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Review Article

Costs of Malnutrition in Institutionalized and Community-Dwelling Older Adults: A Systematic Review

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A B S T R A C T

Objectives: The aim of this study was to assess health economics evidence published to date on malnutrition costs in institutionalized or community-dwelling older adults.
Design: A systematic search of the literature published until December 2013 was performed using standard literature, international and national electronic databases, including MedLine/PubMed, Cochrane Library, ISI WOK, SCOPUS, MEDES, IBECS, and Google Scholar. Publications identified referred to the economic burden and use of medical resources associated with malnutrition (or risk of malnutrition) in institutionalized or community-dwelling older adults, written in either English or Spanish. Costs were updated to 2014 (€).
Results: A total of 9 studies of 46 initially retrieved met the preestablished criteria and were submitted to thorough scrutiny. All publications reviewed involved studies conducted in Europe, and the results regarding the contents of all the studies showed that total costs associated with malnutrition in institutionalized and community-dwelling older adults were considerably higher than those of well-nourished ones, mainly due to a higher use of health care resources (GP consultations, hospitalizations, health care monitoring, and treatments). Interventions to reduce the prevalence of malnutrition, such as the use of oral nutritional supplements, showed an important decrease in-hospital admissions and medical visits.
Conclusion: Malnutrition is associated with higher health care costs in institutionalized or community-dwelling older adults. The adoption of nutritional interventions, such as oral nutritional supplements, may have an important impact in reducing annual health care costs per patient.

Undernutrition, defined as a deficiency of energy, protein, and other nutrients,[1] could be caused by changes in body metabolism due to acute or chronic diseases and/or interventions, which is known as disease-related malnutrition (DRM).[2] Unlike starvation-related malnutrition, diseases may interfere with the ingestion or absorption of nutrients, increasing energy requirements.[1]

DRM is a common problem among older adults,[3] and its prevalence changes significantly depending on the population studied, the methods used for nutritional screening or assessment, and health-related problems. Malnutrition, as assessed using the Mini Nutritional Assessment (MNA), was observed in an important percentage of the older population (16.6%) (95% confidence interval [95% CI] 0–62). Moreover, prevalence rates of malnutrition were higher in hospitalized (24.6%; 95% CI 5.2–50) and institutionalized older adults (20.8%; 95% CI 6–62) compared with those living in the community (6.9%; 95% CI 0–16.6).[4]

DRM adversely affects older adults in different settings, with potentially serious consequences at the physical and the psychosocial levels.[5] DRM has been closely related to frailty, as both are serious multifactorial conditions affecting the geriatric population. It is estimated that from 20% to 60% of frail older adults have DRM, defined as

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unintended weight loss and/or an acute or chronic imbalance between intake and requirements.[1] A recent study including institutionalized Spanish older adults showed that frailty was significantly associated with incident disability and mortality (OR 3.3; 95% CI 1.7–6.6).[6] Like frailty, malnutrition was also shown to be related to higher morbidity rates leading to extended length of hospital stay (LOS), more frequent general practitioner (GP) visits, and intensive nursing care, thereby confirming previous results from several previous studies.[1,4,7–11] Moreover, a worsening of clinical outcomes associated with deterioration in the quality of life has been shown in institutionalized older adults at risk of malnutrition.[12,13]

Malnutrition is a tremendous burden of illness in aging populations and it has been demonstrated to lead to significant extra costs every year.[14,15] However, its economic impact on institutionalized and community-dwelling older adults has not been sufficiently explored. Previous studies have associated intake of oral nutritional supplements (ONS) with improved clinical outcomes and reduced health care costs among older patients.[16–18] Results from these studies support the proposal that routine ONS prescriptions could prevent weight loss, improve MNA scores, and reduce the length of hospitalizations in elderly populations.[19] Nevertheless, there is a lack of consistent published data to support this evidence; in addition, the information available regarding the economic impact of malnutrition in the nonhospitalized older adult population is scarce.

With this purpose in mind, we conducted a systematic review of the literature to identify and synthesize the available evidence related to malnutrition costs or use of resources in institutionalized and community-dwelling older adults. Likewise, we sought to investigate the effect of therapeutic interventions in the optimization of nutrition and associated costs in this population.

Methods

A systematic literature search regarding malnutrition costs or the resources use in institutionalized or community-dwelling older adults was performed. All publications until December 2013 were included. International (MedLine/PubMed, Cochrane Library, ISI Web of Knowledge [ISI WOK], SCOPUS) and national electronic databases (*Medicina en Español* [MEDES], *Índice Bibliográfico Español en Ciencias de la Salud* [IBECS]) were used, including Google Scholar. The English search terms used are summarized in Table 1, and it was expanded with an additional search using Spanish terms (Supplementary Table 1).

Selected publications included original articles, reviews, and congress proceedings in English or Spanish, related to the economic burden and/or use of medical resources associated with malnutrition (or risk of malnutrition) and/or the impact of preventive or therapeutic interventions aimed at improving the nutritional status of institutionalized or community-dwelling older adults. The review excluded economic evaluations of specific drugs, letters to the editor, editorials, experts' opinions, case studies, studies related to hospital admissions for acute events, and publications without a health economics component or analysis. No geographic or time limitations were applied for the literature review.

An initial comprehensive search was performed using the search terms strategy described in Table 1 and followed by an abstract/title review focused on the exclusion of studies that either did not provide any information that was relevant to the review or were duplicates. After the first article selection, a second review was conducted in the selected articles to fully apply the inclusion/exclusion criteria by full-text reading.

The publication selection was performed by 2 independent researchers and discrepancies were solved by consensus. All cost

Table 1
Search Terms and Search Strategy

#	Search Terms: Malnutrition
1	Undernutrition
2	Undernourished
3	Risk of undernutrition
4	Malnutrition
5	Malnourished
6	Risk of malnutrition
7	Disease-related malnutrition
8	Nutritional risk
9	Nutritional deficiency
10	Nutritional deficiencies
11	#01 OR #02 OR #03 OR #04 OR #05 OR #06 OR #07 OR #08 OR #09 OR #10
#	Search Terms: Institutionalized or Community-Dwelling Older Adults
12	Nursing home
13	Nursing homes
14	Retirement home
15	Retirement homes
16	Rest home
17	Rest homes
18	Geriatric
19	Geriatrics
20	Hospice
21	Long term care hospital
22	Institutionalized
23	Institutionalization
24	Institutionalisation
25	#12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24
26	Aged
27	Aging
28	Older adult
29	Older adults
30	Older people
31	Elder
32	Elderly
33	#26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32
34	#25 AND #33
#	Search Terms: Cost-of-illness and Economic Evaluation
35	"Economics"[Mesh]
36	"Economics, Nursing"[Mesh]
37	"Economics, Medical"[Mesh]
38	"Economics, Hospital"Mesh]
39	"Economics, Pharmaceutical"[Mesh]
40	"Drug Costs"[Mesh]
41	"Employer Health Costs"[Mesh]
42	"Hospital Costs"[Mesh]
43	"Direct Service Costs"[Mesh]
44	"Health Care Costs"[Mesh]
45	"Cost-Benefit Analysis"[Mesh]
46	"Cost Savings"[Mesh]
47	"Cost Sharing"[Mesh]
48	"Cost of Illness"[Mesh]
49	"Costs and Cost Analysis"[Mesh]
50	economic*
51	cost
52	costs
53	costly
54	costing
55	price
56	prices
57	pricing
58	pharmacoeconomic*
59	resources use
60	resources utilization
61	health resources
62	#35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51 OR #52 OR #53 OR #54 OR #55 OR #56 OR #57 OR #58 OR #59 OR #60 OR #61
63	#50 OR #51 #52 OR #53 OR #54 OR #55 OR #56 OR #57 OR #58 OR #59 OR #60 OR #61