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Risk Factors for Malnutrition among Older Adults in the Emergency Department: A Multicenter Study

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Abstract

Background—Among older adults, malnutrition is common, often missed by healthcare providers, and influences recovery from illness or injury.

Objective—To identify modifiable risk factors associated with malnutrition in older patients.

Design—Prospective cross-sectional multicenter study

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Setting—3 EDs in the South, Northeast, and Midwest

Participants—Non-critically ill, English-speaking adults aged ≥ 65 years

Measurements—Random time block sampling was used to enroll patients. The ED interview assessed malnutrition using the Mini Nutritional Assessment Short-Form. Food insecurity and poor oral health were assessed using validated measures. Other risk factors examined included depressive symptoms, limited mobility, lack of transportation, loneliness, and medication side effects, qualified by whether the patient reported the risk factor affected their diet. The population attributable risk proportion (PARP) for malnutrition was estimated for each risk factor.

Results—In our sample (n=252), the prevalence of malnutrition was 12%. Patient characteristics associated with malnutrition included not having a college degree, being admitted to the hospital, and residence in an assisted living facility. Of the risk factors examined, the PARPs for malnutrition were highest for poor oral health (54%; 95% CI 16%, 78%), food insecurity (14%; 95% CI 3%, 31%), and lack of transportation affecting diet (12%; 95% CI 3%, 28%).

Conclusion—Results of this observational study identify multiple modifiable factors associated with the problem of malnutrition in older adults.

Keywords

Malnutrition; Emergency Medicine; Geriatric

INTRODUCTION

The total economic burden of disease-associated malnutrition in the U.S. is approximately \$157 billion annually.¹ Among older adults in the U.S., malnutrition affects an estimated 3 million individuals and is associated with functional decline, decreased quality of life, and mortality.^{2–4} Despite the prevalence and burden of malnutrition among older adults and the availability of validated screening instruments,⁵ screening is rarely conducted and malnutrition is rarely identified by healthcare providers.⁶ Although clinical trials of nutritional interventions in malnourished older adults generally show benefit, the absence of studies from specific healthcare settings has limited policies supporting routine screening and intervention.⁷

U.S. emergency departments (EDs) receive over 20 million visits by older adults annually and disproportionately care for individuals with limited financial resources and limited access to medical care. As such, the ED is a potentially important setting for identifying and addressing malnutrition. Prior research has found that the burden of malnutrition is high among older adults presenting to the ED, with prevalence point estimates ranging from 12% to 16%.^{5,8,9} Only one clinical trial has examined the value of identifying and treating malnutrition in older ED patients.⁸ This pilot study provided patients with individualized dietary counseling over a period of 12 weeks and observed clinically important but non-statistically significant improvements in quality of life and reductions in healthcare utilization. Although these results support the need for a large trial, much remains unknown about the optimal strategy to improve nutritional health among malnourished older ED patients.

Given the heterogeneity of older ED patients in regard to financial resources, social support, and chronic disease, efforts to optimize an intervention should be informed by an understanding of the contribution of specific modifiable risk factors for malnutrition in this population. When malnutrition is identified in other healthcare settings, the most common treatment is oral nutritional supplementation providing protein and energy supplementation.¹⁰ Available evidence suggests oral nutritional supplementation only partially addresses the problem of malnutrition.¹¹ Additional components to an intervention might include oral health care, access to foods other than nutritional supplements, exercise programs, treatment of depression, and consultation with dietitians.^{12–17} We sought to better understand the types of interventions that might be useful in this population by examining differences in the prevalence of malnutrition across patient sociodemographic characteristics and by estimating population attributable risk proportions (PARPs) for several modifiable risk factors for malnutrition.

METHODS

Study Design and Setting

We conducted a cross-sectional study at three EDs in the South, Northeast, and Midwest United States from June 2015–March 2016. Screening, consent, and data collection was conducted by research assistants (RAs) using a standardized interview following training by a study coordinator. Enrollment occurred during random time blocks: For each week over a period of two to three months at each site, four days of the week including weekend days, were randomly selected. For each day selected, a four-hour time block was randomly selected (9am–1pm, 1pm–5pm, or 5pm–9pm). During each block, the order in which patients were approached for screening was randomly assigned to prevent biased enrollment. Informed consent was obtained for each participant, and the study was approved by each site's institutional review board prior to data collection.

Participants

RAs screened ED patients who were aged 65 years and older and English speaking. We excluded patients receiving psychiatric evaluation, as well as those who were critically ill based on an emergency severity index score of 1 or provider judgement. Capacity to consent was assessed based on the patient's ability to answer three questions about the study within three tries.¹⁸ For patients who were unable to answer all three questions correctly, consent was sought from a legally authorized representative. In order not to interrupt patient care, patients who had already received an order to be admitted or discharged from the ED were excluded.

Measures

Nutritional status was assessed using the Mini Nutritional Assessment Short-Form (MNA-SF). The MNA-SF is a validated questionnaire that asks patients or their caregivers,¹⁹ if they have recently experienced a decline in food intake, weight loss, mobility problems, stress or acute disease, and dementia (determined using Six-Item Screener) or depression (self-reported).²⁰ The MNA-SF also includes the patient's body mass index (BMI) or calf circumference. RAs determined BMI by directly measuring a participant's height and

weight; for participants who were unable to stand, RAs measured the calf circumference. A score of 12–14 on the MNA-SF indicates normal nutritional status, 8–11 indicates at risk for malnutrition, and ≤ 7 indicates malnutrition.²⁰

The ED interview also obtained information about patient sociodemographic characteristics, cognition, living arrangement, and potentially modifiable risk factors for malnutrition. Cognition was assessed using the Six-Item Screener, with a score of 6/6 used to define normal cognition, 4/6 or 5/6 to define mild cognitive impairment, and 3/6 or less to define moderate/severe cognitive impairment.²¹ Oral health was assessed using the 12-item Geriatric Oral Health Assessment Index (GOHAI), a self-reported measure of dental health developed for and validated in older adults.^{22,23} Participant responses to each item were coded on a 5-item Likert scale (always, often, sometimes, seldom, never), and the total score was used to define patients with good (57–60), moderate (51–60), or poor (≤ 50) oral health. Food insecurity was assessed using the Household Food Insecurity Access Scale (HFIAS), a 9-item questionnaire that asks participants how often they have experienced difficulty accessing food over the past month using a 4-item Likert scale (none, rarely, sometimes, often).²⁴ The participant's household is then categorized as food secure, mildly insecure, moderately insecure, and severely insecure. Depressive symptoms were assessed using two items from the PRIME-MD survey in combination with the 10-item Center for Epidemiologic Studies Depression scale (CES-D).^{25,26} The PRIME-MD asks if patients felt 1) down, depressed, or hopeless, or 2) little interest or pleasure in doing things much of the time in the past month. If a patient answered “yes” to either of these two questions, the patient also completed the 10-item CES-D. Participants were considered to have depressive symptoms if they had a CES-D score ≥ 4 (0–10 scale).²⁷ Patients were also asked if they believed their mood or depression affected their eating habits.

The ED interview also examined whether patients had difficulty with the following conditions over the past month: side effects from medications, lack of transportation, and limited mobility. If the patient said “yes” to any of these conditions, they were asked if the condition made it difficult to eat well. To assess social isolation, patients were also asked “in the past month, did you ever not eat or eat less because you were lonely?”. Finally, participants were asked if there were any other conditions that made it difficult to eat well.

Statistical Analysis

We calculated the percentage of participants identified as (1) normal nutritional status, (2) at risk for malnutrition, and (3) malnourished, overall and by patient subgroups. The distribution of the three categories of malnutrition was compared across patient characteristics using the Cochran-Mantel-Haenszel chi-squared test, stratified by study site. The prevalence of malnutrition was calculated among each risk factor. We then estimated the PARP for malnutrition for each of these risk factors along with the 95% confidence intervals (95% CIs).²⁸ The PARP is a measure of association describing the proportion of the disease incidence in the population that is possibly due to a certain risk factor. For example, the PARP for oral health was calculated by dividing the malnutrition incidence in participants with poor oral health by the malnutrition incidence in the total study sample. For risk factors with 3 category outcomes (food insecurity and oral health), categories were dichotomized to

“severe/moderate vs. mild/no food insecurity” and “poor/moderate vs. good oral health” to calculate the PARP. For depressive symptoms, limited mobility, lack of transportation, and medication side effects, we estimated the PARP for the presence of the risk factor (e.g., limited mobility) and the presence of the risk factor and an attribution by the patient that this risk factor contributed to poor nutrition (e.g., limited mobility making it difficult to eat well). Statistical analyses were conducted using STATA 14.1 (StataCorp LP, College Station, TX) and SAS 9.3 (SAS Institute Inc, Cary, NC).

RESULTS

Two hundred and ninety-two patients who met the eligibility criteria based on review of the EDs electronic tracking board were screened in person. Of these, 283 met all eligibility criteria, 258 were enrolled, and 252 completed the ED interview (Figure 1). Study participants (n=252) were predominantly White (68%), without a college degree (68%), and residents of a private home (95%). The study sample was 51% female and 46% were aged 75 years or older (Table 1). Fourteen study patients were identified as cognitively impaired (Six-Item Screener score ≤ 3). Of these, 7 demonstrated capacity to consent and 7 lacked capacity to consent but a legally authorized representative provided consent.

The overall prevalence of malnutrition in the study population was 12.3% (Table 1). Point estimates for the prevalence of malnutrition varied from 7% (n=76) in the Northeast to 12% (n=78) in the Midwest and 15% (n=98) in the South (p=0.01). The prevalence of malnutrition was similar for females and males (p=0.59) and for Whites and Blacks (p=0.61). Higher rates of malnutrition were observed among those without a college degree vs. with a college degree (13% vs. 6%, p<0.01) and those who lived in an assisted living facility vs. a private residence (30% vs. 10%, p=0.05).

The most common risk factor identified was oral health, with 138 participants (54.8%) having poor or moderate oral health. Nineteen percent of patients in the sample stated that they always or often had trouble biting or chewing certain foods and 8% stated that they always or often limited the kinds or amount of food they ate due to problems with their teeth or dentures (Appendix S1). Eleven percent of patients reported having difficulty getting access to dental care, most often due to cost (Appendix S2). Rates of malnutrition were 20% for those with poor oral health and 14% for those with moderate oral health. The combined risk factor of poor or moderate oral health yielded the highest PARP of the risk factors examined of 54.3% (95% CI 16%, 78%; Table 2). Lack of transportation, depressive symptoms, medication side effects, and had the next three highest PARPs: 22.8% (95% CI 7%, 42%), 19.8% (95% CI 1%, 42%), and 15.2% (95% CI 1%, 36%), respectively. The PARPs for these risk factors were substantially lower when calculated based on patients who thought this risk factor was affecting their diet. Food insecurity was reported in only 8% of the sample, but due to the strong association with malnutrition had a PARP of 13.9% (95% CI 3%, 31%). Eleven patients (4%) reported that they sometimes or often ate smaller meals than they felt they needed because there was not enough food (Appendix S3). Limited mobility in the home and loneliness had the smallest associations with malnutrition, with PARPs of 6.4% (95% CI -9%, 29%) and 6.4% (95% CI -2%, 23%) respectively. Among

malnourished individuals, additional reasons offered by patients for not eating well included loss of appetite (n=9) and gastrointestinal problem (n=4).

Of the malnourished patients (n=29), 27 individuals (93%) had at least one of the risk factors examined in this study. Of these 19 has more than one risk factor (Appendix S4). Eighteen of the 23 individuals with poor/moderate oral health had another risk factor, most commonly depressive symptoms (31%), lack of transportation (31%), medication side effects (28%), or limited mobility (28%).

DISCUSSION

Among older adults presenting to three EDs in distinct areas of the U.S., the prevalence of malnutrition was estimated to be 12%. This value is within the range of a prior estimate by our group (16%; 95% CI 11%, 23%; n=138) and is similar to that from a study conducted in Australia (15%; 95% CI 9%, 21%).^{5,9} These estimates are more than double the estimated prevalence of malnutrition in community-dwelling older adults (5.8%), supporting the idea that EDs provide access to a nutritionally vulnerable subset of older patients.²⁹ Despite the fact that malnutrition screening takes less than 5 minutes to complete,⁵ screening is rarely performed. While a majority of malnourished patients in our study were admitted, 21% of malnourished participants were discharged home from the ED without any formal assessment or treatment for malnutrition. Given the evidence that even discharged older ED patients are at increased risk for functional decline and death,^{30,31} screening and treatment of malnutrition may be important for all older ED patients.

Of the risk factors examined, poor or moderate oral health had the highest PARP of 54%. Based on this estimate, improving the oral health of older ED patients from poor or moderate to good would reduce by more than half the incidence of malnutrition in this population. Poor oral health might lead to malnutrition by altering food choices due to chewing or swallowing difficulties or might reduce nutrient absorption because of the failure to adequately break down food before swallowing.³² Oral health care is not covered by Medicare and is often prohibitively expensive for older adults. In a 2012 survey of older Americans, 38% of respondents reported not being able to afford dental care, making oral health the most commonly reported health problem.³³ Consistent with this, in our study 34% of all patients and 41% of malnourished patients had not seen a dentist in the past 2 years. The Department of Health and Human Services has proposed steps to address oral health care disparities in the United States,³⁴ but whether such policies can improve oral health among older adults is unknown. Geriatric-centered dental clinics can increase access to dental care in older adults (seniordentalcenter.org) but are few in number. For malnourished patients whose dental problems cannot be solved easily or in a timely manner, liquid oral nutritional supplementation may be an important component of treatment.

Lack of transportation judged by the patient to affect their eating had a PARP of 12%. Driver's license restrictions and total driving cessation are common in older adults.^{35,36} Public transportation may also be unavailable or inaccessible.³⁷ These transportation problems can prevent older adults from purchasing fresh foods. Twenty participants (9%) were identified as having moderate or severe food insecurity, and of those, 6 patients (30%)

were malnourished (PARP 13.9%). Food access issues can be addressed in the ED by connecting seniors with organizations like Meals on Wheels, a non-profit organization focused on providing nutritional services to older adults.³⁸ Nationally, these community organizations are pushing for collaboration with the health care system,³⁹ and the ED may be an important setting for facilitating this collaboration.

In this sample, 23% of older adults screened positive for clinically important depressive symptoms, slightly higher than point estimates from other studies of older ED patients (12–21%).^{5,40} Additionally, of the 57 patients with depressive symptoms, 19% were malnourished (PARP 19.8%). The association between depression and malnutrition has been previously reported,⁴¹ and depression has been linked to loss of appetite and weight loss in the elderly.^{42,43} Nutritional deficiencies may also intensify depressive symptoms,⁴¹ potentially creating positive feedback between depression and malnutrition.

Medication side effects and loneliness affecting diet had lower PARPs when compared to other risk factors, but intervening on these factors may be important for some individuals. Polypharmacy is common among older adults and can contribute to malnutrition by causing loss of appetite or altering nutrient absorption.⁴⁴ Social isolation has previously been linked with several adverse health outcomes in older adults, including malnutrition.⁴⁵ Interventions to encourage companionship during mealtimes and support with meal preparation or provisions could help to reduce malnutrition in this population. Limited mobility in the home had also a PARP of 6%, but limited mobility in the home affecting eating was not associated with malnutrition (PARP –1.0%).

There are several limitations to this study. Attributable risk is usually calculated using longitudinal data because exposures are assessed at an initial time point and outcomes are assessed at a subsequent time point.⁴⁶ In our study, risk factors and the outcome were both assessed at the time of the ED interview, but the assessment of risk factors questions asked about behaviors and conditions in the past. For example, the GOHAI asks about oral health in the past 4 weeks, and the HFIAS asks about food insecurity in the past 3 months. Although using cross-sectional studies to estimate attributable risk has been described as a method⁴⁶ and used successfully in other studies,⁴⁷ results using this approach may be influenced by recall bias and survivor bias. Both forms of bias may be present in the data presented here. We excluded patients who were receiving psychiatric evaluation, were critically ill or non-English speaking, and were enrolled before 9 a.m. or after 9 p.m. This may somewhat limit the generalizability of these findings. Furthermore, only 10 patients in this study lived in assisted living, which limits the conclusions that can be drawn about this sub-population. We chose to examine modifiable factors known to increase risk for malnutrition in other patient populations. There are likely other modifiable factors that contribute to the problem of malnutrition in this population including drug and alcohol use, eating disorders, and elder abuse or neglect.^{48–50}

In a sample of older adults receiving care in U.S. EDs, malnutrition was present in 12%. Several factors, including food insecurity, depressive symptoms, and lack of transportation, were associated with malnutrition in this sample, with the largest contributing factor being poor oral health. Because U.S. EDs are often the primary source of care for patients with

low income or little access to medical/dental care, they offer a unique opportunity to detect at-risk patients. Further research is needed to assess the feasibility and value of linking malnourished older adults in the ED to interventions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Flow diagram of the screening and enrollment process.

Table 1

Prevalence of normal nutritional status, risk for malnutrition, and malnutrition, overall and by participant characteristics.

Characteristic	All patients	N (%)		P-value ^b
		Normal nutritional status ^a	At risk of malnutrition ^a	
All patients	252	132 (52)	91 (36)	29 (12)
Sex				
Male	124	64 (52)	45 (36)	15 (12)
Female	128	68 (53)	46 (36)	14 (11)
Age, years				
65–74	136	74 (54)	50 (37)	12 (9)
75	116	58 (50)	41 (35)	17 (15)
Race				
White	171	92 (54)	59 (34)	20 (12)
Black	64	33 (51)	23 (36)	8 (13)
Other	17	7 (41)	9 (53)	1 (6)
Education ^c				
No college	171	78 (46)	70 (41)	23 (13)
College	80	54 (68)	21 (26)	5 (6)
Living arrangement ^d				
Private residence	240	129 (54)	86 (36)	25 (10)
Assisted living	10	3 (30)	4 (40)	3 (30)
Disposition ^e				
Admitted ^f	144	77 (53)	45 (32)	22 (15)
Discharged	99	51 (52)	42 (42)	6 (6)
Study site region				
South	95	40 (41)	43 (44)	15 (15)
Midwest	78	50 (64)	19 (24)	9 (12)
Northeast	79	42 (55)	29 (38)	5 (7)

^aDefined using the Mini Nutritional Assessment Short Form (MNASF), where a score 0–7 points is considered malnourished, 8–11 points is at risk of malnutrition, and 12–14 points is normal nutritional status

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b Calculated using Cochran-Mantel-Haenszel chi-squared test, stratified by study site
 c Total n=251
 d Total n=250
 e Total n=243
 f Includes 9 patients who were treated in an Observation Unit
 g Comparison of malnutrition across sites was calculated using chi-squared test, not stratified by site

Table 2

Malnutrition prevalence and population attributable risk proportion, by risk factor.

Risk Factor	Total n	Malnourished N (%)	Population attributable risk proportion % (95% CI)
Oral health ^a			
Poor or moderate	138	23 (17)	54.3 (15.5,78.1)
Good	114	6 (5)	
Food insecurity ^b			
Severe or moderate	20	6 (30)	13.9 (3.0,30.6)
Mild or none	232	23 (10)	
Loneliness affecting diet ^c			
Yes	20	4 (20)	6.4 (−2.3,23.2)
No	232	25 (11)	
Depressive symptoms ^d			
Yes	57	11 (19)	19.8 (1.1,41.7)
No	195	18 (9)	
Depressive symptoms affecting diet ^e			
Yes	41	6 (15)	5.3 (−7.3,25.4)
No	211	23 (11)	
Medication side effects ^f			
Yes	47	9 (19)	15.2 (−0.8,36.1)
No	205	20 (10)	
Medication side effects affecting diet ^c			
Yes	23	5 (22)	8.9 (−1.2,26.3)
No	229	24 (10)	
Lack of transportation ^f			
Yes	38	10 (26)	22.8 (7.0,42.4)
No	214	19 (9)	
Lack of transportation affecting diet ^c			
Yes	14	5 (36)	12.4 (3.2,27.6)
No	238	24 (10)	
Limited mobility in home ^f			
Yes	57	8 (14)	6.4 (−9.7,28.7)
No	195	21 (11)	
Limited mobility in home affecting diet ^c			
Yes	11	1 (9)	−1.0 (−4.0,15.6)
No	241	28 (12)	

^aDefined using the Geriatric Oral Health Assessment Index (GOHAI), where a score of 50 is poor, 51–56 is moderate, and 57 is good oral health^bDefined using the Household Food Insecurity Access (HFIAS) instrument, where categories 1 and 2 indicate mild or none, and categories 3 and 4 indicate moderate or severe food insecurity^cDefined as answering “yes” to “Has (specific risk factor) made it difficult for you to eat well?”

^d Defined as answering “yes” to 1 item on the PRIME-MD and a score of ≥ 4 on the 10-item Center for Epidemiological Studies Depression Scale (CES-D)

^e Defined as answering “yes” to 1 item on the PRIME-MD and answering “yes” to “Do you think your mood or depression affects your eating habits?”

^f Defined as answering “yes” to the question “In the past month, has (specific risk factor) been a problem for you?”

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