medically prescribed diets in focus groups and pilot investigations of questionnaire. Imprudent diets have been related to micronutrient deficiencies and poor diet quality. Calcium and vitamin D intakes and bone mineral status are particular concerns for older persons engaged in weight reduction.	1. Chao.et al. J Am Geriatr Soc 2000;48:753-9. 2. Shapses SA, et al. J Bone Miner Res 2001;16:1329-36. 3. Jensen LB, et al. J Bone Miner Res 2001;16:141-7.	Exploratory queries to examine potential relationships between reported dietary practices and outcome measures.
6a. Skip breakfast	a. Skip breakfast High prevalence in focus groups and pilot investigations. Eating breakfast is associated with more adequate micronutrient intakes, lower percentages of calories from fat, and more successful weight reduction.	a. Skip breakfast 1. Nicklas, et al. J Am Diet Assoc 1998;98:1432-8. 2. Morgan, et al. J Am Coll Nutr 1986;5:551-63. 3. Ruxton, et al. Br J Nutr 1997;78:199-213. 4. Wyatt, et al. Obesity Res 2002;10:78-82. 5. Sharkey JR, et al. Am J Clin Nutr 2002;76:1435-45.	a. Skip breakfast Exploratory queries to examine potential relationships between skipping breakfast and outcome measures.

Table 2 (continued)
Prevalence of malnutrition in elderly determined by the MNA®

Item	Justification	Selected References	Purpose
6b. Food security (worry whether enough food to eat, or enough money to spend on food)	b. Food security Self-reported concern about food security has been associated with increased risk of obesity and healthcare resource use.	b. Food security 1. Centers for Disease Control. MMWR Morb Mortal Wkly Rep 2003;52:840-2. 2. Adams EJ, et al. J Nutr 2003;133:1070-4. 3. Nelson K, et al. J Gen Intern Med 2001;16:404-11. 4. Klegas LM, et al. Am J Public Health 2001;91:68-75.	b. Food security Exploratory query to examine potential relationships between food security and outcomes measures.
6c. Eating problems (difficulty chewing or swallowing; pain in mouth, teeth, or gums)	c. Eating problems Outcome differences in relation to oral health observed for micronutrient deficiencies, diet quality, functional limitations, and healthcare resource use.	c. Eating problems 1. Sullivan, et al. J Am Geriatr Soc 1993;41:725-31. 2. Jensen GL, et al. Am J Clin Nutr 1997;66:819-28. 3. Jensen GL, et al. Am J Clin Nutr 2001;74:201-5. 4. Bailey RL, et al. J Am Diet Assoc 2004;104:1273-6.	c. Eating problems Identify high-risk for micronutrient deficiencies, poor diet quality, functional decline, and healthcare resource use.
7a. Medication use	a. Medication use High prevalence of polypharmacy in preliminary investigations of GRAS and other older cohorts. Outcome differences observed in relation to polypharmacy for functional limitations and healthcare use.	a. Medication use 1. Jensen GL, et al. Am J Clin Nutr 1997;66:819-28. 2. Jensen GL, et al. Am J Clin Nutr 2001;74:201-5.	a. Medication use Identify high-risk for functional decline, and healthcare resource use. Explore possible relationships with micronutrient deficiencies and diet quality
7b. Multivitamin use	b. Multivitamin use High prevalence of use in GRAS cohort and other older populations.	b. Multivitamin use 1. Ervin RB, Wright JD, Kennedy-Stephenson J. Vital Health Stat 1999;11:1-14.	b. Multivitamin use Needed to discern risk for micronutrient deficiencies.
7c. Herbal or other dietary supplements	c. Herbal or other dietary supplements High prevalence of use in GRAS cohort and other older populations.	c. Herbal or other dietary supplements 1. Ervin RB, Wright JD, Kennedy-Stephenson. J Vital Health Stat 1999;11:1-14. 2. Blanck HM, Khan LK, Serdula MK. JAMA 2001;286:930-5.	c. Herbal or other dietary supplements Exploratory item to examine possible relationships with micronutrient deficiencies and diet quality.
8. Medical co-morbidities	Focus on relevant co-morbidities for obesity. Outcome differences in relation to co-morbidities observed for functional limitations and healthcare resource use.	1. Jensen GL, et al. Am J Clin Nutr 2001;74:201-5. 2. Bailey RL, et al. J Am Diet Assoc 2004;104:1273-6. 3. Boult C, et al. J Am Geriatr Soc 1993;41:811-7. 4. Brody KK, et al. Gerontologist 1997;37:182-91. 5. Coleman EA, et al. J Am Geriatr Soc 1998;46:419-25.	Identify high-risk for functional decline, and healthcare resource use. Explore possible relationships with micronutrient deficiencies and diet quality.
9. Physician contact / hospitalization	Outcome differences in relation to physician contact / hospitalization in past year observed for future healthcare resource use.	1. Jensen GL, et al. Am J Clin Nutr 2001;74:201-5. 2. Boult C, et al. J Am Geriatr Soc 1993;41:811-7. 3. Pacala J, et al. J Am Geriatr Soc 1995;43:374-7. 4. Boult C, et al. J Aging 1994;7:15-64. 5. Boult C, et al. J Am Geriatr Soc 1994;42:707-11. 6. Pacala J, et al. J Am Geriatr Soc 1997;45:614-7.	Identify high-risk for healthcare resource use. Explore possible relationships with functional decline, micronutrient deficiencies and diet quality.

Table 2 (continued)
Prevalence of malnutrition in elderly determined by the MNA®

Item	Justification	Selected References	Purpose
10. Functional limitations	A key study outcome that has been strongly associated with further functional decline and healthcare resource use. Preliminary studies also suggest relationship with micronutrient deficiencies and poor diet quality.	1. Jensen GL, et al. Am J Clin Nutr 1997;66:819-28. 2. Jensen GL, et al. Am J Clin Nutr 2001;74:201-5. 3. Jensen GL, et al. J Am Geriatr Soc 2002;50:918-23. 4. Ledikwe JH, et al. Am J Clin Nutr 2002;77:551-8. 5. Millen BE, et al. J Nutr Health Aging 2001;5:269-77.	Identify high-risk for functional decline and healthcare resource use. Explore possible relationships with micronutrient deficiencies and diet quality.
11a. Living environment	a. Living environment Living alone and homebound status are prevalent living environment features for obese older women. These characteristics have been associated with risk for micronutrient deficiencies and poor diet quality, and for functional decline and healthcare resource use.	a. Living environment 1. Sharkey JR, et al. Am J Clin Nutr 2002;76:1435-45. 2. Millen BE, et al. J Nutr Health Aging 2001;5:269-77. 3. Ledikwe JH, et al. Am J Clin Nutr 2002;77:551-8.	a. Living environment Identify high-risk for micronutrient deficiencies, poor diet quality, functional decline, and healthcare resource use.
11b. Television watching	b. Television watching Television watching has been associated with elevated BMI in children and adults and is highly prevalent among obese older persons in our preliminary investigations of the GRAS cohort.	b. Television watching 1. Anderson RE, et al. JAMA 1998;279:938-42. 2. Utter J, et al. J Am Diet Assoc 2003;103:1298-305. 3. Hu FB, et al. JAMA 2003;289:1785-91. 4. Liebman M, et al. Int J Obes Relat Metab Disord 2003;27:684-92.	b. Television watching Exploratory query to examine relationship with micronutrient deficiencies, poor diet quality, functional decline, and healthcare resource use.
12. Depression	High prevalence of self-reported depression in GRAS cohort and other older populations, especially among the obese. Preliminary studies have suggested association with functional decline and healthcare resource use.	1. Jensen GL, et al. Am J Clin Nutr 1997;66:819-28. 2. Stewart KJ, et al. J Cardiopulm Rehabil 2003;23:115-21. 3. Roberts RE, et al. Int J Relat Metab Disord 2003; 27:514-21. 4. Roberts RE, et al. Am J Epidemiol 2000;152:163-70. 5. Sarkisian CA, et al. J Am Geriatr Soc 2000;48:170-8.	Identify high-risk for functional decline and healthcare resource use. Explore possible relationships with micronutrient deficiencies and diet quality.
13. General health status	Self-reported general health status has been associated with risk for functional decline and healthcare resource use. Elevated BMI has been associated with poor general health status.	1. Testa MA, Simonson DC. N Engl J Med 1996;334:835-40. 2. Jensen GL, et al. Am J Clin Nutr 2001;74:201-5. 3. Ware JE, et al. Medical Care 1996;34:220-33. 4. Boult C, et al. J Am Geriatr Soc 1993;41:811-7. 5. Ford, et al. Obes Res 2001;9:31-31. 6. Lee Y. J Epedemiol Community Health 2000;54:123-9. 7. Stewart KJ, et al. J Cardiopulm Rehabil 2003; 23:115-21.	Identify high-risk for functional decline and healthcare resource use. Explore possible relationships with micronutrient deficiencies and diet quality.
14. Food frequencies	Preliminary testing found that recommended food frequency items would misclassify many persons at nutritional risk. Revised items based on dietary intake and dietary quality findings have been selected for further testing.	1. Mitchell DC, et al. J Am Diet Assoc, 2002;102: 842-4. 2. Ledikwe JH, et al. Am J Clin Nutr 2002;77:551-8. 3. Ledikwe JH, et al. J Am Geriatr Soc 2004;52:589-95.	Exploratory queries to ascertain whether revised food frequency items will have improved validity in relation to outcome measures. Subject to ongoing revision and testing.

Table 3

NHOQ Responses by BMI Categories

(total n = 1324)	BMI <18.5		BMI 18.5-24.9		BMI 25-29.9		BMI 30-34.9		BMI ≥35	
	n=24		n=356		n=593		n=272		n=79	
	N	%	N	%	N	%	N	%	N	%
Variable										
Gender										
Male	8	33.3	155	43.5	303	51.1	138	50.7	26	32.9
Female	16	66.7	201	56.5	290	48.9	134	49.3	53	67.1
Lost 10 lbs	8	33.3	67	18.8	92	15.5	55	20.2	19	24.1
Gained 10lbs	0	0	16	4.5	54	9.1	32	11.8	16	20.3
Use of Medications or supplements										
Use 3 or more prescription drugs/day	16	66.7	221	62.1	387	65.3	203	74.6	67	84.8
Take anti-depressant medication	2	8.3	26	7.3	52	8.8	24	8.8	14	17.7
Take a diuretic	6	25	80	22.5	181	30.5	104	38.2	48	60.8
Take a daily MVI	11	45.8	214	60.1	309	52.1	145	53.3	44	55.7
Use herbal or dietary supplement	0	0	54	15.2	76	12.8	33	12.1	11	13.9
Eating Habits/Concerns										
Do not have enough food to eat	0	0	11	3.1	21	3.5	10	3.7	4	5.1
Frequently skip breakfast	2	8.3	15	4.2	35	5.9	14	5.1	4	5.1
Difficulty chewing and/or swallowing	2	8.3	18	5.1	17	2.9	13	4.8	3	3.8
Has pain in mouth, teeth, or gums	0	0	13	3.7	16	2.7	16	5.9	6	7.6
Special Diets										
Following weight reduction diet	0	0	38	10.7	78	13.2	42	15.4	12	15.2
Self prescribed weight reduction diet	0	0	13	3.7	50	8.4	25	9.2	10	12.7
Physician prescribed weight reduction diet	0	0	3	0.8	9	1.5	4	1.5	4	5.1
Received RD counseling	0	0	16	4.5	36	6.1	22	8.1	10	12.7
Focus is on cutting calories	0	0	25	7	81	13.7	41	15.1	13	16.5
Focus is on cutting fat	1	4.2	56	15.7	151	25.5	73	26.8	26	32.9
Focus is on cutting CHO	0	0	17	4.8	34	5.7	29	10.7	10	12.7
Approach include wt loss supp or med	0	0	1	0.3	3	0.5	2	0.7	1	1.3
Approach includes physical activity	0	0	45	12.6	86	14.5	36	13.2	8	10.1
Other weight reduction diet	0	0	5	1.4	6	1	5	1.8	0	0
Follow special diet for another reason	4	16.7	56	15.7	118	19.9	61	22.4	17	21.5
Low cholesterol or low fat	3	12.5	83	23.3	161	27.2	79	29	16	20.3

OBESITY AMONG OLDER PERSONS: SCREENING FOR RISK OF ADVERSE OUTCOMES

Table 3 (continued)

NHOQ Responses by BMI Categories

(total n = 1324)	BMI <18.5		BMI 18.5-24.9		BMI 25-29.9		BMI 30-34.9		BMI ≥35	
	n=24		n=356		n=593		n=272		n=79	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Diabetic diet	1	4.2	46	12.9	85	14.3	49	18	18	22.8
Low salt diet	4	16.7	60	16.9	151	25.5	73	26.8	27	34.2
Another special diet	1	4.2	8	2.2	7	1.2	5	1.8	0	0
Eat following items almost daily										
Breakfast Cereal	17	70.8	270	75.8	424	71.5	198	72.8	59	74.7
Potatoes	13	54.2	164	46.1	283	47.7	118	43.4	37	46.8
Vegetables (>2 servings)	14	58.3	242	68	420	70.8	189	69.5	56	70.9
Fruit (>3 servings)	9	37.5	153	43	234	39.5	119	43.8	35	44.3
Low-fat or Non-fat Dairy (>2 servings)	4	16.7	176	49.4	277	46.7	132	48.5	37	46.8
Sweets	15	62.5	199	55.9	303	51.1	121	44.5	35	44.3
Living arrangements										
Alone	9	37.5	95	26.7	181	30.5	69	25.4	25	31.6
With spouse	12	50.0	218	61.2	355	59.9	176	64.7	43	54.4
With son or daughter	2	8.3	22	6.2	31	5.2	16	5.9	7	8.9
With other family member	0	0	7	2.0	10	1.7	3	1.1	1	1.3
With other	0	0	8	2.2	8	1.3	5	1.8	1	1.3
Housebound	3	12.5	11	3.1	14	2.4	11	4.0	2	2.5
Use assistance device	6	25.0	24	6.7	42	7.1	35	12.9	18	22.8
No one to provide assistance	3	12.5	25	7.0	40	6.7	13	4.8	9	11.4
Flight of stairs	13	54.2	158	44.4	274	46.2	112	41.2	27	34.2
TV available	19	79.2	293	82.3	516	87.0	231	84.9	66	83.6
TV < 4 hr day	12	50.0	172	48.3	270	45.5	121	44.5	30	38.0
TV ≥ 4 hr day	10	41.7	158	44.4	285	48.1	139	51.1	44	55.7
TV with snacks	3	12.5	38	10.7	66	11.1	24	8.8	11	13.9
TV with meals	8	33.3	95	26.7	170	28.7	83	30.5	30	38
Function / mobility										
Bathing	3	12.5	12	3.4	10	1.7	6	2.2	3	3.8
Dressing	2	8.3	9	2.5	10	1.7	4	1.5	2	2.5
Grooming	2	8.3	8	2.2	4	0.7	6	2.2	1	1.3
Toileting	1	4.2	4	1.1	4	0.7	3	1.1	1	1.3
Eating	1	4.2	5	1.4	3	0.5	1	0.4	0	0
Walking	2	8.3	7	2.0	8	1.3	12	4.4	4	5.1
Out of bed or chair	1	4.2	6	1.7	6	1.0	4	1.5	3	3.8
Traveling	6	20.8	37	10.4	41	6.9	21	7.7	11	13.9
Preparing food	2	8.3	19	5.3	12	2.0	8	2.9	3	3.8
Shopping	3	12.5	31	8.7	35	5.9	23	8.5	14	17.7
Any ADL	3	12.5	19	5.3	18	3.0	15	5.5	7	8.9
Any IADL	6	25.0	54	15.2	54	9.1	31	11.4	19	24.1
Any ADL/IADL	7	29.2	56	15.7	59	9.9	35	12.9	20	25.3
General health rating										
Excellent	0	0	23	6.5	33	5.6	17	6.3	1	1.3
Very good	3	12.5	105	29.5	184	31.0	67	24.6	20	25.6
Good	8	33.3	144	40.4	257	43.3	124	45.6	26	32.9
Fair	8	33.3	54	15.2	92	15.5	48	17.6	25	31.6
Poor	4	16.7	15	4.2	14	2.4	12	4.4	3	3.9

Table 3 (continued)

NHOQ Responses by BMI Categories

(total n = 1324)	BMI <18.5		BMI 18.5-24.9		BMI 25-29.9		BMI 30-34.9		BMI ≥35	
	n=24		n=356		n=593		n=272		n=79	
	N	%	N	%	N	%	N	%	N	%
Healthcare use										
MD, visits 0	0	0	11	3.1	9	1.8	0	0	1	1.3
MD visits 1	3	12.5	28	7.9	53	8.9	11	4	3	3.8
MD visits 2-3	7	29.2	149	41.9	253	42.7	116	42.6	24	30.4
MD visits 4-6	8	33.3	89	25.0	171	28.8	98	36.0	36	45.6
MD visits >6	5	20.8	63	17.7	93	15.7	45	16.5	12	15.2
Admits - 0	18	75.0	270	75.8	483	81.5	17	6.3	1	1.3
Admits - 1	3	12.5	44	12.4	61	10.3	38	14	11	13.9
Admits 2-3	0	0	16	4.5	25	4.2	8	2.9	2	2.5
Admits >3	2	8.3	5	1.4	2	0.3	3	1.1	0	0
Health problems										
Diabetes	2	8.3	53	14.9	111	18.7	65	23.9	28	35.4
Cholesterol	4	16.7	110	30.9	221	37.3	108	39.7	34	43.0
Hypertension	5	20.8	152	42.7	308	51.9	164	60.3	50	63.3
Lung disease	10	41.7	46	12.9	57	9.6	39	14.3	14	17.7
Knee arthritis	4	16.7	42	11.8	103	17.4	89	32.7	45	57.0
Edema	1	4.2	22	6.2	56	9.4	46	16.9	28	35.4
Coronary disease	3	12.5	49	13.8	90	15.2	47	17.3	6	7.6
Congestive failure	6	25.0	19	5.3	27	4.6	20	7.4	5	6.3
Angina	3	12.5	28	7.9	44	7.4	27	9.9	6	7.6
Myocardial infarction	1	4.2	15	4.2	30	5.1	11	4.0	2	2.5
Other heart problem	2	8.3	30	8.4	35	5.9	13	4.8	3	3.8
Depression										
Sad, blue downhearted	2	8.3	25	7.0	45	7.6	16	5.9	10	12.7
Tired, worn out lack energy	11	45.8	84	23.6	146	24.6	86	31.6	36	45.6

Table 4

NHOQ Outcome Variables - n=1,324 GRAS participants

a) Reported Physician, Emergency Room or Clinic Visits
Over Prior 12-months as a Function of BMI Category

Physician visits past 12-mos.	BMI<18.5 N=23		BMI 18.5-24.9 N=340		BMI 25-29.9 N=579		BMI 30-34.9 N=270		BMI ≥ 35 N=76	
None	0	(0%)	11	(3.2%)	9	(1.6%)	0	(0%)	1	(1.3%)
Once	3	(13.0%)	28	(8.2%)	53	(9.2%)	11	(4.1%)	3	(3.9%)
2-3 times	7	(30.4%)	149	(43.8%)	253	(43.7%)	116	(43.0%)	24	(31.6%)
4 or greater	13	(56.5%)	152	(44.7%)	264	(45.6%)	143	(53.0%)	48	(63.2%)
OR										
(95% CI)*	1.47 (0.64-3.37)		1.00		1.04 (0.79-1.36)		1.40 (1.02-1.93)		2.06 (1.29-3.42)	

* For physician, emergency room or clinic visits of > 4

Table 4 (continued)
NHOQ Outcome Variables - n=1,324 GRAS participants

b) Reported IADL/ADL* as a Function of BMI Category

Any IADL or ADL	BMI<18.5 N=24	BMI 18.5-24.9 N=356	BMI 25-29.9 N=593	BMI 30-34.9 N=272	BMI ≥ 35 N=79
No	17 (70.8%)	300 (84.3%)	534 (90.1%)	237 (87.1%)	59 (74.7%)
Yes	7 (29.2%)	56 (15.7%)	59 (9.9%)	35 (12.9%)	20 (25.3%)
OR					
(95% CI)	2.21	1.00	0.59	0.79	1.82
	(0.87-5.57)		(0.40-0.88)	(0.50-1.25)	(1.02-3.25)

*Instrumental Activities of Daily Living, Activities of Daily Living.

c) Reported Disease Burden as a Function of BMI Category

Disease Burden*	BMI<18.5 N=24	BMI 18.5-24.9 N=356	BMI 25-29.9 N=593	BMI 30-34.9 N=272	BMI ≥ 35 N=79
0	6 (25.0%)	125 (35.1%)	155 (26.1%)	42 (15.4%)	8 (10.1%)
1	13 (54.2%)	131 (36.8%)	237 (40.0%)	90 (33.1%)	23 (29.1%)
2	4 (16.7%)	69 (19.4%)	142 (23.9%)	98 (36.0%)	25 (31.6%)
3 or more	1 (4.2%)	31 (8.7%)	59 (10.0%)	42 (15.5%)	23 (29.2%)
OR	0.46	1.00	1.16	1.91	4.31
(95% CI)**	(0.06-3.49)		(0.73-1.83)	(1.17-3.14)	(2.34-7.92)

*Total number out of 6 chronic conditions: diabetes, hypertension, coronary artery disease, arthritis, cancer, lung disease; ** For heavy disease burden defined as > 3 of 6 chronic conditions

References

1. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999-2000. JAMA 2002;288:1723-1727.
2. Huang Z, Willet WC, Manson JE, et al. Body weight, weight change, and risk for hypertension in elderly women. Ann of Int Med 1998;128:81-88.
3. Stevens J, Cai J, Pamuk ER, Williamson DF, Thun MJ, Wood JL. The effect of age on the association between body-mass index and mortality. N Eng J Med 1998;338:1-7.
4. Hochberg MC, Lethbridge-Cejku M, Scott WW, Jr., Reichle R, Plato CC, Tobin JD. The association of body weight, body fatness and body fat distribution with osteoarthritis of the knee: data from the Baltimore Longitudinal Study of Aging. J Rheum 1995;22:488-493.
5. Colditz GA, Willet WC, Rotnitzky A, Manson JE. Weight gain as a risk factor for clinical diabetes mellitus in women. Ann Int Med 1995;122:481-486.
6. Holvoet P, Kritchevsky SB, Tracy RP, et al. The metabolic syndrome, circulating oxidized LDL, and risk of myocardial infarction in well-functioning elderly people in the health, aging, and body composition cohort. Diabetes 2004;53:1068-1073.
7. Zamboni M, Zoico E, Fantin F, et al. Relation between leptin and the metabolic syndrome in elderly women. J Gerontol A Biol Sci Med Sci 2004;59:396-400.
8. Galanos AN, Pieper CF, Cornoni-Huntley JC, Bales CW, Fillenbaum GG. Nutrition and function: is there a relationship between body mass index and the functional capabilities of community-dwelling elderly? J Am Geriatr Soc 1994;42:368-373.
9. Apovian CM, Frey CM, Wood CG. Rogers JZ. Body mass index and physical function in older women. Obesity Res 2002;10:740-747.
10. Jensen GL, Friedmann JM. Obesity is associated with functional decline in community-dwelling rural older persons. J Am Geriatr Soc 2002;50:918-923.
11. Miller GD, Rejeski WJ, Williamson JD, et al. The Arthritis, Diet and Activity Promotion Trial (ADAPT): design, rationale, and baseline results. Controlled Clinical Trials 2003;24:462-480.
12. Zoico E, Di Francesco V, Guralnik JM, et al. Physical disability and muscular strength in relation to obesity and different body composition indexes in a sample of healthy elderly women. Int J Obes Relat Metab Disord 2004;28:234-241.
13. Finkelstein EA, Fiebelkorn JC, Wang G. National medical spending attributable to overweight and obesity: how much and who's paying? Health Affairs (Millwood) 2003;Jan-Jun (Suppl):W3-219-26.
14. Jensen GL, Kita K, Fish J, Heydt D, Frey C. Nutrition risk screening characteristics of rural older persons: Relation to functional limitations and health care charges. Am J Clin Nutr 1997;66:819-828.
15. Jensen GL, Friedmann JM, Coleman CD, Smiciklas-Wright H. Screening for hospitalization and nutrition risks among community dwelling older persons. Am J Clin Nutr 2001;74:201-205.
16. Bailey RL, Ledikwe JH, Smiciklas-Wright H, Mitchell DC, Jensen GL. Persistent oral health problems associated with comorbidity and impaired diet quality in older adults. J Am Diet Assoc 2004;104:1273-1276.
17. Klein GL, Kita K, Fish J, Sinkus B, Jensen GL. Nutrition and health services for older persons in rural America: a managed care model. J Am Diet Assoc 1997;97:885-888.
18. Taylor-Davis S, Smiciklas-Wright H, Davis AC, Jensen GL, Mitchell DC. Time and cost for recruiting older adults. J Am Geriatr Soc 1998;46:753-757.
19. Ledikwe JH, Smiciklas-Wright H, Mitchell DC, Jensen GL, Friedmann JM, Still CD. Nutrition risk assessment and obesity in rural older adults: a sex difference. Am J Clin Nutr 2003;77:551-558.
20. Apovian CM, Frey CM, Rogers JZ, McDermott B, Jensen GL. Body mass index and physical function in obese older women. J Am Geriatr Soc 1996;44:1487-1488.
21. Seale JL, Klein G, Friedmann J, Jensen GL, Mitchell D, Wright HS. Energy expenditure by doubly labeled water, activity recall and diet records in the rural elderly. Nutrition 2002;18:568-573.
22. Ledikwe JH, Smiciklas-Wright H, Mitchell DC, Miller CK, Jensen GL. Dietary patterns of rural older adults are associated with weight and nutritional status. J Am Geriatr Soc 2004; 52:589-595.
23. Friedmann J, Elasy T, Jensen GL. The relationship between body mass index and self-reported functional limitation among older adults: A gender difference. J Am Geriatr Soc 2001;49:398-403.
24. Jensen GL, Silver HJ, Roy MA, Callahan E, Still C, Dupont W. Obesity is a risk factor for reporting homebound status among community dwelling older persons. Obesity Res 2006;14:509-517.
25. Clarke R, Daly L, Robinson K, Naughten E, et al. Hyperhomocysteinemia: an independent risk factor for vascular disease. N Engl J Med 1991;324:1149-1155.
26. Seshadri S, Beiser A, Selhub J, et al. Plasma homocysteine as a risk factor for dementia and Alzheimer's disease. N Engl J Med 2002;346:476-483.
27. Mattson MP, Kruman II, Duan W. Folic acid and homocysteine in age-related disease. Ageing Res Rev 2002;1:95-111.
28. Kaplan ED. Association between homocysteine levels and risk of vascular events. Drugs Today 2003;39:175-192.
29. van Meurs JBJ, Dhonukshe-Rutten RAM, Pluijm SMF, et al. Homocysteine levels and the risk of osteoporotic fracture. N Engl J Med 2004; 350:2033-2041.
30. McLean RR, Jaques PF, Selhub J, et al. Homocysteine as a predictive factor for hip fracture in older persons. N Engl J Med 2004; 350:2042-2049.
31. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: The Mini Nutritional Assessment as part of the geriatric evaluation. Nutr Rev. 1996;54 (1 Pt 2):S59-65.
32. Vellas B, Guigoz Y, Garry PJ, et al. The Mini Nutritional Assessment (MNA®) and its use in grading the nutritional state of elderly patients. Nutrition. 1999;15:116-122.
33. Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA®-

SF). J Gerontol A Biol Sci Med Sci. 2001;56:M366-372.

34. Vellas B, Guigoz Y, Baumgartner M, Garry PJ, Lauque S, Albarede JL. Relationships between nutritional markers and the mini-nutritional assessment in 155 older persons. J Am Geriatr Soc. 2000;48:1300-1309.

35. Nutrition Screening Initiative. A physician's guide to nutrition in chronic disease management for older Americans. Washington, DC; 1992.

36. Wellman NS. The Nutrition Screening Initiative. Nutr Reviews 1994;52:S44-S47.

37. Jensen GL, Roy MA, Buchanan AE, Berg MB. Weight loss intervention for obese older women: improvements in performance and function. Obes Res 2004;12:1814-1820.

38. Hancock GR, Mueller RO. Rethinking construct reliability within latent variable systems. In Chudek R, duToit S, and Sorbom D, eds. Structural Equation Modeling:

Present and Future. Lincolnwood, Il: Scientific Software International, Inc, 2001:195-216.

39. Embertson SE, Reise SP. Item Response Theory for Psychologists. Mahwah, NJ: Lawrence Erlbaum, 2000.

40. Muthén BO, Kao CF, Burstein L. Instructionally sensitive psychometrics: Application of a new IRT-based detection technique to mathematics achievement test items. J Edu Measurement 1991; 28:1-22.

41. Baker PS, Bodner EV, Allman RM. Measuring life-space mobility in community-dwelling older adults. J Am Geriatr Soc 2003;51:1610-1614.

DISCUSSION

Bruno Vellas, MD, Toulouse University, Toulouse, FR: *Is there any data on the MNA® score in elderly people who have a high body mass index? If not, maybe we can look at that. One of Yves' ideas was to put some data sets together to do some kind of meta-analytic study. If we put the data sets that we have in France, Spain, Sweden, Germany or the US together, maybe we can have some percentage of people, and it would be interesting to look at that. Do you have some data of the MNA® in obese people?*

Gordon Jensen, MD, Vanderbilt University, Nashville, TN, USA: *One of the things we could do for you is, in fact, rigorously analyse this. Obviously, we have the data to retroactively, apply the MNA® to obese persons. We have a very robust database. We have their dietary intakes, their micro-nutrient blood tests. What I did before coming here, just in exploratory fashion, was take 10 patients with laboratory documented micronutrient deficiencies out of the database and look at them. Indeed, as I stated, in terms of the micro-nutrient deficiencies in particular, the MNA® was not really designed to identify such persons. At least half the time the MNA® would not have identified those individuals as being at risk. I would not have expected it to. There is no simple screening tool that can readily do that.*

Phillip Garry, MD, University of New Mexico, Albuquerque, NM, USA: *The MNA® is primarily for undernutrition. What we are talking about here is malnutrition. I do not think you can combine those two. As I understood from your talk, it looks like we need a different questionnaire for malnutrition, apart from undernutrition.*

Bruno Vellas: *Maybe with an MNA® score of less than 17, it is undernutrition, and between 17 and 23.5, it is malnutrition. I think it would be interesting to know how many obese elderly people have an MNA® between 17 and 23.5. I think it might be a high proportion.*

Pam Charney, PhD, Nutrition Consultant, Seattle, WA, USA: *Gordon, I think you have raised some very important questions about the use and interpretation of BMI. Most of my practice has been in acute care. I know that, in the United States at least, it is always a surprise when we get a patient weighed. Very rarely can we get an accurate height. How far off do you have to be before you get an incorrect BMI? Looking at the MNA®, which is a fantastic tool for screening the elderly in an acute care setting, can we determine whether or not we need to actually use the BMI? Can we look at some of these other questions on the short form?*

Gordon Jensen: *That is an interesting question. Annalynn Skipper was actually part of a study we published several years ago in JPEN (Jensen GL, Friedmann JM, Henry D, et al. Non-compliance with body weight measurement in tertiary care teaching hospitals. JPEN 2003;27:89-90) that looked at availability and accuracy of heights and weights obtained in acute care teaching hospitals in the United States. To this audience it will not be a surprise, it was abysmal. More than 30 % of the patients were not weighed at all. What was fascinating was that among the people that were not weighed, some of them actually had a recorded weight. Of course, those are either self-reports or abstracted from the medical record or sometimes, I suspect, outright fabricated. The only reassuring thing was that when the patients were actually weighed by hospital staff, that weight was much more likely to be close to our reference research weight that we obtained with a validated scale. Trying to obtain reliable weights is a huge problem.*

Riva Touger-Decker, PhD, RD, University of Medicine & Densitry of New Jersey, Newark, NJ, USA: *You are going to find the same thing in long-term care. It really is worse. I am working with two students who have looked at long-term care institutions across New Jersey and Pennsylvania. They found that height may be off by inches, or it is an unknown height. Weights may be 'guesstimates' because the nurse or nursing assistant does not want to put the patient on the scale. Pointing the finger at any discipline, you are going to find the same thing.*

Cameron Chumlea, PhD, Wright State University, Dayton, OH, USA: *Twenty years ago there was the same problem and there was no way of doing it. People were not doing it. It sounds like the "same old, same old". Gordon, do you have any follow-up mortality data on your study?*

Gordon Jensen: *We do, but we have not looked at it systemically or published it.*

Cameron Chumlea: *I did not know whether you were statistically seeing the same thing that Katherine Flegal reported within the NHANES data in the sense that moderate BMIs were in a sense protective to some degree.*

Gordon Jensen: *One of the things we are doing right now is we are curious to see what actually happened to the group of people who 10 years ago entered the study and were profoundly obese at that time. To my knowledge we have one of the only data sets really capable of doing this. These are people 65 years of age or older. We will focus on those with BMIs of 35 and above at entry and look specifically at their health and mortality outcomes. I think that will be fascinating.*

Bruno Vellas: *Do you know the percentage of these obese people that are on a diet?*

Gordon Jensen: *Actually, I did not share that data. Part of our Nutrition Health Outcomes Questionnaire actually queries them specifically about whether they are attempting to lose weight. There is a series of about half a dozen different options for them to check. Those include whether it is doctor prescribed, or is it their own, or have they had instructions from a dietitian. It asks specifically whether it is low in fat, low in calories. If you look at the people who are obese and older, easily half of them or greater are trying to lose weight; interestingly, often in ill-advised ways. They follow myriad different dietary practices, everything from low carbohydrate to low fat approaches. Interventions variably involve physical activity or supplements. What is fascinating, especially among the women, is many of them will report dieting even with BMIs in the 18.5 to 24.9 range. Ultimately, in the United States, we have women dieting from grammar school to the grave.*

OBESITY AMONG OLDER PERSONS: SCREENING FOR RISK OF ADVERSE OUTCOMES

Yves Guigoz, PhD, Nestlé Product Technology Center, Konolfingen: *Did I understand correctly that the functional limitation is just when you have a BMI above 35? And this is about 5 % of your population. It is not the majority of your population.*

Gordon Jensen: *What you are pointing out is the increased significant odds ratio and confidence intervals for which we saw a positive association with functional decline, was at a body mass index of 35 or greater. Again, this is over a several year period only, not a prolonged follow-up. Of course that does not in any way suggest that intervention at a 30 to 34.9 range might not in fact favourably impact on such an outcome. Of course it also does not address some of the other co-morbidities like diabetes and hypertension.*

Tommy Cederholm, MD, Karolinska University Hospital Huddinge, Stockholm, SW: *I see a potential problem as we usually call those with MNA® over 23.5 well-nourished. They are actually not malnourished or not undernourished. This population is a mix of the well-nourished and the obese. We obviously need to have some complimentary tool to identify those obese. Maybe it is enough to have body mass index above 35 as a denominator of being not undernourished, to make it simple.*

Gordon Jensen: *I think one of the challenges there is that you are going to have people across the range of BMI who develop an inflammatory process or disease. They are then certainly at nutritional risk but may also become profoundly malnourished. You can have a BMI of 30 and have serious malnutrition. You can have a BMI of 40 and have serious malnutrition with loss of lean mass. The trick is how to identify those people and the even bigger trick is how to identify people that you can actually intervene upon to promote a favourable outcome.*

Tommy Cederholm: *Do you not think that you will identify them with the MNA® as weight loss and dietary intake changes?*

Gordon Jensen: *Our concerns about obtaining and monitoring reliable weights are profound. Obese people are very difficult to assess and indeed, they may be malnourished and not be losing weight. In fact, they may be gaining weight. Let me give you an extreme example. I cared for an obese person who presented with a chief complaint of a 50-pound weight gain over the preceding six weeks. Now, it just so happened that he had contracted a viral cardiomyopathy with congestive heart failure and had barely been able to eat for the previous six weeks. In fact, he was quite malnourished despite the fact that not only was he not losing weight, he was gaining fluid weight. It is a very challenging audience to assess. My contention is that the MNA® is not really applicable to many obese persons, nor is any other tool that is currently available.*

Bruno Vellas: *It is true, however, that in our clinical practice many times we see obese elderly people who currently have acute diseases and some kind of malnutrition. It could be interesting to look at the MNA® score under those conditions.*

Cameron Chumlea: *Gordon, if we get out of the clinical setting, the MNA® is a screening tool. If we had a screening tool and a kind of follow-up on what Phil was saying, the MNA® in its present form identifies undernutrition. We are trying to define malnutrition. I agree it is difficult to get obese people on a scale. If someone has a BMI of over 30ish, you can look at him and tell, to some degree if they are obese. How do you feel about rather than trying to measure them, asking them their belt size as a way of getting at abdominal obesity? If you had somebody and you could not measure them and they had a BMI of 29, that tells you the upper range. If they have a belt size of 32, you are not going to worry about them. However, if they had a belt size of 42, that would not get you out of the measurement issue, but would still give you information that you could put into some kind of a screening device.*

Gordon Jensen: *There are a number of ways of measuring waist circumference. Clearly, the intent of these measures is an attempt to get at abdominal adiposity, which certainly, in terms of risk for co-morbid inflammatory conditions, would be helpful. Belt size would not necessarily address the issue of destructive joint disease in obese females who may not have truncal adiposity but rather adiposity of the buttocks and hips. As a crude indirect measure that would not require measuring height and weight, belt size might have some utility. I guess it ultimately comes down to what it is you are trying to identify. This is why in our approach to developing this new questionnaire for overweight and obese persons, we have tried to define some clear cut measurable outcomes, like healthcare use and functional decline.*

Cornel Sieber, Erlangen-Nürnberg University, Nürnberg, DE: *I would be careful to say that we cannot use the MNA® in this population without having really studied it. The BMI question is just one of the questions. Other things like loss of appetite, presence of acute disease or depression, all those things may also be present in obese people. They would then score in a way that the short form would show something in that direction. I would be careful with that. A short comment. If I am going to try your newly developed questionnaire with the 14 items, there is nothing about cognition. You are looking at an elderly population which is obese and by that has an increased risk for both vascular dementia and Alzheimer's disease with diabetes and so on. Is it correct that you do not have an item for cognition? I did not see one in the 14 items.*

Gordon Jensen: *Since this application is a self-report tool suitable for large scale mailing, a formal cognitive assessment is problematic. When we more rigorously study sub-samples of our cohort we apply the Mini Mental Status Exam to secure more detailed cognitive assessments. The patients I have looked at with documented micro-nutrient deficiencies from poor quality diets in a community setting who are obese would not be screening positive by the six item short MNA® screen. I think what we really need to do is work on our data and vigorously apply the MNA® and see what its utility actually is in the cohort. The MNA® just was not developed for this purpose.*

Yves Guigoz: *There is one study (Cairella G et al. Ann Ig 2005; 17:35-46) where 40 % of the people in the study are obese. They say that there is a risk of malnutrition even in the obese people.*