

Indicators of Prescription Drugs and Oral Dietary Supplements among Inhabitants of Nursing Homes

Mohammed Salman Almazeedi¹, Ahmed Saud Alghanim¹, Mossa Ali Alsaad¹, Ayat Jaber Alhamadah¹, Shaker Abdullah Alabdullah¹, Adnan Ahmed Bu-Hassan¹, Yousef Yassen Alhashim¹, Hayder Taher Alhumaid¹, Haya Saad Mubarak Alqahtani², Atif Nasser Alatafi³

¹Nursing Technician King Fahad Hufof Hospital

²Food Nutrition Service's Prince Sultan Cardiac Center Alahsa

³Pharmacy Technician Aldahow PHC

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ABSTRACT

Background: Malnutrition is a common issue among elderly individuals, especially in nursing homes, leading to various health complications such as disability, falls, and hospitalizations. Oral nutritional supplements (ONS) are frequently used to address malnutrition in this population, but factors influencing their prescription remain poorly understood. This study aimed to identify both resident-specific and nursing home-specific factors associated with ONS prescription in nursing home residents.

Methods: A study was performed to examine resident characteristics (e.g., age, disability, comorbidities, malnutrition indicators) and nursing home characteristics (e.g., ownership, GP staffing, presence of dietitians, meal preparation) in relation to ONS prescription. Multivariate binary logistic regression was used to assess the association between these variables and the likelihood of receiving ONS.

Results: Of the participants, 7.8% were prescribed ONS. Factors associated with increased ONS prescription included advanced age, low BMI (<21 kg/m²), recent weight loss, greater disability in activities of daily living, pressure sores, pain, and a higher number of hospitalizations. Nursing homes with specialized geriatric training for coordinating physicians, dietitians on staff, and provision of evening snacks were more likely to prescribe ONS. On-site meal preparation, fasting duration, and the number of medications were associated with reduced likelihood of ONS prescription.

Conclusion: Both resident-related and nursing home-related factors influence the prescription of ONS in nursing homes. Specifically, advanced age, low BMI, and greater disability are key predictors for ONS use, while nursing home infrastructure, including the presence of dietitians and specialized training for healthcare providers, also plays a significant role. Addressing these factors may enhance ONS prescription practices and improve nutritional care for nursing home residents.

Keywords: infrastructure, nutritional, pressure sores, pain.

INTRODUCTION

Malnutrition is widely prevalent among elderly individuals [1,2], particularly in nursing homes [3]. It affects approximately 20% of residents in these facilities [3], though prevalence rates vary significantly across studies, primarily due to differences in diagnostic criteria used to define malnutrition [1–6]. The impact of malnutrition on residents' health is profound, leading to issues such as disability, falls, fractures, and hospitalizations [7–9]. Oral nutritional supplements (ONS) are frequently considered as a therapeutic intervention to address malnutrition in nursing home residents [10]. These supplements are available in liquid, powder, or cream form and are prescribed to enhance protein and overall caloric intake. Numerous clinical studies have demonstrated the benefits of ONS in nursing home populations, including improvements in weight gain [11–14], energy intake [14], comorbidities [8,10,14], functional decline [6,11,14], hospital length of stay [8,11], mortality rates [8,11], and healthcare costs [8,14].

Recommendations for prescribing ONS are typically based on malnutrition criteria, such as significant weight loss ($\geq 5\%$ in one month or $\geq 10\%$ in six months), low body mass index (BMI <21 kg/m²), Mini Nutritional Assessment (MNA) scores ≤ 17 , or albumin levels <35 g/L in the absence of an inflammatory syndrome [20]. ONS is advised for cases of severe malnutrition or when nutritional intake remains inadequate despite dietary guidance. However, a key limitation of this approach is the underdiagnosis of malnutrition [7]. Additional factors may also influence ONS prescription in nursing homes, though research on this subject is limited [15].

Most existing studies have focused on patient-related factors [16–24], with little investigation into how internal organizational aspects of nursing homes might influence ONS prescriptions.

The objective of this study is to determine whether factors related to residents and those related to nursing homes are independently associated with ONS prescription. The primary hypothesis is that ONS prescription is influenced by both resident-specific and nursing home-specific factors, independent of one another.

Patients and Methods

The study included 175 nursing homes and 6275 residents. Data were collected using two questionnaires—one focused on nursing home structure and organization and the other on residents' health status—completed online through a dedicated research website. The coordinating physician or nurse and the nursing home director completed the respective questionnaires.

The primary outcome was the prescription of oral nutritional supplements (ONS). This was determined by the response to the question: "Does the patient have a specific diet currently?" (response options: yes/no).

Independent variables related to residents included: age (continuous); levels of disability in activities of daily living measured using a 6-item scale (bathing, toileting, indoor locomotion, outdoor locomotion, eating, and incontinence), with scores ranging from 6 to 18; number of diseases (calculated by summing 20 conditions, including those from the Charlson comorbidity index [26], excluding dementia); number of medications taken; and number of hospitalizations in the past year (categorized as 0, 1, or 2 or more). Dichotomous variables included: sex, presence of dementia, psychiatric disorders (excluding depression), pain complaints, behavioral disturbances (wandering and aggressive behavior as separate variables), pressure sores, falls in the past year, and history of fractures. Indicators of malnutrition were also recorded, including BMI (calculated as weight in kilograms divided by height in meters squared) $<21 \text{ kg/m}^2$ [27] and significant weight change in the last month (defined as a change exceeding 1 kg [28] or $\geq 2.5\%$ of body weight).

Nursing home-related factors included: ownership type (public, private non-profit, or private for-profit), the number of general practitioners (GPs) per bed (categorized into tertiles: high (>0.19), intermediate ($0.10\text{--}0.18$), low (<0.10)), presence of a coordinating physician (yes/no), presence of a dietitian (yes/no), training level of coordinating physicians (specialized training, such as a university degree or geriatric training, vs. no specific geriatric training), on-site meal preparation (yes/no), and provision of snacks (morning, afternoon, or evening). The average fasting duration (in hours) between dinner and breakfast was also recorded.

Statistical Analysis

Associations between categorical variables and the outcome were analyzed using the χ^2 test. Differences between ONS users and non-users in continuous variables were assessed using the Student t-test for independent samples, after confirming the normality assumption. To adjust for multiple comparisons, the false discovery rate (FDR) method was applied [28]. After checking for multicollinearity among independent variables, multivariate binary logistic regression was conducted, with ONS prescription as the dependent variable. A sensitivity analysis was performed using mixed-effect binary logistic regression with a random nursing home effect to account for data clustering. Model discrimination was assessed using Harrell's c-index [29], and goodness-of-fit was evaluated with the Hosmer-Lemeshow test and Pearson χ^2 statistics [30]. All analyses were conducted using Stata version 11.

RESULTS

Oral nutritional supplements (ONS) were prescribed to 489 participants, representing 7.8% of the study population. Table 1 provides a comparison of participant and nursing home characteristics based on ONS usage. The fully adjusted binary logistic regression model, as shown in Table 2, identified several factors associated with ONS prescription. Among resident-related factors, the likelihood of ONS prescription increased with advanced age, low BMI ($<21 \text{ kg/m}^2$), recent weight loss, greater disability in activities of daily living (ADLs), presence of pressure sores, pain, and a higher number of hospitalizations in the past year. Conversely, residents with psychiatric disorders were less likely to receive ONS prescriptions.

Regarding nursing home structure and organization, ONS prescriptions were less likely in facilities with an intermediate number of general practitioners (GPs) per bed compared to those with a low number. Preparing meals on-site rather than off-site, the fasting duration between dinner and breakfast, the length of the dinner period, and the number of prescribed medications were all associated with a lower likelihood of ONS use. In contrast, the presence of a coordinating physician with specialized training in geriatrics, a dietitian on staff, and the provision of evening snacks increased the probability of ONS prescription. Model fit was confirmed using the Hosmer-Lemeshow test and Pearson χ^2 statistics.

In the sensitivity analysis, several nursing home-related factors, including the presence of a dietitian, on-site meal preparation, fasting duration, and dinner duration, were no longer significantly associated with ONS prescription. Similarly, among resident-related factors, psychiatric disorders and the number of medications taken were no longer significant predictors.

Table 1: Differences Between Users and Non-Users of Oral Nutritional Supplements (n = 6275)

Variables	ONS Users (n = 489, 7.8%)	ONS Non-users (n = 5786, 92.2%)	P value
Age (years)	88.1 (7.1)	85.8 (8.2)	0.000
Sex			0.000
- Men (%)	19.6	26.9	
- Women (%)	80.4	73.1	
Clinical markers of undernutrition			
- Weight lost in the last month > 2.5% or 1 kg (%)	8.7	4.29	0.000
- BMI < 21 kg/m ² (%)	21.2	25.6	0.000
- Disability in activities of daily living (scores 6-18)	15.9 (2.8)	13.4 (3.9)	0.000
- Charlson comorbidity index	1.7 (1.8)	1.6 (1.7)	0.248
- Dementia (%)	58.1	41.6	0.000
- Psychiatric disorder (%)	12.5	18.1	0.002
Behavioral disturbances			
- Wandering (%)	17.0	13.4	0.025
- Aggressive behavior (%)	25.6	20.4	0.006
- History of fracture (%)	48.3	37.3	0.000
- Falls during the past year (%)	52.6	48.6	0.001
- Pain (%)	29.1	22.9	0.002
- Pressure sores (%)	13.3	3.3	0.000
Number of hospitalizations during the past year (%)			0.000
- 0	63.8	72.9	
- 1	28.8	23.3	
- 2 and more	7.3	3.8	
NH Profile			0.733
- Public (%)	49.9	49.1	
- Private non-profit (%)	34.2	35.8	
- Private for-profit (%)	16.0	15.1	
Presence of professionals working at the NH			
- Coordinating physician (%)	96.6	96.7	0.001
- Dietician (%)	53.4	45.0	0.000
Training Coordinating Physician			0.000
- ≥1 training (Post-degree in geriatrics/Training in coordinating geriatrics medicine/Others) (%)	96.7	89.6	
- No training (%)	3.3	10.4	
Number of general practitioners per NH bed			0.000
- High (>0.19)	32.7	33.3	
- Intermediate (0.10-0.18)	22.1	33.9	
- Low (<0.10)	45.2	32.8	
Onsite meal preparation (%)	86.9	89.9	0.169
Morning snack (%)	43.2	38.6	0.046
Afternoon snack (%)	99.2	99.3	0.747
Evening snack (%)	72.6	63.7	0.000
Duration of the fasting period (hours)	12.4 (0.5)	12.4 (0.6)	0.209
Lunch duration (min)	55.9 (13.1)	57.2 (12.2)	0.039
Dinner duration (min)	48.7 (9.2)	49.2 (9.2)	0.258
Number of drug prescriptions	7.5 (3.4)	8.0 (3.5)	0.007

ONS = Oral Nutritional Supplement

BMI = Body Mass Index

NH = Nursing Home

Table 2: Impact of subject-, structure- and organization-related indicators on the use of the oral nutritional supplements (n = 6129)

Variables	OR (95% CI)	P
Age (years) mean (SD)	1.02 (1.01–1.03)	0.016

Sex (ref men)	1.13 (0.87–1.46)	0.369
Clinical markers of undernutrition		
Weight lost in the last month $\geq 2.5\%$ or 1 kg (ref. no)	1.38 (1.08–1.78)	0.014
BMI (< 21 kg/m ²) (ref. no)	4.51 (3.49–5.84)	0.001
Disability in activities of daily living (scores 6–18) mean (SD)	1.19 (1.14–1.23)	0.001
Charlson Comorbidity Index mean (SD)	1.03 (0.97–1.04)	0.268
Dementia (ref. no)	1.24 (0.99–1.53)	0.554
Psychiatric disorder (ref. no)	0.72 (0.53–0.98)	0.041
Behavioral disturbances		
Wandering (ref. no)	1.12 (0.84–1.50)	0.431
Aggressive behavior (ref. no)	1.10 (0.86–1.40)	0.444
History of fracture (ref. no)	1.17 (0.95–1.45)	0.136
Falls during the past year (ref. no)	1.18 (0.95–1.46)	0.136
Pain (ref. no)	1.34 (1.06–1.70)	0.014
Pressure sores (ref. no)	2.76 (1.96–3.88)	0.001
Number of hospitalizations during the past year (Ref. 0)		
1	1.13 (0.88–1.45)	0.331
2 and more	1.44 (1.08–2.19)	0.014
NH profile		
Public (ref)	1	
Private non-profit	0.95 (0.73–1.12)	0.682
Private for profit	0.85 (0.61–1.19)	0.341
Presence of professional working at the NH		
Coordinating physician (ref. no)	3.70 (0.87–15.63)	0.076
Dietician (ref. no)	1.46 (1.18–1.88)	0.000
Training coordinating physician		
≥ 1 training (Geriatrics capacity/University degree in Coordinating physician/Others) (ref. no)	2.58 (1.48–4.49)	0.001
Number of general practitioners by NH beds		
High (> 0.19)	0.77 (0.59–1.06)	0.056
Intermediate (0.10–0.18)	0.49 (0.38–0.64)	0.000
Low (< 0.10) (ref)	1	
Onsite meal preparation (ref. no)	0.49 (0.34–0.65)	0.000
Morning snack (ref. no)	1.05 (0.84–1.30)	0.673
Afternoon snack (ref. no)	1.73 (0.56–5.36)	0.340
Evening snack (ref. no)	1.63 (1.28–2.07)	0.000
Duration of the fasting period (hours) mean (SD)	0.74 (0.61–0.91)	0.004
Lunch duration (min) mean (SD)	1.00 (0.99–1.01)	0.413
Dinner duration (min) mean (SD)	0.98 (0.97–0.99)	0.049
Number of medications mean (SD)	0.97 (0.94–0.99)	0.049
Goodness of fit (P value)		
Hosmer and Lemeshow		0.91
Pearson χ^2		0.96
Harrell's c-index	0.94 (0.93–0.95)	

OR = Odds ratio; CI = Confidence interval; BMI = Body mass index; NH = Nursing home.

Note: Reduction in sample size (n = 146, i.e., 2.3%) is mainly related to missing values for the variable dinner and fasting duration.

DISCUSSION

This study observed that 7.8% of nursing home (NH) residents received oral nutritional supplements (ONS). While it was anticipated that ONS prescriptions would be influenced by resident characteristics, a novel finding of this research is the association between ONS use and factors related to NH organizational practices, such as the number of general practitioners (GPs), meal duration, and the presence of a dietitian in the facility.

Consistent with prior research, the study found that older age, low BMI, recent weight loss [16], pain, pressure sores [31], higher hospital admission rates over the past year, and greater impairment in activities of daily living (ADL) [32] were linked to increased likelihood of ONS prescriptions. Although the study did not document specific criteria for prescribing ONS, the findings suggest that prescriptions align with standard guidelines for addressing malnutrition, such as low BMI or recent weight loss. In NHs, GPs are typically responsible for

resident prescriptions, including ONS, even though the coordinating physician provides expertise in geriatrics. Interestingly, the study found a trend ($p = 0.056$) where facilities with a higher number of GPs per bed were less likely to prescribe ONS. One possible explanation is that a greater number of external physicians—sometimes exceeding 60 in some NHs—might hinder streamlined care, potentially affecting the identification and treatment of malnutrition.

The findings underscore the value of geriatric-specific training for NH physicians, as the presence of a coordinating physician with such expertise was associated with higher ONS prescription rates. Similarly, having a dietitian in the NH was positively correlated with ONS use. Conversely, onsite meal preparation was associated with fewer ONS prescriptions, potentially indicating a focus on enhancing nutrition through fortified or personalized meals rather than supplementation. While this may reduce the need for ONS, further research is required to determine if such strategies effectively minimize the risk of malnutrition. The "nutritional culture" or policy within an NH, including its approach to managing malnutrition, may play a critical role in these patterns, though this study lacked sufficient data to confirm this hypothesis.

Shorter dinner durations and longer overnight fasting periods were linked to lower rates of ONS prescriptions. These meal timing variables might reflect the NH's organizational structure and leadership priorities. For instance, shorter dinner periods could reduce the opportunity to supervise ONS administration, potentially impacting food intake. Similarly, extended overnight fasting might indicate inadequate staffing during night shifts or limited support for evening snacks [33]. It is also possible that ONS are provided as nighttime snacks, though this study did not collect data on the timing of their administration. Further research is needed to explore these associations in greater detail.

The study has some limitations. The data were based on self-reports from coordinating physicians, and there was no detailed information on the quality, content, or adherence to ONS prescriptions. Additionally, unmeasured factors, such as family involvement, the dining environment, and social or physical activity support, may also influence ONS use [34, 35].

To improve nutrition among NH residents, new approaches are required, emphasizing leadership, regular malnutrition screening, and staff education [2]. Effective communication between healthcare staff and GPs is critical, as is involving dietitians in care planning and monitoring food intake [36].

In conclusion, this study highlights that both resident-specific and organizational factors influence ONS prescriptions in NHs. Key contributors include geriatric training for coordinating physicians, the presence of dietitians, and organizational elements like GP staffing levels, meal preparation practices, and snack provision. While these factors may affect resident nutritional status, additional research is needed to validate these findings. Current evidence suggests that enhancing care practices—such as training staff, fostering collaboration with GPs, and ensuring adequate support during ONS administration [7, 17, 27]—could improve nutritional outcomes for NH residents. Future research should explore whether optimizing ONS prescription and adherence leads to better nutritional status in this population.

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