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Under-nutrition at baseline and health services utilization and mortality over a one-year period in older adults receiving Medicare home health services

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Abstract

Objective—Older adults receiving Medicare home health services who experience under-nutrition may be at increased risk of experiencing adverse outcomes. We sought to identify the association between baseline nutritional status and subsequent health service utilization and mortality over a one-year period in older adults receiving Medicare home health services.

Design—This was a longitudinal study using questionnaires and anthropometric measures designed to assess nutritional status (Mini-Nutritional Assessment [MNA]) at baseline and health services utilization and mortality status at six-month and one-year follow-ups.

Setting—Participants were evaluated in their homes.

Participants—198 older adults who were receiving Medicare home health services.

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Results—Based upon MNA, 12.0% of patients were Malnourished, 51.0% were At Risk for Malnourishment, and 36.9% had Normal Nutrition Status. Based upon body mass index (BMI), 8.1% of participants were underweight, 37.9% were normal weight, 25.3% were overweight, and 28.8% were obese. Using multivariate binary logistic regression analyses, participants who were Malnourished or At Risk for Malnourishment were more likely to experience subsequent hospitalization, emergency room visit, home health aide use, and mortality for the entire sample and hospitalization and nursing home stay for overweight and obese participants.

Conclusions—Experiencing under-nutrition at the time of receipt of Medicare home health services was associated with increased health services utilization and mortality for the entire sample, and with increased health services utilization only for the overweight and obese subsample. Opportunities exist to address risk of under-nutrition in patients receiving home health services, including those who are overweight or obese, to prevent subsequent adverse health outcomes.

Keywords

Mini Nutritional Assessment; Medicare home health care; health services utilization; mortality; overweight and obese; older adults

INTRODUCTION

The growing number of older adults in the United States and throughout the world is drawing increased attention toward efforts designed to promote health and wellness in this sub-population, especially those efforts targeted at alleviating the growing burden of chronic disease and reducing potentially preventable utilization of scarce and expensive health care resources. Nutrition is an important factor contributing to improved function and health for all persons regardless of age.¹ Older adults, however, are more likely than younger persons to be in an impaired nutritional state, and to be at higher risk for frank nutritional deficiency when they experience episodes of illness.^{2,3} Furthermore, there is evidence that under-nutrition is common in the geriatric population but is underestimated in diagnostic and therapeutic processes of care, and therefore, not addressed by health care providers.⁴

The consequences of undiagnosed and unaddressed under-nutrition in older adults receiving Medicare home health care services because of an acute illness or an exacerbation of a chronic illness may be especially severe, as inadequate caloric intake may affect the course of illness or, in some instances, be made worse by illness or treatment.⁵ Researchers have only begun to report on the adverse complications associated with under-nutrition in homebound older adults. These include: functional decline or frailty,⁶ higher rates of adverse complications from other health conditions,⁷ increased institutionalization,⁸ and increased mortality.⁹ Whether under-nutrition is associated with increased health care utilization and mortality among community-dwelling older adults who are receiving Medicare home health services is not known. Therefore, we sought to identify the association between baseline nutritional status and subsequent health service utilization and mortality over a one-year period in older adults who were receiving Medicare home health services.

A paradoxical finding that has previously been reported is that homebound older adults may appear to be over-nourished based upon one measure of nutritional status (body mass index [BMI]), yet undernourished based upon another measure (caloric intake).¹⁰ A persistent finding in the literature has been that older adults who are overweight and/or obese experience lower rates of mortality compared with those who are normal weight.^{11,12} Recent research, though, has begun to focus on the role that sarcopenic obesity plays in contributing to functional decline in older adults.^{13,14,15,16} Overweight and obese older

adults who are receiving home health services because of a recent illness and who are experiencing nutritional deficiencies may be at particularly high risk for experiencing adverse health outcomes and increased health service utilization because of under-nutrition. This is because under-nutrition experienced by overweight and obese older adults that contributes to loss of lean muscle mass may lead to greater functional impairment compared with those who are normal weight. Therefore, we additionally sought to identify the associations between baseline nutritional status and subsequent health service utilization and mortality over a one-year period separately for those participants who were overweight or obese.

METHODS

Study Population

Participants in this study were 238 homebound older adults receiving Medicare home health services because of a recent acute illness or an exacerbation of a chronic condition. In order to be eligible for the study, participants had to be community dwelling (residing in their own or some other private residence), be able to communicate or have a caregiver who was able to communicate in English, be free of significant cognitive impairment (if living alone, Mini-Mental State Examination Score [MMSE]¹⁷ ≥ 24 ; if caregiver present, MMSE ≥ 15), be free of known terminal illness, not be tube-fed, and not be dependent on a ventilator. The participants were recruited from area home health agencies ($n = 146$), a university-affiliated geriatric medicine outpatient clinic ($n = 60$), a university-affiliated inpatient rehabilitation facility ($n = 27$), and area churches ($n = 5$). Of the 238 participants, 8 were excluded from the final analysis because of incomplete baseline data. For this paper where mortality is an important endpoint, we additionally excluded 32 participants who had any history of cancer. Thus the final size of the study sample for this paper was 198. The University of Alabama at Birmingham Institutional Review Board reviewed and approved the study protocol and all participants signed written informed consent.

Data Collection

Interviewers visited participants in their homes at baseline, six months, and one year. Participants were administered a questionnaire consisting of items related to nutritional status and health service utilization, as well as medical, functional, economic, social, and psychological factors that could potentially affect nutritional status. Interviewers obtained measurements of height and weight from all participants who were able to stand using a portable digital scale and vertical ruler. For those participants who were unable to stand, self-report of height and weight was obtained. Mortality status was ascertained during attempted contacts at six months and one year.

Measures

The primary dependent variables were measures of health services utilization and mortality status. Health services utilization was determined at six month and one year follow-ups and include: hospitalization (yes/no), times admitted to hospital, number of days hospitalized, nursing home stay (yes/no), number of days in nursing home, doctor visit (yes/no), number of doctor visits, emergency room visit (yes/no), number of emergency room visits, receipt of home health care services (yes/no), receipt of home health aide services (yes/no). These measures were derived by patient (and caregiver, when appropriate and/or necessary) self-report to the following questions: "Since we last talked six months ago: how many times did you visit the doctor? How many times did you visit the emergency room? Have you received any home health care (i.e., nursing or other skilled services)? Have you stayed overnight in a hospital? How many times were you admitted to a hospital? What were the dates of your admission and length of stay? Have you stayed overnight in a nursing home? What were the

dates of your admission and length of stay?” If participants were either hospitalized or admitted to a nursing home during attempts at contact for the six month or one year follow-up assessment, these were counted as a hospitalization or nursing home stay. Mortality status was obtained also during these attempted contacts, and vital status was confirmed using the Social Security Death Index.

Mini Nutritional Assessment—The primary independent variable was baseline nutritional status. This was operationalized using the Mini Nutritional Assessment (MNA®).^{18·19·20} The MNA is a reliable and easy-to-use nutritional assessment tool. It was developed to assess nutrition status as part of the standard evaluation of patients age 65 years and older. The assessment includes eighteen items encompassing anthropometry assessment (BMI calculated from weight and height, weight loss, and arm and calf circumferences), general assessment (lifestyle, medication, mobility, and presence of signs of depression or dementia), dietary assessment (number of meals, food and fluid intake, and autonomy of feeding), and subjective self-perception of health and nutrition status. Anthropometric measures were obtained by trained research assistants using standard protocols. Other items included in the MNA were based upon self-report. The MNA has been well-validated in different settings including in the community with homebound populations, the nursing home, and in the hospital.^{21·22} The MNA can be used to evaluate the risk of undernutrition, and to identify those who could benefit from early intervention. Three groups of patients are derived based upon the total score of 30 for the MNA: Normal Nutritional Status (≥ 24), At Risk for Malnourishment (17–23.5), and Malnourished (< 17).

Body Mass Index—Weight and height were obtained on all participants who were able to stand (55% of all participants) using a portable digital scale and vertical rule. Self-report of height and weight was obtained on 45% of participants who were not able to stand. Self-report status did not vary according to BMI status¹⁰. BMI was calculated as weight (in Kg) divided by height (in m²) and categorized according to the National Heart, Lung, and Blood Institute (1998) clinical guidelines for underweight (BMI < 18.5), normal weight (BMI = 18.5–24.9), overweight (BMI = 25.0–29.9), Class I obesity (BMI = 30.0–34.9), Class II obesity (BMI=35.0–39.9), and Class III obesity (BMI > 40). We further classified all levels of obesity into a single category.

Control Variables—We additionally controlled for medical, social, and cognitive factors that might influence health service utilization and mortality. Medical factors were evaluated using the Charlson Comorbidity Index.^{23·24} The Charlson Comorbidity Index is a weighted count of comorbidities with higher numbers indicating greater burden of illness. Marital status (married or unmarried) and living arrangement (living alone or living with someone) was used to assess social support, and highest level of education completed was used as an indicator for socioeconomic status. Cognitive status was assessed using the Mini-Mental State Examination (MMSE).

Statistical Analyses

Descriptive statistics were used to characterize the sample. Chi-square analysis or one-way analyses of variances (ANOVA) was used where appropriate to test bivariate associations between nutritional status and the dependent variables. Binary logistic regression models were used to identify the independent association of baseline nutrition status and subsequent health service utilization and mortality, while controlling for other variables that might affect outcomes, for those measures that were statistically significantly associated in the bivariate analyses. We used PASW Statistics 18 (IBM SPSS Statistics) for statistical analyses.

RESULTS

For the entire sample of 198, the average MNA score was 21.9 ± 3.9 (SD) and ranged from a minimum of 8.0 to a maximum of 29, with a median of 22.5. Based upon results from the MNA, three nutritional status subgroups were identified: Malnourished (12.1%), At Risk for Malnutrition (51.0%), and Normal Nutritional Status (36.9%). Table 1 presents the baseline characteristics of the study sample according to the three nutritional groups. The mean age of all study participants was 79.2 years (range 60–99). There were 40 males and 158 females, of which 79 were African Americans (AA) and 119 European Americans (EA). BMI ranged from 13.3 to 65.2, with a mean of 27.6; 8.1% of participants were underweight, 37.9 % were normal weight, 25.3 % were overweight, and the rest (28.8%) were obese. Participants who were overweight or obese were just as likely as those with normal BMI status to be either Malnourished (8.0% of overweight, 10.5% of obese, and 9.3% of normal) or At Risk for Malnourishment (48.0% of overweight, 47.4% of obese, and 50.6% of normal); although participants who were underweight were more likely to be Malnourished (25.0% of underweight) or At Risk for Malnourishment (75.0% of underweight) ($p=.058$).

Nutrition status, health service utilization, and mortality

Table 2 presents the bivariate associations using Chi-square analysis or ANOVA, where appropriate, between baseline nutritional status and subsequent health services utilization and mortality at the six month and one year follow-ups. There were significant differences observed between baseline nutritional status and subsequent hospitalization ($P = 0.040$), number of times admitted to the hospital ($P=0.045$), and emergency room visit ($P = 0.047$) at 6 months, and baseline nutritional status, number of hospital days ($P = 0.049$), and home health aide use ($P=0.027$) at one year for the entire sample. Participants who were either At Risk for Malnourishment or Malnourished, based on MNA Score, reported greater health service utilization compared with those who were Normal nutritional status. There were no significant differences observed between baseline nutritional status and other types of health service utilization, including doctor visits or nursing home stays. There were 25 participants who died before the six month follow-up and 39 deaths in total before the last day of the one year study. Mortality was significantly associated with baseline nutritional status at both six months ($p = 0.001$) and one year ($P = 0.031$) for the entire sample only.

Table 3 presents binary logistic regression models for those measures of health service utilization that were significantly associated with baseline nutritional status in the bivariate analyses for both six month and one year for the entire sample and the sub-sample for those who were overweight or obese. Normal nutritional status was used as the reference group. All models controlled for age, gender, ethnicity, marital status, living status, education status, comorbidity status, and cognitive status. The findings revealed that poor nutritional status as measured by the MNA was associated with higher rates of hospitalization and mortality at six months and higher rates of home health care utilization and mortality at one year for the entire sample. Poor nutritional status at baseline was associated with higher rates of rates of hospitalization at six months and higher rates of hospitalization and nursing home stays at one year for participants who were overweight or obese.

DISCUSSION

Twelve percent of patients were categorized as Malnourished and 51.0% were At Risk for Malnourishment; while 36.9% had Normal Nutrition Status. Overweight and obese patients were just as likely to be either Malnourished or At Risk for Malnourishment as patients having a BMI within a normal range. Thus, 63% of patients, including those who were overweight or obese, may have benefitted from receipt of nutritional intervention for under-nutrition. In another paper, it was reported that 70% of these patients were not consuming

enough calories (based upon collection of 24-hour dietary recalls) to maintain their current body weight.¹⁰ These numbers are consistent with other reports in the literature of homebound populations.^{25·26·27·28·29}

In multivariate analyses, under-nutrition was significantly associated with subsequent health services utilization (hospitalization, emergency room visit, and home health aide use) and mortality at six-month and one year follow-ups for the entire sample. In contrast, under-nutrition at baseline was associated with increased rates of hospitalization and nursing home stays, but not mortality, for the subsample of overweight and obese patients. Our analyses controlled for factors that could have predicted health services utilization and/or mortality, including age, gender, and comorbidity status. Thus, it appears that being either Malnourished or At Risk for Malnourishment as measured by the MNA is an independent risk factor for experiencing greater health services utilization and mortality in older adults receiving Medicare home health care, regardless of BMI status. Our findings are consistent with other studies using the MNA that screen for malnutrition and find associations with increased subsequent health service utilization (higher rates of discharge to nursing homes and a longer length of stay) and mortality in hospitalized patients²¹ and mortality in patients receiving home health services in Sweden²². Our study is unique in that we report on a community-dwelling population who were receiving formal home health services and in whom the MNA predicted both health service utilization and mortality.

A recent article appearing in the New England Journal of Medicine found that rehospitalizations among patients in the Medicare fee-for-service program were frequently associated with nutrition-related and metabolic issues.³⁰ We previously similarly reported in a cross-sectional analysis that a recent hospitalization was associated with increased rates of under-nutrition in the homebound older adult sample reported on in this paper.¹⁰ In this paper, we report our longitudinal findings that hospitalizations, visits to emergency rooms, and use of home health aides were associated with patients who were either Malnourished or At Risk for Malnourishment. Utilization of these health care resources occurred frequently, and they are costly. They are also potentially preventable through implementation of interventions that may be much less costly. Greater attention to nutritional status must be a priority of both hospitals and home health agencies.

There were notable intriguing differences observed when comparing results of the entire sample with those of overweight and obese patients only. First, being Malnourished or At Risk for Malnourishment predicted subsequent nursing home stays in the subsample of overweight or obese patients, but not for the entire sample. We speculate that overweight and obese patients may experience a significant loss of lean muscle mass that leads to a level of functional decline whereby care in the community is no longer a viable option because of the difficulty of caring for someone with excess weight. This is in contrast to underweight or normal weight persons who, while also experiencing sarcopenia, may be easier to transfer by caregivers. This explanation is consistent with recent reports that highlight the likelihood of sarcopenic obesity contributing to increased frailty and associated healthcare needs and resources.^{13· 14· 15· 16}

Further, being Malnourished or At Risk for Malnourishment did not predict subsequent mortality for the overweight or obese subsample as it did for the entire sample. This is consistent with a large body of research that demonstrates that overweight and obese older adults are less likely to experience mortality than those who are underweight and normal weight.^{11·12} It may be that while being overweight or obese is protective against the detrimental effects of malnutrition for mortality, it is not for other adverse outcomes. This is consistent with our findings that the subsample of overweight and obese patients who are Malnourished experience higher rates of nursing home stays. This is the first study that we

are aware of that examines multiple outcomes of under-nutrition in a home health population.

This study was limited in some regards. The first was the relatively small sample size, combined with the competing hazard of multiple adverse events, which may not have allowed for detection of association between baseline nutritional status and some indicators of health services utilization. Future work would benefit from a larger sample. A second limitation is our reliance to a large extent on self report based upon questionnaires. Future research might include more sophisticated physical and/or biological measures to more comprehensively assess nutritional status, particularly measures of body composition that evaluate changes in lean muscle mass. Finally, we do not know what the actual cause of death was in patients. While we controlled for comorbidity status in our analyses, we do not know if baseline nutritional status reflected underlying and un-detectable illness not amenable to intervention. For example, if patients had cancer that was not yet diagnosed, we do not know. Despite these shortcomings, we were able to determine that baseline nutritional status is associated with subsequent health services utilization and mortality as we hypothesized.

Conclusion

In conclusion, older adults receiving Medicare home health services who are experiencing under-nutrition, defined by the MNA as either Malnourished or At Risk for Malnourishment, are more likely to subsequently use greater amounts of health care resources and to experience mortality, although, mortality was not associated with under-nutrition in the overweight and obese subsample. Focusing resources on older adults receiving Medicare home health care services to address risk of malnutrition may be especially useful for several reasons.¹⁰⁻³¹ First, prevalence estimates of under-nutrition are high in this group ranging from between 70% and 93% of individuals. Second, they are a group whose numbers are rapidly increasing. In 2008, 3.2 million older adults received Medicare home health service, and this number is expected to rise.³² Fewer older persons with functional impairment are entering nursing homes and more are choosing to remain in the community.³³ Last, programs and policies are already in place that addresses nutritional needs in this population. These include: Medicare policies that support nutrition counseling for diabetes and renal disease, federal food and nutrition programs that target at-risk homebound older adults, and state-level programs that may provide nutritional support to homebound older adults.³¹⁻³⁴ Rising health care costs and consumer preferences for aging-in-place highlight the need for greater attention devoted to nutritional matters with a goal of preventing costly and unnecessary health services utilization and mortality.

Whether nutritional interventions targeted at addressing under-nutrition in this vulnerable population, including those who are overweight and obese, may improve health outcomes and decrease health service utilization is not known. Further work is warranted investigating whether nutritional interventions can be an effective approach to addressing under-nutrition and its sequelae in homebound older adults.

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Table 1

Baseline Characteristics of the Study Sample (N =198)

Variable	Malnourished (N=24)	At Risk for Malnutrition (N=101)	Normal Nutritional Status N=73)	P-value
Demographic				
Age	78.3 ± 8.1 ¹	78.7 ± 8.7	80.2 ± 8.6	.463
Female	22 (91.7) ²	79 (78.2)	57 (78.0)	.303
African American	9 (37.5)	34 (33.7)	36 (49.3)	.111
Married	5 (20.8)	25 (24.8)	23 (31.5)	.478
Lives alone	6 (25)	32 (31.7)	29 (39.7)	.337
Highest education level				.084
None	1 (4.2)	6 (5.9)	4 (5.5)	
Elementary or middle school	7 (29.2)	39 (38.6)	17 (23.3)	
High school, junior college	14 (58.3)	40 (39.6)	30 (41.1)	
College or beyond	2 (8.3)	16 (15.8)	22 (30.1)	
Body Mass Index				.058
Underweight	4 (16.7)	12 (11.9)	0 (0)	
Normal weight	10 (41.7)	38 (37.6)	27 (37.0)	
Overweight	4 (16.7)	24 (23.8)	22 (30.1)	
Obese	6 (25.0)	27 (26.7)	24 (32.9)	
Charlson Comorbidity Index	4.0 ± 3.1	3.7 ± 2.6	2.6 ± 2.3	.012*
Mini-Mental State Examination	25.2 ± 4.2	26.5 ± 3.9	27.4 ± 3.0	.031*

¹ Mean ± SD (all such values),² n (%) (all such value),

* P < 0.05

Table 2

Baseline Nutritional Status and Subsequent Health Services Utilization and Mortality^{1, 2}

Variable	Six months				One year			
	Malnourished	At Risk for Malnutrition	Normal Nutritional Status	P-value	Malnourished	At Risk for Malnutrition	Normal Nutritional Status	P-value
ENTIRE SAMPLE								
Hospitalization	4 (26.7)	27 (38.0)	11 (18)	.040*	6 (37.5)	37 (46.3)	20 (30.3)	.430
Times admitted to hospital	0.7 ± 1.6	0.6 ± 0.9	0.2 ± 0.5	.045*	0.8 ± 1.5	0.8 ± 1.1	0.5 ± 1.2	.318
# of days hospitalized	2.9 ± 5.9	5.1 ± 12.9	1.5 ± 4.0	.102	4.5 ± 8.4	7.0 ± 14.8	2.3 ± 4.9	.049*
Nursing home stay	2 (12.5)	3 (4.1)	1 (1.6)	.141	2 (12.5)	6 (7.6)	2 (3.0)	.288
# of days in nursing home	3.0 ± 11.7	1 ± 7.4	3.0± 23.0	.761	14± 45.7	5 ± 23.3	5.5 ± 31.1	.519
Doctor visit	15 (100)	68 (93.2)	59 (96.7)	.413	16 (100)	77 (96.3)	65 (97.0)	.729
# of doctor visits	3.3 ± 2.3	4.3 ± 3.1	4.7 ± 6.6	.572	6.2 ± 6.0	6.7 ± 5.1	6.6 ± 6.6	.950
Emergency room visit	3 (20)	33 (45.2)	17 (27.9)	.047*	6 (37.5)	44 (55.0)	28 (41.8)	.191
# of emergency room visits	0.3 ± 0.6	1.6 ± 7.2	0.3 ± 0.6	.342	0.4 ± 0.6	1.8 ± 7.0	0.6 ± 0.9	.313
Receipt of home health care	6 (40)	31 (42.5)	15 (24.6)	.088	8(50)	36 (45)	21 (31.8)	.189
Receipt of home health aide	5 (33.3)	12 (16.7)	7 (11.5)	.121	7 (43.8)	16 (20)	9 (13.8)	.027*
Death	7 (29.2)	16 (15.8)	2 (2.7)	.001**	8 (33.3)	23 (22.8)	8 (11.0)	.031*
OVERWEIGHT AND OBESE SAMPLE								
Hospitalization	4(57.1)	16(43.2)	7(17.9)	.022*	4(50.0)	23(53.5)	13(30.2)	.084
Times admitted to hospital	1.4 ± 2.1	0.6 ± 0.8	0.3 ± 0.6	.006**	1.4 ± 2.0	1.0 ± 1.2	0.4 ± 0.8	.036*
# of days hospitalized	6.1 ± 10.5	7.7 ± 17.0	2.0 ± 4.8	.122	6.3± 9.7	9.2 ± 17.6	3.0 ± 5.6	.084
Nursing home stay	2(25.0)	1(2.6)	1(2.6)	.017*	2(25.0)	4(9.5)	1(2.3)	.067
# of days in nursing home	6.4 ± 17.0	1.6 ± 10.1	4.6 ± 28.8	.769	28.1 ± 63.4	7.4 ± 29.8	4.2 ± 27.4	.169
Doctor visit	7(100)	37(97.4)	38(97.4)	.911	8(100)	42(97.7)	43(97.7)	.910
# of doctor visits	4.0 ± 3.0	4.3 ± 2.3	5.6 ± 8.0	.557	5.8 ± 4.6	6.9 ± 4.4	7.3 ± 7.7	.815
Emergency room visit	2(28.6)	18(47.4)	12(30.8)	.280	3(37.5)	25(58.1)	19(43.2)	.294

Variable	Six months			One year		
	Malnourished	At Risk for Malnutrition	Normal Nutritional Status	P-value	Malnourished	At Risk for Malnutrition
# of emergency room visits	0.4 ± 0.8	2.3 ± 9.8	0.4 ± 0.6	.433	0.5 ± 0.8	2.6 ± 9.4
Receipt of home health care	3(42.9)	18(47.4)	12(30.8)	.322	4(50.0)	20(46.5)
Receipt of home health aide	2(28.6)	8(21.6)	6(15.4)	.638	3(37.5)	10(22.3)
Death	1(10.0)	4(7.8)	0(0)	.132	2(20.0)	10(19.6)
						5(10.9)
						.467

¹ N (%) (all such values),
² Mean ± SD (all such values),
^{*} P<0.05;
^{**} P<0.01

Binary Logistic Regression of Baseline Nutritional Status and Subsequent Health Services Utilization and Mortality^{1, 2}

Table 3

Variables		Odds Ratio	B	Standard Error	Wald	P value	95% Confidence Interval
ENTIRE SAMPLE							
Six Months Hospitalization	Mini Nutritional Assessment				3.972	.137	
	Malnourished	1.544	0.434	.722	0.362	.547	0.375–6.355
	At risk for malnutrition	2.389	0.871	.440	3.911	.048*	1.008–5.661
Emergency Room Visit	Mini Nutritional Assessment				4.557	.102	
	Malnourished	0.460	−0.777	.778	0.996	.318	0.100–2.114
	At risk for malnutrition	1.782	0.578	.403	2.055	.152	0.809–3.928
Receipt of Home Health Aide	Mini Nutritional Assessment				2.317	.314	
	Malnourished	2.913	1.069	.758	1.989	.158	0.659–12.874
	At risk for malnutrition	1.113	0.107	.564	0.036	.850	0.368–3.363
Mortality	Mini Nutritional Assessment				7.307	.026*	
	Malnourished	11.190	2.415	.894	7.291	.007**	1.939–64.587
	At risk for malnutrition	5.630	1.728	.797	4.707	.030*	1.182–26.852
One Year Hospitalization	Mini Nutritional Assessment				2.121	.346	
	Malnourished	1.641	0.495	.625	0.627	.428	0.482–5.590
	At risk for malnutrition	1.732	0.549	.384	2.051	.152	0.817–3.674
Emergency Room visit	Mini Nutritional Assessment				1.241	.538	
	Malnourished	0.752	−0.286	.620	0.212	.645	0.223–2.535
	At risk for malnutrition	1.335	0.289	.368	0.617	.432	0.649–2.748
Receipt of Home Health Aide	Mini Nutritional Assessment				4.559	.102	
	Malnourished	3.884	1.357	.671	4.087	.043*	1.042–14.476
	At risk for malnutrition	1.182	0.167	.496	0.114	.736	0.447–3.122

	Variables	Odds Ratio	B	Standard Error	Wald	P value	95% Confidence Interval
Mortality	Mini Nutritional Assessment				4.922	.085	
	Malnourished	3.924	1.367	.626	4.775	.029*	1.151–13.373
	At risk for malnutrition	2.069	0.727	.475	2.340	.126	0.815–5.252
OVERWEIGHT AND OBESE SAMPLE							
Six Months							
Hospitalization	Mini Nutritional Assessment				6.131	.047*	
	Malnourished	6.432	1.861	1.027	3.284	.070	0.859–48.162
	At risk for malnutrition	3.771	1.327	0.593	5.006	.025*	1.179–12.061
One Year Hospitalization	Mini Nutritional Assessment				4.541	.103	
	Malnourished	4.491	1.502	.978	2.357	.125	.660–30.563
	At risk for malnutrition	3.114	1.136	.580	3.838	.050*	.999–9.700
Nursing Home Stay	Mini Nutritional Assessment				5.268	.072	
	Malnourished	83.868	4.429	2.037	4.727	.030*	1.547–4546.6
	At risk for malnutrition	3.124	1.139	1.545	0.543	.461	.151–64.532

¹ All models are adjusted for age, gender, ethnicity, living status, education status, Mini-Mental State Examination score, and Charlson Comorbidity scores.

² Normal Nutritional Status is the reference for all Mini Nutritional Assessment groups.

* P<0.05