

Effectiveness of dietary counseling with or without nutrition supplementation in hospitalized patients who are malnourished or at risk of malnutrition: A systematic review and meta-analysis

Alvin Wong MSc^{1,2}  | Yingxiao Huang BSc¹ | P. Marcin Sowa PhD³  |
Merrilyn D. Banks PhD⁴  | Judith D. Bauer PhD² 

¹Department of Dietetic and Food Services, Changi General Hospital, Singapore, Singapore

²School of Human Movement and Nutrition Sciences, University of Queensland, St. Lucia, Queensland, Australia

³Centre for the Business and Economics of Health, The University of Queensland, St Lucia, Queensland, Australia

⁴Department of Nutrition and Dietetics, Royal Brisbane and Women's Hospital, Herston, Queensland, Australia

Correspondence

Alvin Wong, MSc, Department of Dietetic and Food Services, Changi General Hospital, Singapore 529889, Singapore.
Email: alvin_wong@cgh.com.sg

Abstract

Background: Nutrition support is associated with improved survival and nonelective hospital readmission rates among malnourished medical inpatients; however, limited evidence supporting dietary counseling is available. We intend to determine the effect of dietary counseling with or without oral nutrition supplementation (ONS), compared with standard care, on hospitalized adults who are malnourished or at risk of malnutrition.

Methods: We searched MEDLINE/PubMed, CINAHL, Embase, Scopus, The Cochrane Library, and Google Scholar for studies listed from January 1, 2011, to August 31, 2021. Meta-analysis was performed to obtain pooled risk ratios (RRs) and 95% CIs to estimate the effect. The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system was used to assess the certainty of the evidence.

Results: Sixteen studies were identified. Compared with standard care, dietary counseling with or without ONS probably does not reduce inpatient rates of 30-day mortality (RR = 1.24; 0.60–2.55; $I^2 = 45\%$; $P = 0.56$; moderate certainty), slightly reduces 6-month mortality (RR = 0.83; 0.69–1.00; $I^2 = 16\%$; $P = 0.06$; high certainty), reduces complications (RR = 0.85; 0.73–0.98; $I^2 = 0\%$; $P = 0.03$; high certainty), and may slightly reduce readmission (RR = 0.83; 0.66–1.03; $I^2 = 55\%$; $P = 0.10$; low certainty) but may not reduce length of stay (mean difference: -0.75 days; -1.66 – 0.17 ; $I^2 = 70\%$; $P = 0.11$; low certainty). Intervention may result in slight improvements in nutrition status/intake and weight/body mass index (low certainty).

Conclusions: There is an increase in the certainty of evidence regarding the positive impact of dietary counseling on outcomes. Future studies should standardize and provide details/frequencies of counseling methods and ONS adherence to determine dietary counseling effectiveness.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2022 The Authors. *Journal of Parenteral and Enteral Nutrition* published by Wiley Periodicals LLC on behalf of American Society for Parenteral and Enteral Nutrition.

KEYWORDS

adult, geriatrics, home nutrition support, nutrition support teams, outcomes research/quality

INTRODUCTION

Malnutrition is associated with increased mortality and morbidity, which is a concern for healthcare practitioners. Higher hospitalization rates have also been reported for malnourished populations, thus increasing healthcare needs.¹ The prevalence of protein-energy malnutrition in hospitalized populations has been reported to be 40%–60% worldwide.^{2–4} This wide variation in prevalence may be due to inherent differences between healthcare systems of developed and developing nations, the definition of malnutrition, or the availability of nutrition interventions in hospitals.⁵

The current meta-analyses inadequately address the effectiveness of dietary counseling and nutrition care in malnourished hospitalized populations. A 2019 meta-analysis by Gomes et al.⁶ showed that nutrition support is associated with improved survival and nonelective hospital readmission rates among malnourished medical inpatients. The meta-analysis also demonstrated a more pronounced reduction in mortality risk in trials published after 2015 (odds ratio [OR]: 0.47; 95% CI, 0.28–0.79) vs that in older studies (OR: 0.94; 95% CI, 0.72–1.22).⁶ However, as the authors investigated the effects of individualized nutrition support, studies that did not have dietary education provided by trained clinicians were included in the meta-analysis. Hence, the role of dietary education or counseling remains uncertain in improving outcomes.

Baldwin and Weekes⁷ examined the effects of dietary counseling given with or without oral nutrition supplementation (ONS) on mortality and nutrition outcomes and found no evidence of an effect on mortality outcomes in malnourished patients.⁷ A 2021 Cochrane review⁸ by the same group also found little to no effect of dietary advice on mortality, although the researchers observed an improvement in weight gain when comparing dietary advice only with no advice. The review focused on all populations and did not include a subanalysis of hospitalized patients, hence further strengthening the need for a population-specific analysis.⁸

ONS is often prescribed to hospitalized patients without provision of sufficient advice or information on how to effectively use these supplements in conjunction with their usual diet. To a certain extent, this has led to an overly optimistic view on the use of ONS in acute care and community settings. This is particularly important because ONS is usually paid for by patients. A recent umbrella review reported an increasing number of systematic reviews and meta-analyses on the use of ONS in the treatment of malnourished patients.⁹ However, the authors noted that there was inadequate information available on how ONS was used and whether there was any support provided to maximize the intake of ONS in these reviews.⁹ As such, it is important to determine whether concurrent nutrition interventions, such as dietary counseling by trained healthcare professionals, enhance the effects of ONS provision.

Gomes et al.⁶ also concluded that more recent studies were of better quality, had lower risk of bias (RoB), and had larger sample sizes. As such, this updated review of dietary counseling will explore whether recent improvements in trial designs, reporting, and better educational resources have led to improved outcomes in hospital settings. The results from this review will provide further evidence for the initiation of dietary counseling in an acute setting. We aim to determine whether dietary counseling with or without ONS provided to hospitalized adults who are malnourished or at risk of malnutrition, compared with standard care, will improve clinical, nutrition, and functional outcomes.

METHODS

The review protocol was registered on PROSPERO (ID: CRD 42021257325). This review is written in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.¹⁰

Study selection

We used the “PICOS” method (Population, Intervention, the appropriate Comparator/Control, the Outcome[s] of interest, and Study design) to define the inclusion criteria. We included studies of adult hospitalized patients aged ≥ 18 years who were malnourished or at risk of malnutrition and receiving dietary counseling during hospitalization.

Dietary counseling was defined as instruction or education in modifying food intake to improve nutrition or dietary quality. We considered three different dietary counseling interventions: (1) dietary counseling with compulsory ONS, (2) dietary counseling with ONS if appropriate, and (3) dietary counseling only. Any healthcare professional could provide counseling, including a dietitian, medical doctor, nurse, or other clinical staff. The dietary counseling must have been provided to the patient or caregiver during hospitalization and could continue subsequently in outpatient or community settings.

Eligible studies included randomized controlled trials (RCTs) only, as clinical outcomes such as mortality may be confounded by multiple factors in nonrandomized studies. We included studies that were published or accepted with an online early view. There was no restriction on language, sex, race and ethnicity, or study location.

Exclusion criteria included interventions that only provide ONS, dietary supplements, or intravenous and/or parenteral and/or enteral nutrition without any dietary counseling. In addition, we excluded studies in which the purpose of education was to instruct patients to consume ONS and multimodal studies that used physical therapy or

exercises. This is because additional therapies on top of ONS may confound the effect of dietary counseling. Finally, we excluded trials with patient cohorts that included critical illness, immunological and oncological diseases (eg, HIV/AIDS and cancer), end-stage organ failure (eg, kidney and liver), palliative care, and elective surgery admissions, as health outcomes may be affected regardless of dietary interventions provided.

The included studies required the following outcomes:

- (1) Clinical outcomes: hospital length of stay (LOS), frequency of hospital admissions (within 30 days to 6 months), complications, and mortality rates (from inpatient to 1 year)
- (2) Quality-of-life (QoL) indicators (baseline to 6 months): EQ-5D, 12-Item Short Form Survey (SF-12), and SF-36 scores or similar
- (3) Nutrition and physical indicators: changes in nutrition status (measured using nutrition screening or assessment tools), anthropometric measurements (eg, weight, body mass index [BMI; defined as weight divided by square height], handgrip strength, skinfold measurement, and mid-arm circumference), and functional outcomes

The literature search was performed using the following electronic databases: MEDLINE/PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Embase, Scopus, The Cochrane Library, and Google Scholar.

Free-text and broad search terms, including Medical Subject Headings (MeSH), CINAHL Headings, and Emtree terms, were used in the review (Supporting Information). Citations identified from the search strategy were imported into EndNote (Endnote Version 9.3.3; Clarivate Analytics).

The studies' titles, abstracts, and keywords were screened for relevance by two authors (A.W. and Y.H.). Duplicates and studies that did not provide the necessary information for this systematic review were excluded. After screening, full-text articles were retrieved for review to implement the inclusion/exclusion criteria. Finally, additional papers referenced in the final retrieved papers were hand-searched. All discrepancies were resolved by consensus, and a third reviewer's opinion (J.D.B.) was sought if no agreement was reached. We contacted authors for clarification of data where required. We searched for RCTs from January 1, 2011, to August 31, 2021, and included preidentified studies published between 1998 and 2010 from a previous meta-analysis by Baldwin et al.⁷ Data (study characteristics and outcomes) were extracted using a piloted form by one author (A.W.), and two other authors (Y.H. and J.D.B.) checked and agreed on the data extracted.

Quality assessment

Articles considered for inclusion were independently assessed for methodological quality by two authors (A.W. and Y.H.). The Cochrane Risk of Bias tool version 2 (RoB 2) was used to assess the quality of the RCT studies.¹¹ Disagreement regarding each of the domains' judgment

was resolved by consensus between the two reviewers, and a third reviewer's opinion (J.D.B.) was sought if no consensus was reached.

The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system was used to assess the certainty of the evidence in the included studies across important clinical outcomes of mortality, readmission, complications, LOS, and QoL.¹² The certainty of the evidence was graded from very low to high, based on the following criteria: study design, RoB, inconsistency (unexplained heterogeneity of results), indirectness (differences in population, intervention, and outcomes measures or indirect comparison), imprecision (uncertainty of results), and risk of publication bias.¹²

Statistical analysis

Meta-analyses were undertaken only when the treatments, participants, and outcomes were similar enough for pooling to make sense. Meta-analyses were performed using the Mantel-Haenszel model when more than two studies could be pooled. We only pooled results of studies with low RoB and those with some concerns, avoiding studies with high RoB when possible. We combined the studies for dietary counseling only, those with compulsory ONS, and those with ONS if appropriate as "dietary counseling with or without ONS," to pool results if each intervention did not have sufficient studies.

For binary outcomes, if studies varied in intervention and patient inclusion criteria, a random-effects analysis was used to generate risk ratios (RRs) and their accompanying 95% CIs; otherwise, a fixed-effects model was used. For continuous outcomes, data across studies were combined and expressed as a mean difference (95% CI).

The meta-analysis was based on the principles from the *Cochrane Handbook for Systematic Review of Interventions*¹³ and performed by using the statistics software Review Manager Version 5.4.1 (The Nordic Cochrane Centre, The Cochrane Collaboration, 2014). A forest plot was generated for visualization of the meta-analysis results and grouped by the type of intervention. Visual inspection of funnel plots was used to assess publication bias when ≥ 10 studies were included in the meta-analysis. A funnel plot is a scatterplot of the effect estimates from individual studies against some measure of each study's size or precision.¹⁴

Given the variation in trial design and the scales used to measure QoL, pooled effects were summarized as standardized mean differences (SMDs) corrected for scale directionality. The SMD is derived by dividing the mean difference by the SD in each RCT.¹³ We summed the means of independent variables from studies with two or more intervention groups and obtained a new variance from the summation of each of their variances, for outcomes that are independent and uncorrelated. When the change in outcomes from baseline to postintervention (eg, QoL scores) were not reported but separate baseline and postintervention results (eg, mean with SD) were available, mean differences with SDs were calculated. Finally, we converted results reported in the median with interquartile range to mean with SD, based on the methods by Wan et al.¹⁵

Planned subgroup analyses were undertaken on comparison groups' data (dietary counseling with compulsory ONS vs standard care; dietary counseling with ONS if appropriate vs standard care; dietary counseling only vs standard care). A *P* value of <0.05 was deemed statistically significant for the overall effect. Heterogeneity was determined by using the *I*² statistic. For analyses with heterogeneity ≥50%, we explored the study characteristics of publications included in the analysis for an explanation.

RESULTS

Study selection

The search identified 2950 potential trials. After removing duplicates, title screening, and abstract screening, 27 studies underwent full-text screening. We found eight additional articles through other sources (bibliography and previous meta-analysis⁷). We only included one¹⁶ of three publications available in the previous meta-analysis, as two studies^{17,18} did not meet the inclusion criteria. Excluded manuscripts after full-text screening (list of excluded studies available from authors on request) and the reasons for exclusion are provided in Figure 1. Sixteen studies^{16,19–33} met the inclusion criteria of our review and underwent data extraction. We also included data from the five post hoc study publications^{34–38} by Neelemaat et al.,²⁶ Scheutz et al.,²⁷ and Söderström et al.,³⁰ as they contained outcome data relevant to this meta-analysis.^{28,32} The study characteristics are depicted in Table 1.

Characteristics of studies

Sample sizes range from 46 to 2028 (total = 4359 participants). The majority of studies^{16,18–20,22–24,26,27,29–33} (14 of 16) focused on geriatric participants, with one study each focusing specifically on those with heart failure²⁰ and pneumonia.³³

Dietary counseling with compulsory ONS

Three studies^{16,26,30} were classified as “dietary counseling with compulsory ONS” for the pooled analyses, including an intervention group from Söderström et al.³⁰ Adherence to ONS intake ranged from 63% to 90% in these studies.

Dietary counseling with ONS if appropriate

Eight studies were identified.^{19,20,23,27,29–31,33} Söderström et al.³⁰ had multiple intervention groups, and we aggregated the results of the two intervention groups (dietary counseling with ONS and dietary counseling only) into this category for pooling purposes. The use of ONS among the intervention groups ranged from 24% to 48% of the intervention populations.

Dietary counseling only

Five studies^{21,22,24,28,32} provided only dietary counseling as intervention.

Control groups

Most of the studies did not provide or provided only minimal dietary counseling to the control group. The exception was the study by Hyunh et al.,²⁵ in which one full dietary counseling session was provided. The control groups in six studies received ONS before or during the study,^{23,24,29–31,33} although most did not report the proportion of participants who received ONS.^{23,24,26,27,29–31,33}

Study design

Most of the studies used validated nutrition screening tools (Mini Nutritional Assessment–Short Form [MNA-SF], Nutritional Risk Screening 2002 [NRS-2002], and Malnutrition Universal Screening Tool [MUST])^{16,19,21–23,27,31–33} or assessment tools (MNA, Patient-Generated Subjective Global Assessment [PG-SGA], and SGA).^{20,24,25,29,30} Vázquez-Sánchez et al.³² and Sharan Kumar et al.²⁸ recruited patients with a malnutrition diagnosis, whereas Neelemaat et al.²⁶ used a combination of low BMI and weight loss as an indicator for malnutrition.

Study duration ranged from a few days (in the hospital) to 6 months. Six studies^{16,19–21,23,30} did not meet a priori planned sample-size recruitment, although one study³⁰ performed an interim analysis and indicated no significant differences in the primary outcome (mortality) between the study groups. Two studies^{17,18} did not perform sample-size and power calculation. Finally, 11 studies^{16,19,20,22,24–28,30,31} analyzed the results based on an intention-to-treat methodology.

The frequency of dietary counseling varied from one to three or more sessions. Seven studies^{16,20,21,27,28,32,33} did not report the frequencies of the follow-up sessions. Additionally, Holyday et al.²⁴ reported a mean of 43.0 ± 4.5 min per session, whereas Sharma et al.²⁹ reported that each follow-up call lasted an average of 30 min. All studies used a face-to-face session for the first session.^{16,19–33} Four studies^{16,26,29,33} used telephone calls for follow-up sessions. Most dietary counseling was performed by dietitians or nutritionists, with two studies by nurses^{22,32} and one by a physician.²⁰

RoB across RCTs

Only 12.5% (2 of 16) of the RCTs had low RoB,^{27,30} 56.3% (9 of 16) were of some concern for RoB,^{16,19–21,23,24,26,33} and the remaining 31.2% (5 of 16) had high RoB.^{22,25,28,29,31,32} The RoB assessment of the individual RCT with an overall summary is presented in the Supporting Information.

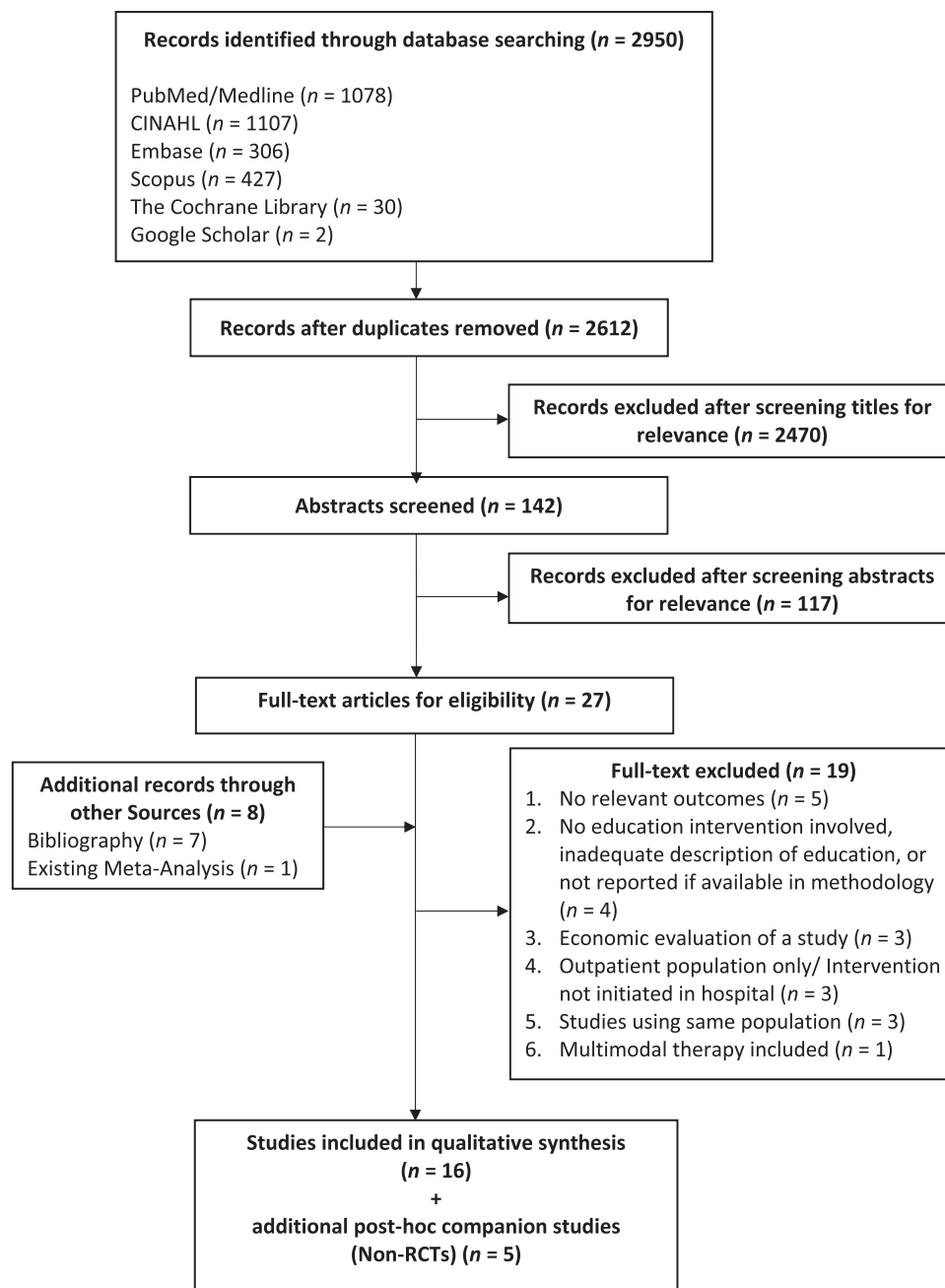


FIGURE 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart. RCT, randomized controlled trial

Funding of studies

Among the 14 studies^{16,20,22-33} that reported funding sources, three studies^{16,24,25} received support from pharmaceutical or food companies.

Outcomes

In terms of reported nutrition and prognostic parameters, meta-analyses were performed for mortality (inpatient to 30 days and up to 6 months), readmissions (6 months), complications, hospital

LOS, and QoL. We combined all three categories of studies as “dietary counseling with and without ONS” and pooled the results.

The meta-analysis of the pooled effect sizes of studies with “low RoB” and “some concerns” is presented for selected outcomes (inpatient to 30-day and up to 6-month mortality, complications, 6-month readmission, hospital LOS, and QoL) in Figures 2-4. The forest plots for the remaining outcomes and funnel plots of the pooled analysis are available in the Supporting Information. The GRADE certainty of the evidence of these outcomes is summarized in Table 2.

TABLE 1 Description of selected randomized controlled trials

Source	Patient population; country	Age, mean (SD), years	Study length; sample size	Prestudy nutrition status and assessment method	Intervention group	Control group	Outcomes available for this review	Supplement funder and research study grant provider
Dietary counseling with compulsory ONS								
Hyunh et al ²⁵	Adult malnourished patients hospitalized to home; India	Intervention: 40.6 (19.6) Control: 39 (16.4)	12 weeks; N = 207	Malnourished; mSGA	Prescription of supplements and dietary education given; 100% of participants received supplements. Dietary counseling was provided by dietitian; patients received three sessions of dietary counseling at baseline and weeks 4 and 8.	Only dietary education was provided; 0% of participants received supplements. Patients received three sessions of dietary counseling at baseline and weeks 4 and 8.	SGA, weight, and HGS	All supplements were given free of charge in the study. Abbott Nutrition provided funding for the present study and was responsible for the study design, monitoring, data analysis, manuscript preparation, and submission.
Neelemaat et al, ²⁶ Neelemaat ^a et al, ³⁵ Neelemaat ^a et al, ³⁶ and Neelemaat ^a et al ³⁷	Elderly patients hospitalized to home; the Netherlands	Intervention: 74.6 (9.7) Control: 74.4 (9.3)	3 months; N = 210	Malnourished; BMI of ≤ 20 and/or $\geq 5\%$ unintentional weight loss in the previous month and/or $\geq 10\%$ unintentional weight loss in the previous 6 months	Patients received standardized nutrition support starting in hospital until 3 months after discharge: Energy- and protein-enriched diet (during the in-hospital period). Two servings of nutrition supplements. 100% of patients received supplements initially; 84% received supplements at 3 months; 400 IU vitamin D ₃ and 500 mg calcium per day. Phone counseling by a dietitian (every other week after discharge from the hospital for six sessions).	Standard care. Treating physician may prescribe supplements; 28.6% of the control group were using supplements preadmission and 31% 3 months after discharge.	Mortality (30 days, 3 months, 6 months, and 1 year), LOS, HGS, and weight	All supplements were given free of charge in the study. Study was supported by the Netherlands Organization for Health Research and Development.

(Continues)

TABLE 1 (Continued)

Source	Patient population; country	Age, mean (SD), years	Study length; sample size	Prestudy nutrition status and assessment method	Intervention group	Control group	Outcomes available for this review	Supplement funder and research study grant provider
Persson et al ¹⁶	Geriatric patients hospitalized to home; Sweden	Intervention: 86 (7) Control: 85 (6.5)	4 months; N = 54	At risk of malnutrition; MNA-SF	Patients received two dietary counseling sessions by a dietitian before discharge and 1 week after. 100% of participants were prescribed one or two servings of nutrition supplements and a daily multivitamin supplement. Phone contact with dietitian at three time points: 1–2 weeks after discharge, middle of the study period, and 1 week before follow-up.	Patients were given brief written dietary advice; 0% of participants received supplements.	Mortality (4 months), BMI, HGS, and QoL	Not reported. Financial support from The Swedish Research Council (04224), Karolinska Institutet, and grants from S. Persson Family Foundation (18:35) and Sempers Foods AB.
Dietary counseling with ONS if appropriate								
Beck et al ¹⁹	Geriatric patients hospitalized to home; Denmark	Intervention: 85 (95% CI, 86–87) Control: 85 (95% CI, 82–88)	12 weeks; N = 71	At risk of malnutrition; NRS-2002	Prescription of supplements if needed before discharge, with three home visits planned on day of discharge and weeks 3 and 8. 48% of participants received supplements. Standard home visit by discharge liaison team. Dietary counseling with materials provided by dietitian.	Discharge liaison team performed standard home visit. Supplement intake was not reported.	Mortality (3 and 6 months), readmission (30 days, 3 months, and 6 months), QoL (EQ-5D-3L), weight, and protein intake	Subscription of supplements reimbursed 60% from health insurance. Research grant from the Danish Regions and the Danish Health Cartel.
Bonilla-Palomas et al ²⁰	Patients with heart failure hospitalized to home; Spain	Intervention: 78.6 (7.1) Control: 79.8 (7)	6 months; N = 120	Malnourished; MNA	Patients were given diet optimization, recommendations, and supplementation. Unknown percentage of participants received supplements.	Standard care; supplement intake not reported.	Mortality (inpatient and 1 year) and readmission (6 months)	Not reported. Supported by the Spanish Society of Cardiology as a Project of the Spanish Society of Cardiology for

TABLE 1 (Continued)

Source	Patient population; country	Age, mean (SD), years	Study length; sample size	Prestudy nutrition status and assessment method	Intervention group	Control group	Outcomes available for this review	Supplement funder and research study grant provider
Feldblum et al ²³	Patients at risk of malnutrition hospitalized to home; Israel	Intervention: 75.3 (5.8) Control: 75.1 (5.7)	6 months; N = 168	At risk of malnutrition; MNA-SF	Dietary counseling was provided by a physician specialist in nutrition, assisted by a nutritionist. Frequency of education was not reported.	One group received one meeting with a dietitian in the hospital. Supplemental nutrition was advised and provided during hospitalization, but unknown percentage of participants received supplements. Another group received standard care. Supplement intake was not reported. Both groups were combined into a single group that served as the control.	Mortality (6 months); MNA; protein, CHO, and fat intake; and Barthel score	All supplements were given free of charge in the study. Supported by the Israel National Institute for Health Policy and Health Services Research.
Scheutz et al ²⁷ and Kaegi-Braun et al ^{34 a}	Adult patients in medical wards hospitalized to home; Switzerland	Intervention: 72.4 (14.1) Control: 72.8 (14.1)	Inpatient; N = 2028	At risk of malnutrition; NRS-2002	Individual nutrition plan by dietitian for each patient, including food adjustment according to individual preferences, food fortification, snacks between meals, and nutrition supplements. 91% of intervention group received oral nutrition supplements in the hospital and 24% in the hospital and 24%	Patients were provided standard hospital food, no nutrition consultation, and no recommendation for additional nutrition support. 12% of control group received nutrition supplements in the hospital and 2% on discharge. On discharge, the decision to prescribe nutrition	Mortality (30 days and 6 months), readmission (30 days and 6 months), complications, QoL, LOS, energy and protein intake, and Barthel score	Not reported. Investigator-initiated and supported by a grant from the Swiss National Science Foundation and the Forschungsrat of the Kantonsspital Aarau.

(Continues)

TABLE 1 (Continued)

Source	Patient population; country	Age, mean (SD), years	Study length; sample size	Prestudy nutrition status and assessment method	Intervention group	Control group	Outcomes available for this review	Supplement funder and research study grant provider
					on discharge. Further increase in nutrition support to enteral or parenteral nutrition was recommended if at least 75% of the daily energy and protein targets could not be reached through oral feeding within 5 days. Nutrition intake was reassessed every 24–48 h during hospitalization. On discharge, patients received dietary counseling and, if indicated, nutrition supplements in the outpatient setting. Frequency of outpatient follow-up was not reported.	support was at the discretion of the nursing and physician team.		
Sharma et al ²⁹	Older patients at risk of malnutrition or malnourished hospitalized to home; Australia	Intervention: 82 (95% CI, 80.0–83.9) Control: 81.6 (95% CI, 79.5–83.6)	3 months; N = 148	At risk of malnutrition and malnourished; PG-SGA tool	Combination of strategies: nutrition supplements, between-meal snacks, and food fortification in the hospital. 42% of patients received nutrition supplements. Dietary counseling was provided by dietitian to patients and caregivers in the wards. Assistance with meals by ward-based staff if needed. Patients were contacted by a monthly telephone call from the dietitian for 2	Standard care. Dietitian review occurs only if patients are referred by a healthcare professional. No dedicated outpatient follow-up after discharge. 43 (61.4%) control patients received dietitian input during hospital stay. Supplement intake during hospitalization unknown percentage. 0% received	Mortality (30 days, 3 months, 6 months, and 1 year), readmission (30 days, 3 months, and 6 months), complications, QoL, PG-SGA, and BMI	The hospital paid for nutrition supplements. Not reported.

TABLE 1 (Continued)

Source	Patient population; country	Age, mean (SD), years	Study length; sample size	Prestudy nutrition status and assessment method	Intervention group	Control group	Outcomes available for this review	Supplement funder and research study grant provider
Terp et al ³¹	Geriatric patients hospitalized to home; Denmark	Diet only: 79.9 (7.9) ONS only: 77.6 (7.5) Diet and ONS: 79.0 (7.6) Control: 78.2 (7.7)	8 weeks; N = 144	At risk of malnutrition; NRS-2002	Dietitian prepared an individual dietary plan for each patient, including advice on nutrition intake after discharge, based on everyday food, and, if relevant, combined with nutrition supplements. Unknown percentage received supplements. Patients were scheduled three follow-up visits at 1, 4, and 8 weeks after discharge, which were conducted by a district nurse or a healthcare assistant.	Standard care. Clinical dietitian was involved in the process if the patient had specific needs; dietitian gave dietary advice and prepared a dietary plan for nutrition intake while patients were hospitalized. Supplement intake was not reported. At discharge, no follow-up was planned.	Mortality (90 and 120 days), readmission (90 days), HGS, and Barthel score	Funded by patients. Supported by the Capital Region of Denmark.
Yang et al ³³	Elderly patients with pneumonia hospitalized to home; Taiwan	Intervention: 80.9 (7.9) Control: 82.2 (7.7)	6 months; N = 82	At risk of malnutrition and malnourished; BMI <18.5 or MNA-SF score ≤7	Patients were given individualized nutrition plan based on nutrition status and physical activity, taught the postdischarge diet, and provided dietary advice by dietitian. Family and caregivers participated in dietary counseling. Unknown	Patients were provided standard nutrition supplements in accordance with the Kaohsiung Chang Gung Memorial Hospital Nutrition Department, and patients' family caregivers were not provided dietary	Mortality (3 and 6 months), LOS, readmission (6 months), MNA-SF, and energy and protein intake	Not reported. Supported by the NSYSU-KMU Joint Research Project.

(Continues)

TABLE 1 (Continued)

Source	Patient population; country	Age, mean (SD), years	Study length; sample size	Prestudy nutrition status and assessment method	Intervention group	Control group	Outcomes available for this review	Supplement funder and research study grant provider
Dietary counseling only								
Cano-Torres et al ²¹	Patients at risk of malnutrition hospitalized only; Mexico	Intervention: 54.7 (22.7) Control: 59.6 (18.3)	Inpatient; N = 55	At risk of malnutrition; NRS-2002	Individualized nutrition plan according to energy and dietary advice based on face-to-face interviews with patients and their caregivers or family members. Use of supplements was avoided. Dietitian provided dietary counseling during inpatient stay. Frequency of education was not reported.	Standard care (20–30 kcal/kg/day). Supplement intake was not reported.	Mortality (6 months), BMI, and LOS	Not applicable. Not reported.
Casals et al ²²	Patients at risk of malnutrition hospitalized to home; Spain	Intervention: 73 (13) Control: 73 (12)	6 months; N = 106	At risk of malnutrition; MUST	For patients with high malnutrition risk, specific dietary counseling and strategies to enrich the diet with ordinary food were started. No supplements. Dietary counseling by case manager nurses during the hospital stay and upon discharge	Standard care of delivering a discharge report to the patient for continuity of nursing care. Supplement intake was not reported. The family nurse made a telephone call to the patient within 72 h of discharge.	Mortality (6 months), readmission, (6 months), LOS, MUST, BMI, QoL, and Barthel score	Not applicable. Research grant from the Government of Andalusia.

TABLE 1 (Continued)

Source	Patient population; country	Age, mean (SD), years	Study length; sample size	Prestudy nutrition status and assessment method	Intervention group	Control group	Outcomes available for this review	Supplement funder and research study grant provider
Holyday et al ²⁴	Geriatric patients hospitalized only; Australia	Intervention: 83.7 (0.8) Control: 83.4 (0.9)	Inpatient; N = 143	At risk of malnutrition and malnourished; MNA	Main nutrition care plan was initiated, which involved the modification of hospital meals, prescription of nutrition supplements, flagging for assistance with meals by ward-based staff, and education of patients and their carers regarding optimization of nutrition intake. 54 of 71 patients in the intervention group were seen by dietitian. Those seen by dietitian received two counseling sessions. Unknown percentage of participants received supplements. Dietitian provided dietary counseling during inpatient stay. Frequency of education was not reported.	Usual nutrition care was provided. Control group only seen by the clinical dietitian if and when referred by medical or other health professionals, and if referred, the same malnutrition care plan was implemented as for the intervention patients. 16 of 72 patients in control group seen by dietitian. Unknown percentage of participants received supplements.	Mortality (30 days and 6 months), readmission (30 days and 6 months), LOS, and weight	Not reported. Supported by the Gut Foundation (Australia), Pharmatel Fresenius Kabi Pty Ltd for the unrestricted research grant provided to support this study.
Sharan Kumar et al ²⁸	Adult patients at risk of malnutrition hospitalized to home; India	Intervention: 51.6 (16.3) Control: 46.4 (13.4)	6 months; N = 46	At risk of malnutrition; BMI	Personalized dietary counseling group was provided dietary counseling with the help of locally available, culturally acceptable foods	Patients were advised to take high-protein diet, but the diet was not charted by the nutritionist.	BMI; CHO, protein, and fat intake; and QoL	Not applicable. Postgraduate dissertation grant.

(Continues)

TABLE 1 (Continued)

Source	Patient population; country	Age, mean (SD), years	Study length; sample size	Prestudy nutrition status and assessment method	Intervention group	Control group	Outcomes available for this review	Supplement funder and research study grant provider
Vázquez-Sánchez et al ³²	Adult patients hospitalized to home; Spain	All patients: 72.8 (11.8)	6 months; N = 106	Malnourished; not reported, but MUST was used to evaluate patients at start and end of study	Patients underwent nutrition counseling by case manager nurses, which began during the hospital stay and lasted for 6 months. No supplements. Frequency of education was unknown. No supplements.	Standard care; no supplements.	Mortality (6 months), BMI, MUST, and Barthel score	Not applicable. Partially funded by a research grant from Junta de Andalucía and Department of Nursing, University of Malaga, Spain.
Dietary counseling with compulsory ONS and dietary counseling only								
Söderström et al ³⁰	Older patients at risk or malnourished hospitalized to home; Sweden	Diet only: 79.9 (7.9) ONS only: 77.6 (7.5)	6 months; N = 671	At risk of malnutrition and malnourished; MNA	Three intervention groups: 1. Individual dietary counseling—Patients were counseled by a registered dietitian before discharge and had no further appointments; 0% received supplements. 2. Oral nutrition supplements only—Patients were asked to drink one or two	Standard care; unknown percentage received supplements.	Mortality (6 months and 1 year) and QoL	The oral nutrition supplements were paid for by grants unrelated to the manufacturers. Supported by grants from Region Vastmanland, Uppsala-Orebro Regional Research Foundation (RRF), and the Swedish National Board of
Söderström ^a et al ³⁸	Diet and ONS: 79.0 (7.6) Control: 78.2 (7.7)							

TABLE 1 (Continued)

Source	Patient population; country	Age, mean (SD), years	Study length; sample size	Prestudy nutrition status and assessment method	Intervention group	Control group	Outcomes available for this review	Supplement funder and research study grant provider
					bottles per day; 100% received supplements. 3. A combination thereof—Dietary counseling and nutrition supplements (one or two bottles per day); 100% received supplements. All three groups were contacted by the dietitian by telephone at 1, 3, and 6 months after discharge.			Health and Welfare.

Abbreviations: BMI, body mass index; CHO, carbohydrate; HGS, handgrip strength; MNA-SF, Mini Nutritional Assessment-Short Form; mSCA, modified Subjective Global Assessment; MUST, Malnutrition Universal Screening Tool; NRS-2002, Nutritional Risk Screening 2002; NSYSU-KMU, National Sun Yat-sen University-Kaohsiung Medical University; ONS, oral nutrition supplementation; PG-SGA, Patient-Guided Subjective Global Assessment; QoL, quality of life.

^aPost hoc study.

Mortality

Various mortality outcomes at different time points were measured in the selected studies. Five studies reported inpatient to 30-day mortality,^{20,24,26,27,29} 5 reported 3-month mortality,^{19,29,31,33,37} 2 reported 4-month mortality,^{16,31} 12 reported 6-month mortality,^{19–24,29,30,32–34,37} and 4 reported 1-year mortality outcomes.^{20,29,30,37}

We derived 3-month and 6-month mortality rates from Kaplan-Meier curves from Sharma et al.²⁹ and Bonilla-Paloma et al.²⁰

In addition, we contacted Söderström et al.³⁰ for the 6-month mortality figures and received a response. Figure 2A and B shows the meta-analysis of the pooled effect of selected studies for inpatient to 30-day mortality^{20,24,27,29,37} (RR = 1.24; 95% CI, 0.60–2.55; *I*² = 45%; *P* = 0.56; GRADE: moderate certainty) and up to 6-month mortality^{16,19–21,23,24,29,30,33,34,37} (RR = 0.83; 95% CI, 0.69–1.00; *I*² = 16%; *P* = 0.06; GRADE: high certainty).

Complications

Only two studies reported complication outcomes during hospitalization.^{27,29} Figure 3A shows the meta-analysis of the pooled effect size for complications^{27,29} (RR = 0.85; 95% CI, 0.73–0.98; *I*² = 0%; *P* = 0.03; GRADE: high certainty).

Hospital LOS

Seven studies reported hospital LOS.^{21,22,24,26,27,29,33} Figure 3B shows the meta-analysis of the pooled effect size for LOS^{21,24,27,29,33,37} (mean difference: -0.75 days; 95% CI, -1.66 to 0.17; *I*² = 70%; *P* = 0.11; GRADE: low certainty). Removing one study²⁹ (in which the mean LOS was calculated from median with IQR) reduced the heterogeneity to 27% but made little difference to the mean difference.

- High certainty: We are very confident that the true effect lies close to that of the estimate of the effect.
- Moderate certainty: We are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
- Low certainty: Our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
- Very low certainty: We have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Hospital readmissions

Among the studies^{19,20,22,24,27,29,33,34} that reported readmission rates, only three studies^{20,22,33} showed reduced readmission rates. Figure 3C

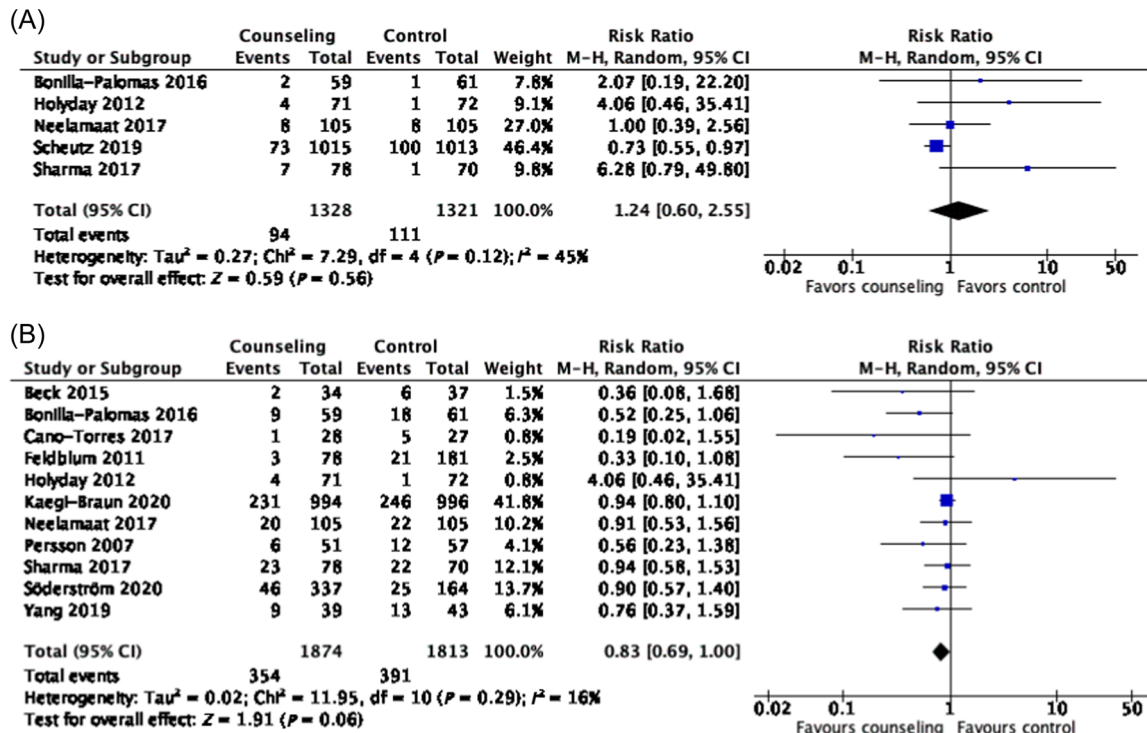


FIGURE 2 Analysis of primary outcome: Inpatient to up to 30-day and up to 6-month mortality. (A) Inpatient to up to 30-day mortality. (B) Six-month mortality. M-H, Mantel-Haenszel

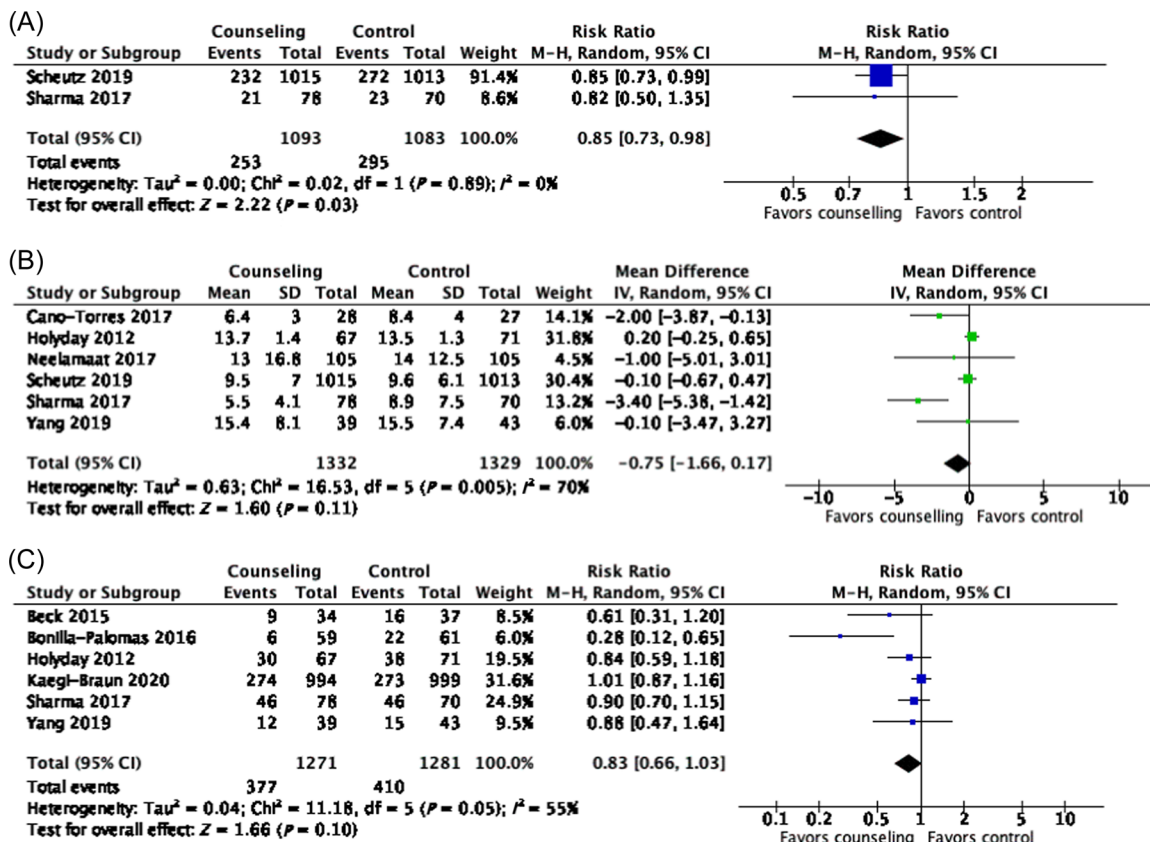


FIGURE 3 Analysis of primary outcomes: Complications, length of stay, and hospital readmissions within 6 months. (A) Complications. (B) Length of stay in hospital. (C) Hospital readmissions within 6 months. IV, Inverse variance; M-H, Mantel-Haenszel

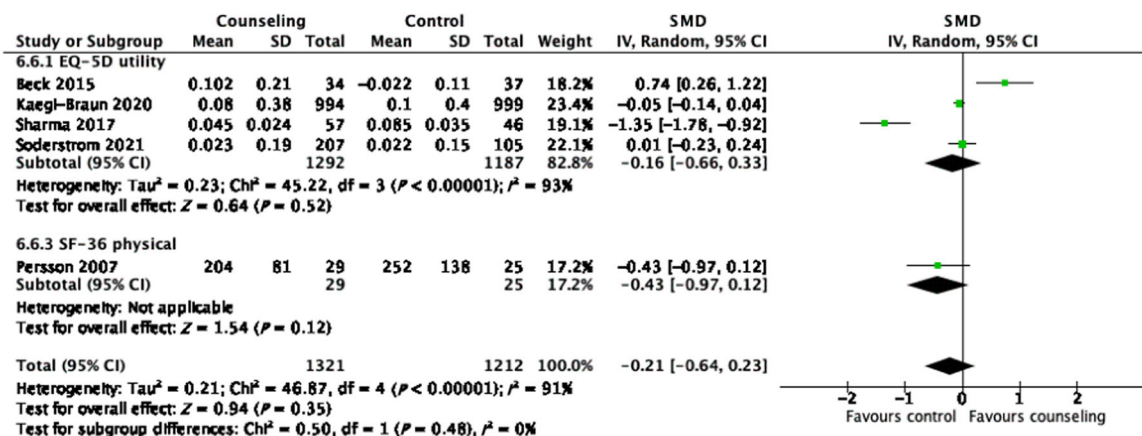


FIGURE 4 Analysis of primary outcome: Changes in generic quality-of-life indicators at the end of study. IV, Inverse variance; SF-36, 36-Item Short Form Survey; SMD, standard mean difference

TABLE 2 Summary of results and GRADE certainty of evidence: Dietary counseling with or without supplementation compared with standard care for malnutrition or risk of malnutrition

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Certainty of the evidence (GRADE)
	Risk with standard care	Risk with dietary counseling with or without supplementation			
Mortality inpatient to 30 days (follow-up: range, 1-30 days)	84 per 1000	104 per 1000 (50-214)	RR = 1.24 (0.60-2.55)	2649 (5 RCTs)	⊕⊕⊕⊙ (moderate ^a)
Mortality up to 6 months (follow-up: range, 4-6 months)	296 per 1000	246 per 1000 (204-296)	RR = 0.83 (0.69-1.00)	2649 (11 RCTs)	⊕⊕⊕⊕ (high)
Complications	272 per 1000	232 per 1000 (199-267)	RR = 0.85 (0.73-0.98)	2176 (2 RCTs)	⊕⊕⊕⊕ (high)
Hospital length of stay	Mean = 10.3 days	MD = -0.75 days (-1.66-0.17)	—	2661 (6 RCTs)	⊕⊕⊙⊙ (low ^a)
Hospital readmission (follow-up: 6 months)	320 per 1000	266 per 1000 (211-330)	RR = 0.83 (0.66-1.03)	2552 (6 RCTs)	⊕⊕⊙⊙ (low ^a)
Quality of life from baseline to after intervention	—	SMD = -0.21 SD (-0.64-0.23)	—	2533 (5 RCTs)	⊕⊙⊙⊙ (very low ^{b,c})

Notes: Patient or population: Malnutrition or at risk of malnutrition. Setting: Hospital to discharge. Intervention: Dietary counseling with or without supplementation. Comparison: Standard care.

GRADE Working Group grades of evidence:

- High certainty: We are very confident that the true effect lies close to that of the estimate of the effect.
- Moderate certainty: We are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
- Low certainty: Our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
- Very low certainty: We have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Abbreviations: GRADE, Grading of Recommendations Assessment, Development, and Evaluation; MD, mean difference; RCT, randomized controlled trial; RR, risk ratio; SMD, standardized mean difference.

^aDowngraded because of serious inconsistency.

^bDowngraded because of very serious inconsistency.

^cDowngraded because of serious indirectness.

*The risk in the intervention group (and its 95% CI) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

shows the meta-analysis of the pooled effect size of selected studies^{19,20,24,29,33,34} for 6-month readmissions (RR = 0.83; 95% CI, 0.66–1.03; $I^2 = 55%$; $P = 0.10$; GRADE: low certainty). Removal of one study²⁰ with a specific heart failure population reduced the heterogeneity to 0% but did not affect the overall results.

QoL

Five studies^{16,19,22,27,30} and two post hoc studies^{34,38} used generic assessment tools EQ-5D,³⁹ SF-12,⁴⁰ and SF-36.⁴¹ One study²⁸ used the respiratory disease-specific Saint George Respiratory Questionnaire (SGRQ).⁴² Additionally, a few studies compared QoL differences between intervention and control groups at different time points (eg, at baseline and 6 months)^{19,22,27} without reporting the changes between baseline and the end of the study period.

We pooled studies^{16,19,29,30,34} with QoL scores from generic tools only and reported the SMD between baseline and the end of the study (up to 6 months) (Figure 4). Pooled results (SMD: -0.21 ; 95% CI, -0.64 to 0.23 ; $I^2 = 91%$; $P = 0.35$; GRADE: very low certainty) showed high heterogeneity, and removal of any individual study did not reduce it.

Nutrition, functional, and physical outcomes

A narrative synthesis was performed for nutrition status, weight, BMI, intake, mid-arm muscle circumference, and functional and physical outcomes. Overall, dietary counseling with or without ONS may result in slight improvements in nutrition status, nutrition intake, and weight/BMI (GRADE: low certainty). However, the intervention may result in little or no difference to mid-arm circumference (GRADE: low certainty), and it remains uncertain whether the intervention has an effect on functional and physical outcomes (GRADE: very low certainty) (Supporting Information).

Nutrition risk or status changes were reported by five studies.^{22,23,25,29,33} Three studies^{22,23,33} reported statistically significant ($P < 0.05$) improvements in nutrition status for the intervention group. Hyunh et al.²⁵ reported improved modified SGA scores, whereas Sharma et al.²⁹ reported improvement in PG-SGA for both groups but no differences between groups.

Four studies reported the change in oral/nutrition intake.^{19,23,28,33} Two studies^{19,28} reported higher protein intake, and one³³ reported more energy and protein intake in the intervention group. However, one study reported no significant change in intake after 6 months.²³

Ten studies reported results on weight and/or BMI changes,^{16,19,21,22,25,26,28,29,31,32} of which eight studies^{17–19,22,25,26,29,31} showed a significant increase in weight and/or BMI in the intervention group. There were no differences found for mid-arm circumference measurements.^{29,33}

For functional and physical outcomes, only one study observed greater improvement in handgrip strength for intervention.²⁵

Two studies^{22,27} showed significantly higher Barthel scores for the intervention group, whereas one²³ showed no differences in change from baseline between groups.

Subgroup analyses

Subgroup analyses for 6-month mortality were performed for the three groups on the basis of data available for pooling for

1. dietary counseling with compulsory ONS (RR = 0.87; 95% CI, 0.60–1.26; $P = 0.46$; $I^2 = 0%$; GRADE: high certainty),
2. dietary counseling with ONS if appropriate (RR = 0.80; 95% CI, 0.60–1.06; $P = 0.12$; $I^2 = 32%$; GRADE: high certainty), and
3. dietary counseling only (RR = 0.55; 95% CI, 0.17–1.86; $P = 0.34$; $I^2 = 39%$; GRADE: moderate certainty).

Separate meta-analyses were also performed for 3-month and 1-year mortality, 30-day and 90-day readmission, and the QoL indicator for EQ-5D utility values. (Refer to the Supporting Information for forest plots.)

DISCUSSION

This meta-analysis found that dietary counseling with or without ONS probably does not reduce mortality from inpatient to 30 days (moderate-certainty evidence), results in a slight reduction in mortality up to 6 months (high-certainty evidence), reduces complications (high-certainty evidence), may result in a slight reduction of readmission (low-certainty evidence), but may not reduce LOS (low-certainty evidence). However, the effect remains very uncertain for QoL (very low-certainty evidence). From the narrative synthesis, nutrition status, weight, BMI, and protein and energy intake may be improved slightly, but the effect remains very uncertain for mid-arm muscle circumference and physical and functional outcomes (very low-certainty evidence).

Clinical outcomes

Although the analyses performed showed no reduction in mortality in each subgroup, it does not necessarily indicate that dietary counseling is an ineffective intervention. The overall pooled results (dietary counseling with or without ONS) still showed high-certainty evidence for 6-month mortality and complications. It is also unsurprising that there was no association found between dietary counseling and inpatient to 30-day mortality, as such short-term outcomes are likely affected by other factors, such as disease severity or timeliness of medical treatment.

We are unable to determine the effects of ONS when used in tandem with dietary counseling, as the use and adherence to ONS were not clearly reported in most studies. Recently, Kaegi-Braun

et al.⁴³ did not find any conclusive benefits of the use of ONS-only intervention. Although ONS may be a part of a nutrition care plan, the presence of a dietitian providing individualized dietary advice may address the various causes of malnutrition more effectively. In a pragmatic, real-world scenario, not every patient will require or can afford ONS. These patients may benefit from other, less costly interventions, such as food fortification/modification or changes to dietary intake.^{44,45} Future RCTs should determine ONS adherence and report the actual proportion of patients receiving ONS.

Some studies provided interventions only during hospitalization, which may be too short to influence positive outcomes.^{21,24,27} This could be seen in the largest nutrition intervention trial by Scheutz et al.,²⁷ for which a subsequent post hoc 6-month analysis³⁴ of the initial positive results showed no differences in mortality outcomes. This is reiterated by Kaegi-Braun et al.,⁴³ who found that interventions of >60 days were more effective in reducing mortality than shorter ones. Similarly, the 2021 Cochrane review reported that positive results for the first 3 months were attenuated at later time points.⁸ Hence, regardless of the type of nutrition intervention, longer interventions are necessary for any beneficial outcomes.

The length of intervention could explain why there was a low certainty of evidence for the impact of dietary counseling on hospital readmissions. Additionally, readmission reasons were either unspecified or inconsistently reported in the studies included in our review. Future studies should also include hospital LOS in readmissions to determine whether dietary counseling has any effect on subsequent LOS.

QoL outcomes

There was a very low certainty of evidence for the effects of dietary counseling for QoL, consistent with the Cochrane review.⁸ We postulate that the high heterogeneity in our results may be due to the differences in the QoL assessment tools used, country specificity, and timing of the measurement. Additionally, whereas generic questionnaires provide an assessment of an individual's overall health, they may be unsuitable to address QoL indicators related to enteral nutrition and ONS use.⁴⁶ Patients in the acute settings also tend to have other disease states in addition to malnutrition, and dietary counseling is only one of the many interventions that affect clinical outcomes.

Nutrition, physical, and functional outcomes

Consistent with the results from Baldwin and Weekes and the subsequent updated Cochrane review,^{7,8} improvements in weight and nutrition status may not translate to noticeable improvements in clinical outcomes. Being underweight or having a low BMI leads to poorer outcomes,⁴⁷ but whether an improvement in anthropometrical outcomes translates into other clinical benefits remains uncertain. In comparison with outcomes such as mortality, complications, and readmissions, improvements in weight and anthropometrical measurements may not be as critically important.

Strengths and limitations

Although the Cochrane review is the most comprehensive on the effectiveness of dietary advice,⁸ the studies included were from a wide range of healthcare settings. For example, the inclusion of studies in the critical care settings and studies that only provided instructions on consuming ONS may have affected the outcomes and may not be an accurate representation of the provision of dietary advice or counseling. Similarly, for Kaegi-Braun et al.,⁴³ we disagree with their classification of the studies using multifactorial dietitian-based interventions, as some were not considered a dietitian-based intervention^{48,49}; and a protein-supplemented meal service was included as an ONS-only intervention.⁵⁰

The results from our meta-analysis complement the findings from the Cochrane review,⁸ Gomes et al.,⁶ and Kaegi-Braun et al.⁴³ First, some of the studies identified as eligible for inclusion in the Cochrane review but not assessed owing to time constraints were included in our meta-analysis. This included two of the largest RCTs on hospitalized populations by Scheutz et al.³⁴ and Söderström et al.³⁰ and their post hoc study results.^{34,38} Second, the intervention we considered in our meta-analysis is a form of individualized nutrition support and provides evidence on the effect of dietary counseling intervention in hospital settings, which the other meta-analyses^{6,43} did not explore.

A limitation of this review was that only 12.5% of publications (2 of 16) were assessed as low RoB. This contradicts the finding by Gomes et al.⁶ that studies published after April 2014 were of higher quality and lower RoB. Future RCTs should improve on their methodology and/or reporting. We have used the new RoB 2, which addressed limitations identified in the original RoB tool and incorporated improvements that aim to increase the reliability of assessments.¹¹ We only pooled studies of low RoB or with some concerns for meta-analysis. A strength of the study is the use of GRADE, which allows a clear and pragmatic interpretation of the strength of recommendations for clinicians.⁵¹

The main reason the certainty of evidence was downgraded was inconsistency, which may be due to the diversity of the study populations. Some control groups in other studies might also have received interventions inadvertently, including ONS and education, owing to the study designs.^{23,24,26,29,31,33} However, it may be unrealistic to recruit a pure control group without prior ONS intake or nutrition knowledge in this modern age.

Information on the type, content, and frequency of the dietary counseling provided, along with details of the experience of clinicians involved in the studies, was inadequately reported. Despite the advance in technology, it appears that resources for dietary counseling have not advanced at the same pace in most of the studies. Face-to-face visits and phone calls for follow-up were the preferred counseling method. Telehealth can be a cost-effective alternative and complement the traditional practice of face-to-face dietary counseling. It will also allow clinicians to increase the frequency and intensity of dietary counseling, which may be a crucial factor in optimizing clinical outcomes.^{52,53}

CONCLUSION

This systematic review and meta-analysis found evidence that dietary counseling with or without ONS probably does not reduce mortality from inpatient to 30 days, results in a slight reduction in mortality up to 6 months and in 6-month readmissions, and reduces complications but may not reduce LOS when compared with standard care. However, the effect remains very uncertain for QoL. The results were limited by the availability of high-quality studies. Future studies will need to standardize counseling/education methods and frequency/length of intervention as well as report details of education and the use of and adherence of supplements, as these are important factors in determining the effectiveness of dietary counseling.

AUTHOR CONTRIBUTIONS

Alvin Wong and Judith D. Bauer designed and conceptualized the study. Alvin Wong and Yingxiao Huang analyzed the data. Alvin Wong, Yingxiao Huang, Judith D. Bauer, Merrilyn D. Banks, and P. Marcin Sowa interpreted the results. Alvin Wong and Yingxiao Huang made the figures and tables. Alvin Wong and Yingxiao Huang drafted the manuscript. Judith D. Bauer, Merrilyn D. Banks, and P. Marcin Sowa revised the paper. All authors approved the final version of the manuscript.

ACKNOWLEDGMENT

Open access publishing facilitated by The University of Queensland, as part of the Wiley - The University of Queensland agreement via the Council of Australian University Librarians.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Template data collection forms, data extracted from included studies, data used for all analyses, and any other materials used in the review are available on request from the authors.

ORCID

Alvin Wong  <http://orcid.org/0000-0002-8187-7415>

P. Marcin Sowa  <http://orcid.org/0000-0001-8892-4133>

Merrilyn D. Banks  <http://orcid.org/0000-0003-4467-4608>

Judith D. Bauer  <http://orcid.org/0000-0002-3830-5147>

REFERENCES

- Abizanda P, Sinclair A, Barcons N, Lizan L, Rodriguez-Manas L. Costs of malnutrition in institutionalized and community-dwelling older adults: a systematic review. *J Am Med Dir Assoc*. 2016;17(1):17-23.
- Correia MI, Hegazi RA, Diaz-Pizarro Graf JI, et al. Addressing disease-related malnutrition in healthcare: a Latin American perspective. *JPEN J Parenter Enteral Nutr*. 2016;40(3):319-325.
- Inciong JFB, Chaudhary A, Hsu HS, et al. Hospital malnutrition in Northeast and Southeast Asia: a systematic literature review. *Clin Nutr ESPEN*. 2020;39:30-45.
- Norman K, Pichard C, Lochs H, Pirlich M. Prognostic impact of disease-related malnutrition. *Clin Nutr*. 2008;27(1):5-15.
- Kiss N, Hiesmayr M, Sulz I, et al. Predicting hospital length of stay at admission using global and country-specific competing risk analysis of structural, patient, and nutrition-related data from nutritionday 2007-2015. *Nutrients*. 2021;13(11):4111.
- Gomes F, Baumgartner A, Bounoure L, et al. Association of nutritional support with clinical outcomes among medical inpatients who are malnourished or at nutritional risk: an updated systematic review and meta-analysis. *JAMA Netw Open*. 2019;2(11):e1915138.
- Baldwin C, Weekes CE. Dietary counselling with or without oral nutritional supplements in the management of malnourished patients: a systematic review and meta-analysis of randomised controlled trials. *J Hum Nutr Diet*. 2012;25(5):411-426.
- Baldwin C, Schueren MAEdvd, Kruijenga HM, Weekes CE. Dietary advice with or without oral nutritional supplements for disease-related malnutrition in adults. *Cochrane Database Syst Rev*. 2021;2021(12):CD002008.
- Baldwin C, Smith R, Gibbs M, Weekes CE, Emery PW. Quality of the evidence supporting the role of oral nutritional supplements in the management of malnutrition: an overview of systematic reviews and meta-analyses. *Adv Nutr*. 2021;12(2):503-522.
- Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71.
- Sterne JAC, Savović J, Page MJ, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. *BMJ*. 2019;366:l4898.
- Guyatt GH, Oxman AD, Kunz R, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*. 2008;336(7650):924-926.
- Higgins JPT, Thomas J, Chandler J, et al. *Cochrane Handbook for Systematic Reviews of Interventions Version 6.2*. Cochrane; 2021. Updated February 2021. Accessed September 1, 2021. www.training.cochrane.org/handbook
- Sterne JA, Sutton AJ, Ioannidis JP, et al. Recommendations for examining and interpreting funnel plot asymmetry in meta-analyses of randomised controlled trials. *BMJ*. 2011;343:d4002.
- Wan X, Wang W, Liu J, Tong T. Estimating the sample mean and standard deviation from the sample size, median, range and/or interquartile range. *BMC Med Res Methodol*. 2014;14:135.
- Persson M, Hytten-Landahl A, Brismar K, Cederholm T. Nutritional supplementation and dietary advice in geriatric patients at risk of malnutrition. *Clin Nutr*. 2007;26(2):216-224.
- Førlil L, Bjørtuft Ø, Vatn M, Kofstad J, Boe J. A study of intensified dietary support in underweight candidates for lung transplantation. *Ann Nutr Metab*. 2001;45(4):159-168.
- Jensen MB, Hesselov I. Dietary supplementation at home improves the regain of lean body mass after surgery. *Nutrition*. 1997;13(5):422-430.
- Beck A, Andersen U, Leedo E, et al. Does adding a dietician to the liaison team after discharge of geriatric patients improve nutritional outcome: a randomised controlled trial. *Clin Rehabil*. 2015;29(11):1117-1128.
- Bonilla-Palomas JL, Gámez-López AL, Castillo-Domínguez JC, et al. Nutritional intervention in malnourished hospitalized patients with heart failure. *Arch Med Res*. 2016;47(7):535-540.
- Cano-Torres EA, Simental-Mendía LE, Morales-Garza LA, et al. Impact of nutritional intervention on length of hospital stay and mortality among hospitalized patients with malnutrition: a clinical randomized controlled trial. *J Am Coll Nutr*. 2017;36(4):235-239.
- Casals C, García-Agua-Soler N, Vázquez-Sánchez M, Requena-Toro MV, Padilla-Romero L, Casals-Sánchez JL. Randomized clinical trial of nutritional counseling for malnourished hospital patients. *Rev Clin Esp (Barc)*. 2015;215(6):308-314.

23. Feldblum I, German L, Castel H, Harman-Boehm I, Shahar DR. Individualized nutritional intervention during and after hospitalization: the nutrition intervention study clinical trial. *J Am Geriatr Soc*. 2011;59(1):10-17.
24. Holyday M, Daniells S, Bare M, Caplan GA, Petocz P, Bolin T. Malnutrition screening and early nutrition intervention in hospitalised patients in acute aged care: a randomised controlled trial. *J Nutr Health Aging*. 2012;16(6):562-568.
25. Huynh DTT, Devitt AA, Paule CL, et al. Effects of oral nutritional supplementation in the management of malnutrition in hospital and post-hospital discharged patients in India: a randomised, open-label, controlled trial. *J Hum Nutr Diet*. 2015;28(4):331-343.
26. Neelemaat F, Bosmans JE, Thijs A, Seidell JC, van Bokhorst-de van der Schueren MA. Post-discharge nutritional support in malnourished elderly individuals improves functional limitations. *J Am Med Dir Assoc*. 2011;12(4):295-301.
27. Schuetz P, Fehr R, Baechli V, et al. Individualised nutritional support in medical inpatients at nutritional risk: a randomised clinical trial. *Lancet*. 2019;393(10188):2312-2321.
28. Sharan Kumar VG, Pajanivel R, Boratne AV, Vimal Raj R. Impact of dietary counselling on the nutritional status and quality of life among pulmonary tuberculosis patients - a randomized control trial. *Indian J Tuberc*. 2021;69(2):201-206.
29. Sharma Y, Thompson CH, Kaambwa B, Shahi R, Hakendorf P, Miller M. Investigation of the benefits of early malnutrition screening with telehealth follow up in elderly acute medical admissions. *QJM*. 2017;110(10):639-647.
30. Söderström L, Rosenblad A, Bergkvist L, Frid H, Thors , Adolfsson E. Dietary advice and oral nutritional supplements do not increase survival in older malnourished adults: a multicentre randomised controlled trial. *Ups J Med Sci*. 2020;125(3):240-249.
31. Terp R, Jacobsen KO, Kannegaard P, Larsen AM, Madsen OR, Noiesen E. A nutritional intervention program improves the nutritional status of geriatric patients at nutritional risk—a randomized controlled trial. *Clin Rehabil*. 2018;32(7):930-941.
32. Vázquez-Sánchez M, Valero-Cantero I, Carrión-Velasco Y, Castro-López P, Suárez-Cadenas E, Casals C. Applicability and clinical validity of nursing outcomes classification in a nursing intervention of nutritional counseling for patients with malnutrition. *Int J Nurs Knowl*. 2019;30(3):168-172.
33. Yang PH, Lin MC, Liu YY, Lee CL, Chang NJ. Effect of nutritional intervention programs on nutritional status and readmission rate in malnourished older adults with pneumonia: a randomized control trial. *Int J Environ Res Public Health*. 2019;16(23):4758.
34. Kaegi-Braun N, Tribolet P, Gomes F, et al. Six- month outcomes after individualized nutritional support during the hospital stay in medical patients at nutritional risk: secondary analysis of a prospective randomized trial. *Clin Nutr*. 2021;40(3):812-819.
35. Neelemaat F, Bosmans JE, Thijs A, Seidell JC, van Bokhorst-de van der Schueren MA. Oral nutritional support in malnourished elderly decreases functional limitations with no extra costs. *Clin Nutr*. 2012;31(2):183-190.
36. Neelemaat F, Lips P, Bosmans JE, Thijs A, Seidell JC, van Bokhorst-de van der Schueren MA. Short-term oral nutritional intervention with protein and vitamin d decreases falls in malnourished older adults. *J Am Geriatr Soc*. 2012;60(4):691-699.
37. Neelemaat F, van Keeken S, Langius JAE, de van der Schueren MAE, Thijs A, Bosmans JE. Survival in malnourished older patients receiving post-discharge nutritional support: long-term results of a randomized controlled trial. *J Nutr Health Aging*. 2017;21(8):855-860.
38. Söderström L, Bergkvist L, Rosenblad A. Oral nutritional supplement use is weakly associated with increased subjective health-related quality of life in malnourished older adults: a multicentre randomised controlled trial. *Br J Nutr*. 2021;127(1):1-22.
39. Brooks R. Euroqol: The current state of play. *Health Policy*. 1996;37(1):53-72.
40. Ware J Jr., Kosinski M, Keller SD. A 12-item short-form health survey: construction of scales and preliminary tests of reliability and validity. *Med Care*. 1996;34(3):220-233.
41. Ware JE Jr. SF-36 health survey update. *Spine (Phila Pa 1976)*. 2000;25(24):3130-3139.
42. Jones PW, Quirk FH, Baveystock CM. The St George's respiratory questionnaire. *Respir Med*. 1991;85(suppl B):25-31; discussion 33-37.
43. Kaegi-Braun N, Faessli M, Kilchoer F, et al. Nutritional trials using high protein strategies and long duration of support show strongest clinical effects on mortality. *Clin Nutr ESPEN*. 2021;45:45-54.
44. Mills SR, Wilcox CR, Ibrahim K, Roberts HC. Can fortified foods and snacks increase the energy and protein intake of hospitalised older patients? A systematic review. *J Hum Nutr Diet*. 2018;31(3):379-389.
45. Poscia A, Milovanovic S, La Milia DI, et al. Effectiveness of nutritional interventions addressed to elderly persons: umbrella systematic review with meta-analysis. *Eur J Public Health*. 2018;28(2):275-283.
46. Zamanillo Campos R, Colomar Ferrer MT, Ruiz López RM, Sanchís Cortés MP, Urgelés Planella JR. Specific quality of life assessment by the Nutriqol® questionnaire among patients receiving home enteral nutrition. *JPEN J Parenter Enteral Nutr*. 2021;45(3):490-498.
47. Bullock AF, Greenley SL, McKenzie GAG, Paton LW, Johnson MJ. Relationship between markers of malnutrition and clinical outcomes in older adults with cancer: systematic review, narrative synthesis and meta-analysis. *Eur J Clin Nutr*. 2020;74(11):1519-1535.
48. Bunout D, Aicardi V, Hirsch S, et al. Nutritional support in hospitalized patients with alcoholic liver disease. *Eur J Clin Nutr*. 1989;43(9):615-621.
49. Saudny-Unterberger H, Martin JG, Gray-Donald K. Impact of nutritional support on functional status during an acute exacerbation of chronic obstructive pulmonary disease. *Am J Respir Crit Care Med*. 1997;156(3 part 1):794-799.
50. Munk T, Beck AM, Holst M, et al. Positive effect of protein-supplemented hospital food on protein intake in patients at nutritional risk: a randomised controlled trial. *J Hum Nutr Diet*. 2014;27(2):122-132.
51. Schünemann H, Brożek J, Guyatt G, Oxman A, eds. *GRADE Handbook for Grading Quality of Evidence and Strength of Recommendations*. The GRADE Working Group. Updated December 2015. Accessed September 1, 2021. [guidelinedevelopment.org/handbook](https://www.guidelinedevelopment.org/handbook)
52. Kelly JT, Allman-Farinelli M, Chen J, et al. Dietitians Australia position statement on telehealth. *Nutr Diet*. 2020;77(4):406-415.
53. Mauldin K, Gieng J, Saarony D, Hu C. Performing nutrition assessment remotely via telehealth. *Nutr Clin Pract*. 2021;36(4):751-768.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Wong A, Huang Y, Sowa PM, Banks MD, Bauer JD. Effectiveness of dietary counseling with or without nutrition supplementation in hospitalized patients who are malnourished or at risk of malnutrition: A systematic review and meta-analysis. *J Parenter Enteral Nutr*. 2022;46:1502-1521. doi:10.1002/jpen.2395