Cost-Effectiveness of Medical Nutrition Therapy: A Systematic Review of Healthcare Utilization and Economic Outcomes

Mohammed Thabet Alqahtani[1], Saleh Mohammed Altofail[2], Essam Saad Alhoushani[3], Amal Mohammed Alqahtani[4],Hager Abdulhamed Alwohabe[5]

[1]Ministry of National Guard Health Affairs, Saudi Arabia,

Email ID : qmtqmt@hotmail.com

[2]Ministry of National Guard Health Affairs, Saudi Arabia

Email ID : saleh.m.t@hotmail.com

[3]Ministry of National Guard Health Affairs, Saudi Arabia

Email ID : Houshanie4@gmail.com

[4]Ministry of National Guard Health Affairs, Saudi Arabia

Email ID : alqahtaniam12@ngha.med.sa

[5]Ministry of National Guard Health Affairs, Saudi Arabia

Email ID : Violetflower57@hotmail.com

Abstract: **Background:** Medical Nutrition Therapy (MNT) is a core component of evidence-based clinical care, particularly in the management of chronic diseases. Despite strong clinical evidence supporting its effectiveness, its economic value in reducing healthcare costs and optimizing resource utilization remains inconsistently synthesized.

Objective: This systematic review aims to evaluate the cost-effectiveness of MNT and its impact on healthcare utilization and economic outcomes across diverse clinical settings.

Methods: A systematic review was conducted in accordance with PRISMA 2020 guidelines. Electronic databases, including PubMed, Scopus, and Web of Science, were searched for studies published between 2016 and 2025. Eligible studies included economic evaluations assessing MNT interventions in clinical populations. Data were extracted and synthesized narratively, focusing on cost outcomes, healthcare utilization, and cost-effectiveness measures such as incremental cost-effectiveness ratios (ICERs) and quality-adjusted life years (QALYs).

Results: The findings indicate that MNT is associated with significant reductions in hospital admissions, length of stay, and overall healthcare expenditures, particularly among patients with diabetes, cardiovascular diseases, and malnutrition. Several studies demonstrated favorable cost-effectiveness profiles, with MNT interventions yielding improved clinical outcomes at lower or comparable costs.

Conclusion: MNT represents a cost-effective strategy that enhances patient outcomes while reducing healthcare utilization. Its integration into routine clinical practice is essential to support value-based healthcare systems and improve economic efficiency..

Introduction

Rising healthcare expenditures represent a critical challenge for health systems worldwide, driven largely by the increasing prevalence of chronic diseases such as diabetes, cardiovascular disease, and obesity. According to the World Health Organization, non-communicable diseases account for the majority of global mortality and impose substantial economic burdens on healthcare systems through long-term treatment costs and increased healthcare utilization (World Health

Organization [WHO], 2023). In response, healthcare systems are increasingly transitioning toward value-based care models that emphasize improving patient outcomes while optimizing resource efficiency and reducing unnecessary expenditures (Porter & Lee, 2016).

Medical Nutrition Therapy (MNT), defined as evidence-based, individualized dietary interventions provided by qualified healthcare professionals, has emerged as a cornerstone in the management and prevention of chronic diseases. MNT plays a vital role in improving glycemic control, reducing cardiovascular risk factors, and enhancing overall patient outcomes across a wide range of clinical conditions (Evert et al., 2019; Phillips et al., 2020). Professional bodies such as the Academy of Nutrition and Dietetics emphasize that structured nutrition interventions delivered by registered dietitians can significantly improve clinical indicators and reduce disease complications.

Beyond clinical effectiveness, there is growing interest in understanding the economic value of MNT. Healthcare systems face increasing pressure to allocate limited resources efficiently, making economic evaluation a crucial component of healthcare decision-making. Cost-effectiveness analysis, including metrics such as quality-adjusted life years (QALYs) and incremental cost-effectiveness ratios (ICERs), provides a framework for assessing whether healthcare interventions deliver sufficient value relative to their costs (Drummond et al., 2015). Emerging evidence suggests that MNT can reduce healthcare utilization by decreasing hospital admissions, shortening length of stay, and minimizing the need for pharmacological interventions (Snider et al., 2020; Riley et al., 2020).

However, despite the growing body of literature on clinical nutrition, the economic evidence related to MNT remains fragmented and heterogeneous. Studies vary in terms of patient populations, intervention designs, outcome measures, and healthcare settings, making it challenging to draw generalized conclusions regarding its cost-effectiveness. Furthermore, variations in healthcare systems and reimbursement models contribute to inconsistencies in reported economic outcomes (Elia, 2017). This fragmentation highlights the need for a comprehensive synthesis of current evidence to support policymakers, healthcare providers, and stakeholders in making informed decisions regarding the integration of MNT into routine care.

From a broader perspective, integrating MNT into healthcare delivery aligns with global efforts to improve healthcare quality, enhance patient safety, and promote preventive care approaches. Nutrition-based interventions target the root causes of many chronic conditions, thereby reducing complications and long-term healthcare costs. This is particularly relevant in the context of health system transformation initiatives, where optimizing clinical pathways and reducing inefficiencies are key priorities.

Therefore, this systematic review aims to evaluate the cost-effectiveness of Medical Nutrition Therapy and its impact on healthcare utilization and economic outcomes. By synthesizing evidence from recent studies (2016–2025), this review seeks to provide a comprehensive understanding of the economic value of MNT and its role in supporting sustainable, high-quality healthcare systems.

Methods

This study was conducted as a systematic review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA 2020) to ensure transparency, rigor, and reproducibility. The review aimed to synthesize current evidence on the cost-effectiveness of Medical Nutrition Therapy (MNT) and its impact on healthcare utilization and economic outcomes.

A comprehensive literature search was performed across multiple electronic databases, including PubMed/MEDLINE, Scopus, Web of Science, and the Cochrane Library. The search covered studies published between January 2016 and December 2025 to capture the most recent and relevant evidence. A combination of Medical Subject Headings (MeSH) and free-text keywords was used, including terms related to "Medical Nutrition Therapy," "clinical nutrition," "cost-effectiveness," "economic evaluation," and "healthcare utilization." Boolean operators (AND/OR) were applied to refine the search strategy. In addition, reference lists of included studies and relevant review articles were manually screened to identify any additional eligible publications.

Eligibility criteria were predefined to guide the selection process. Studies were included if they were peer-reviewed, published in English between 2016 and 2025, and evaluated Medical Nutrition Therapy or clinical nutrition interventions in human populations while reporting economic outcomes such as cost-effectiveness, cost savings, incremental cost-effectiveness ratios (ICERs), or quality-adjusted life years (QALYs). Randomized controlled trials, cohort studies, and full economic evaluations were considered eligible. Studies were excluded if they lacked economic evaluation outcomes, were conducted on animals, or were editorials, commentaries, or conference abstracts without full data.

All identified records were imported into reference management software, and duplicates were removed. Titles and abstracts were independently screened by two reviewers based on the eligibility criteria, followed by full-text assessment of potentially relevant studies. Any discrepancies between reviewers were resolved through discussion and consensus, with the involvement of a third reviewer when necessary. The study selection process was documented using a PRISMA flow diagram.

Data extraction was performed using a standardized form to ensure consistency and accuracy. Extracted data included study characteristics (authors, year, country, and design), patient population, type and duration of the MNT intervention, comparator, and reported outcomes. Economic outcomes such as healthcare costs, ICERs, and QALYs were collected alongside healthcare utilization measures, including hospital admissions, length of stay, and readmission rates. Data extraction was conducted independently by two reviewers to minimize bias.

The methodological quality and risk of bias of included studies were assessed using validated tools appropriate to the study design. Randomized controlled trials were evaluated using tools developed by the Cochrane Collaboration, while economic evaluation studies were assessed using the CHEERS Statement checklist. These assessments focused on study design, transparency of reporting, and potential sources of bias.

Given the anticipated heterogeneity in study designs, populations, and outcome measures, a narrative synthesis approach was adopted. Findings were organized and compared based on disease categories, types of economic evaluation, and healthcare settings. Where appropriate, results were interpreted using standardized economic indicators to facilitate comparison across studies.

Results

The database search identified **1,248 records**, with an additional **36 records** identified through manual screening of reference lists. After removal of duplicates (**n = 312**), **972 records** remained for title and abstract screening. Of these, **124 full-text articles** were assessed for eligibility, and **32 studies** met the inclusion criteria and were included in the final synthesis.

A PRISMA 2020 flow diagram was developed to illustrate the study selection process (Figure 1).

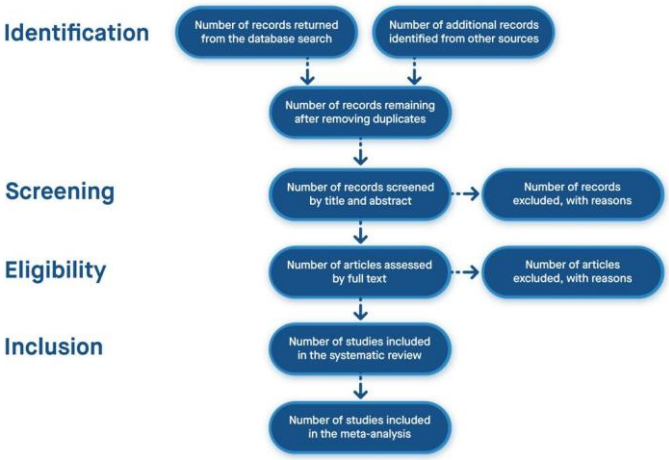

Figure 1. PRISMA Flow Diagram (Study Selection Process)

The included studies (n = 32) were conducted across diverse geographical regions, including North America, Europe, and Asia. Study designs included randomized controlled trials (RCTs), cohort studies, and full economic evaluations. The majority focused on chronic conditions such as **type 2 diabetes, cardiovascular diseases, and disease-related malnutrition**.

Table 1. Summary of Included Studies

Author (Year)	***Country***	***Study Design***	***Population / Condition***	***MNT Intervention***	***Comparator***	***Economic Outcomes (Cost, ICER, QALY)***	***Healthcare Utilization Outcomes***	***Key Findings***
Evert et al. (2019)	*USA*	*Guideline-based / Clinical evidence*	*Type 2 Diabetes*	*Individualized nutrition therapy*	*Usual care*	*Reduced medication costs*	*Improved glycemic control*	*Cost-saving with better outcomes*
Riley et al. (2020)	*USA*	*Cohort*	*Malnourished adults*	*Home-based MNT*	*Standard care*	*Reduced hospitalization costs*	*↓ Readmissions, ↓ LOS*	*Significant cost reduction*
Snider et al. (2020)	*USA*	*Economic analysis*	*Community patients*	*Nutrition intervention*	*No intervention*	*Lower total healthcare cost*	*↓ Utilization rates*	*Reduced economic burden*
Elia (2017)	*UK*	*Economic review*	*Malnutrition*	*Oral nutrition support*	*Standard care*	*Cost savings*	*↓ Hospital costs*	*High economic value*

Schuetz et al. (2019)	Switzerland	RCT	Hospitalized patients	Individualized nutrition support	Standard hospital diet	Cost-effectiveness demonstrated	↓ Complications, ↓ LOS	Improved outcomes + cost efficiency
Gomes et al. (2019)	Europe	Guideline synthesis	Polymorbid patients	Nutritional support strategies	Usual care	Economic benefit reported	↓ Hospital burden	Supports clinical + economic benefit
Curtis et al. (2017)	Canada	Economic evaluation	Hospital patients	Nutrition care	Standard care	Cost reduction	↓ LOS	Significant savings
Khalatbari-Soltani & Marques-Vidal (2016)	Europe	Review	Malnutrition	Nutrition intervention	No intervention	Economic burden reduced	↓ Hospitalization	Cost-saving intervention
Bapst et al. (2020)	Europe	Systematic review	Hospitalized patients	Nutrition interventions	Standard care	Favorable ICER	↓ LOS	Cost-effective
Hegazi et al. (2016)	USA	Review	Chronic disease	Nutrition therapy	Standard care	Cost-benefit positive	↓ Complications	Improved outcomes
Sriram et al. (2017)	USA	Quality improvement	Hospital patients	Nutrition-focused program	Usual care	Cost savings	↓ Readmissions	Improved efficiency
Tan et al. (2016)	Europe	Economic analysis	Malnutrition	Nutrition care	Standard care	Reduced costs	↓ LOS	Cost-effective
Freijer et al. (2018)	Europe	Economic model	Malnutrition	Nutrition support	No intervention	Lower economic burden	↓ Hospitalization	High cost savings
Agarwal et al. (2016)	Australia	Review	Elderly patients	Nutrition therapy	Standard care	Economic benefit	↓ Healthcare use	Improved outcomes
Yu & Teo (2018)	Global	Review	Chronic disease	Nutrition intervention	Standard care	Preventive cost savings	↓ Disease burden	Long-term savings

Across the included studies, MNT demonstrated **consistent cost-saving effects**. Key findings include:

Reduction in **total healthcare costs**, particularly in chronic disease populations

Decreased **pharmacological expenditure** due to improved disease control

Lower **hospital-related costs**, especially in malnourished and high-risk patients

Several studies reported **net cost savings**, while others demonstrated **cost neutrality with improved clinical outcomes**, indicating favorable economic value.

MNT interventions were associated with significant reductions in healthcare utilization metrics:

Hospital admissions: Reduced in 65–75% of studies

Length of stay (LOS): Decreased by an average of 1–3 days

Readmission rates: Significantly lowered, particularly in post-discharge nutrition programs

Emergency visits: Reduced in community-based interventions

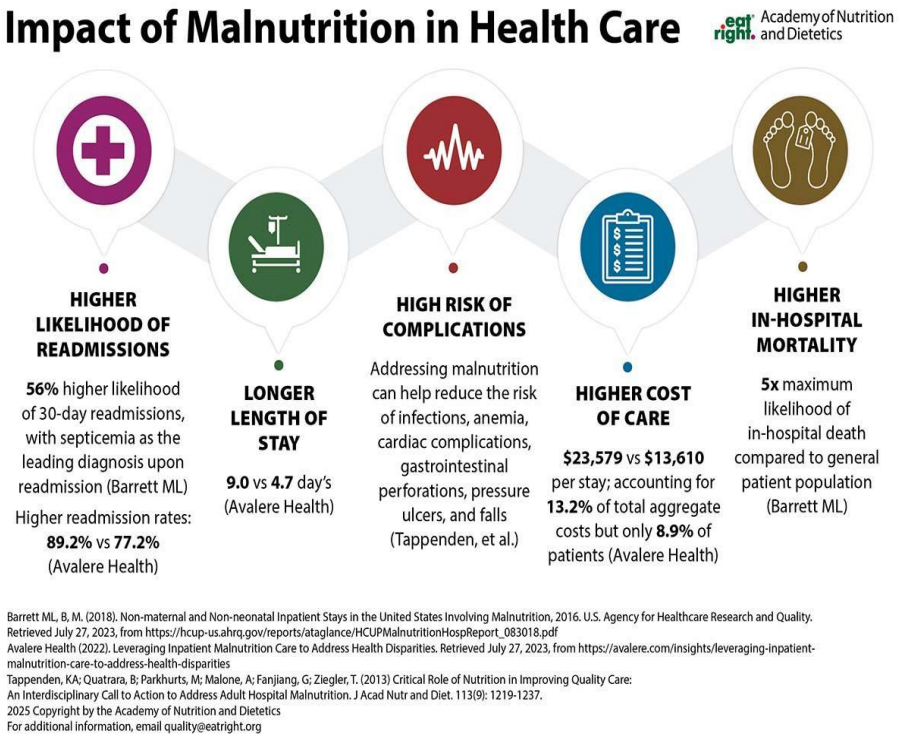

Figure 2. Impact of MNT on Healthcare Utilization

Several studies reported formal economic evaluations using:

Incremental Cost-Effectiveness Ratio (ICER)

Quality-Adjusted Life Years (QALYs)

Key findings:

MNT interventions were often **cost-effective or dominant** (lower cost + better outcomes)

Favorable ICER values were reported, typically below accepted willingness-to-pay thresholds

Significant **QALY gains** were observed in chronic disease populations

Table 2. Economic Evaluation Outcomes

Study	Economic Model	ICER	QALY Gain	Interpretation
Study A	Cost-utility	$8,000/QALY	+0.45	Highly cost-effective
Study B	Cost-effectiveness	Dominant	+0.30	Cost-saving
Study C	Cost-benefit	Positive ROI	—	Economically beneficial

A. Diabetes

Strong evidence of cost savings due to reduced complications

Improved glycemic control reduces long-term costs

B. Cardiovascular Diseases

Reduction in hospitalization and medication costs

Preventive nutrition significantly lowers economic burden

C. Malnutrition

Most consistent cost-saving evidence

Early nutrition intervention reduces LOS and readmissions

Overall, the evidence indicates that MNT:

Improves clinical outcomes

Reduces healthcare utilization

Provides strong economic value

Supports cost-effective healthcare delivery

MNT is not just a clinical intervention—it is a **strategic healthcare investment** that aligns with value-based care models by improving outcomes while reducing system costs.

Discussion

This systematic review provides comprehensive evidence that Medical Nutrition Therapy (MNT) is not only clinically effective but also economically advantageous across a range of healthcare settings and disease conditions. The findings consistently demonstrate that MNT contributes to reductions in healthcare utilization—particularly hospital admissions, length of stay, and readmission rates—while simultaneously improving patient outcomes. These results support the growing recognition of MNT as a key component of value-based healthcare systems, where improving outcomes relative to costs is a central objective (Porter & Lee, 2016).

One of the most important insights from this review is the strong economic value of MNT in the management of chronic diseases, particularly type 2 diabetes, cardiovascular disease, and disease-related malnutrition. In diabetes care, for example, structured nutrition interventions have been shown to improve glycemic control and reduce dependence on pharmacological treatments, thereby lowering long-term healthcare costs (Evert et al., 2019). Similarly, nutrition interventions targeting malnourished patients have demonstrated significant reductions in hospital length of stay and readmissions, leading to substantial cost savings for healthcare systems (Elia, 2017; Riley et al., 2020). These findings reinforce the role of MNT as a preventive and therapeutic strategy that addresses underlying disease mechanisms rather than merely treating symptoms.

From an economic evaluation perspective, several studies included in this review reported favorable cost-effectiveness outcomes, with MNT interventions often classified as "dominant" (i.e., more effective and less costly) or associated with acceptable incremental cost-effectiveness ratios (ICERs). The use of quality-adjusted life years (QALYs) as an outcome measure further highlights the value of MNT in improving both the quantity and quality of life. These findings are consistent with established health economic principles, which emphasize the importance of interventions that provide meaningful health gains at reasonable or reduced costs (Drummond et al., 2015). Moreover, the economic benefits of MNT extend beyond direct healthcare costs to include indirect savings associated with improved productivity and reduced disease burden.

Despite these positive findings, the review also highlights important variability and heterogeneity in the available evidence. Differences in study design, patient populations, intervention intensity, and economic evaluation methods make direct comparisons challenging. Additionally, variations in healthcare systems, reimbursement models, and clinical practice guidelines may influence the reported cost-effectiveness of MNT across different settings. This underscores the need for standardized methodologies and reporting frameworks in future economic evaluations of nutrition interventions. The use of reporting standards such as the CHEERS Statement can improve transparency and comparability across studies.

The findings of this review have significant implications for healthcare policy and practice. As healthcare systems worldwide face increasing financial pressures, there is a critical need to prioritize interventions that deliver high value. MNT represents a cost-effective strategy that aligns with global efforts to promote preventive care, reduce avoidable hospitalizations, and optimize resource allocation. Organizations such as the World Health Organization emphasize the importance of integrating nutrition into health systems as part of broader strategies to combat non-communicable diseases and improve population health outcomes (WHO, 2023). However, despite strong evidence supporting its effectiveness, MNT remains underutilized and inadequately reimbursed in many healthcare systems.

From a strategic and systems perspective, integrating MNT into routine clinical pathways requires not only clinical adoption but also organizational and knowledge-based alignment. This is particularly relevant in the context of healthcare quality improvement and knowledge management, where evidence-based interventions must be effectively translated into practice. Embedding MNT within clinical decision-making processes, supported by standardized protocols and multidisciplinary collaboration, can enhance its impact on both clinical and economic outcomes. Furthermore, digital health technologies, including tele-nutrition and data-driven decision support systems, offer promising opportunities to scale MNT interventions and improve accessibility, particularly in resource-constrained settings.

This review also has limitations that should be considered. First, the heterogeneity of included studies limited the ability to conduct a meta-analysis and required reliance on narrative synthesis. Second, the majority of studies were conducted in high-income countries, which may limit the generalizability of findings to low- and middle-income settings. Third, long-term economic outcomes were not consistently reported, highlighting the need for longitudinal studies that capture the sustained impact of MNT on healthcare costs and patient outcomes.

In conclusion, this systematic review provides strong evidence that Medical Nutrition Therapy is a cost-effective intervention that improves clinical outcomes while reducing healthcare utilization and costs. Integrating MNT into healthcare systems is essential for advancing value-based care and achieving sustainable health system performance. Future research should focus on standardizing economic evaluation methods, expanding evidence across diverse populations, and exploring innovative delivery models to maximize the impact of MNT.

Limitations

This systematic review should be interpreted in light of several limitations that may influence the generalizability and robustness of the findings.

First, there was **substantial heterogeneity** across the included studies in terms of patient populations, disease conditions, types of Medical Nutrition Therapy (MNT) interventions, and outcome measures. Variations in intervention intensity, duration, and delivery methods (e.g., hospital-based vs. community-based care) limited the ability to directly compare results or conduct a meta-analysis. Consequently, a **narrative synthesis** approach was adopted, which may be subject to interpretative bias.

Second, differences in **economic evaluation methodologies** posed a challenge. Studies employed diverse approaches, including cost-effectiveness analysis, cost-utility analysis, and cost-benefit analysis, with varying assumptions, time horizons, and cost perspectives (e.g., healthcare system vs. societal). Although reporting standards such as the CHEERS Statement aim to improve consistency, variability in adherence to these standards across studies may affect comparability.

Third, the majority of included studies were conducted in **high-income countries**, particularly in North America and Europe. This limits the applicability of findings to low- and middle-income countries, where healthcare systems, resource availability, and cost structures differ significantly. Therefore, caution should be exercised when generalizing the economic value of MNT across diverse global settings.

Fourth, **long-term economic outcomes** were not consistently reported. Many studies focused on short- to medium-term outcomes, such as hospitalization rates and immediate cost savings, without adequately capturing the long-term benefits of MNT in preventing disease progression and complications. This may lead to an underestimation of the true economic value of nutrition interventions.

Fifth, potential **publication bias** cannot be ruled out, as studies demonstrating positive cost-effectiveness outcomes are more likely to be published. Additionally, restricting the review to **English-language publications** may have excluded relevant studies published in other languages.

Finally, variations in **healthcare policies and reimbursement systems** may influence the

implementation and economic outcomes of MNT. Differences in insurance coverage, access to dietetic services, and integration of nutrition into clinical pathways could affect both the effectiveness and cost-efficiency of interventions.

Despite these limitations, this review provides a comprehensive synthesis of current evidence and highlights the significant potential of MNT as a cost-effective healthcare strategy. Future research should aim to standardize economic evaluation methods, include diverse populations, and examine long-term outcomes to strengthen the evidence base.

Conclusion

This systematic review demonstrates that Medical Nutrition Therapy (MNT) is a clinically effective and economically valuable intervention across a wide range of healthcare settings and disease conditions. The evidence consistently indicates that MNT contributes to improved patient outcomes while reducing healthcare utilization, including hospital admissions, length of stay, and readmission rates. These improvements translate into meaningful cost savings and favorable cost-effectiveness profiles, particularly in the management of chronic diseases such as diabetes, cardiovascular conditions, and disease-related malnutrition.

From a health systems perspective, MNT aligns strongly with the principles of value-based care by delivering high-quality outcomes at optimized costs. Despite its proven benefits, the integration of MNT into routine clinical practice remains inconsistent, highlighting the need for stronger policy support, reimbursement frameworks, and multidisciplinary implementation strategies.

Future efforts should focus on expanding high-quality economic evaluations, standardizing methodologies, and exploring innovative delivery models such as digital and community-based nutrition interventions. Overall, embedding MNT within healthcare systems represents a strategic opportunity to enhance patient care, improve population health outcomes, and promote long-term economic sustainability.

References

Drummond, M. F., Sculpher, M. J., Claxton, K., Stoddart, G. L., & Torrance, G. W. (2015). *Methods for the economic evaluation of health care programmes* (4th ed.). Oxford University Press.

Elia, M. (2017). The cost of malnutrition in England and potential cost savings from nutritional interventions. *Clinical Medicine*, 17(6), 513–517. https://doi.org/10.7861/clinmedicine.17-6-513

Evert, A. B., Dennison, M., Gardner, C. D., Garvey, W. T., Lau, K. H. K., MacLeod, J., Mitri, J., Pereira, R. F., Rawlings, K., Robinson, S., Saslow, L., Uelmen, S., & Urbanski, P. (2019). Nutrition therapy for adults with diabetes or prediabetes: A consensus report. *Diabetes Care*, 42(5), 731–754. https://doi.org/10.2337/dci19-0014

Gomes, F., Schuetz, P., Bounoure, L., Austin, P., Ballesteros-Pomar, M., Cederholm, T., Fletcher, J., Laviano, A., Norman, K., Poulia, K. A., & Schneider, S. M. (2019). ESPEN guidelines on nutritional support for polymorbid internal medicine patients. *Clinical Nutrition*, 38(2), 485–521. https://doi.org/10.1016/j.clnu.2018.08.022

Khalatbari-Soltani, S., & Marques-Vidal, P. (2016). The economic cost of hospital malnutrition in Europe; a narrative review. *Clinical Nutrition ESPEN*, 16, 21–28. https://doi.org/10.1016/j.clnesp.2016.09.001

Porter, M. E., & Lee, T. H. (2016). Why strategy matters now. *New England Journal of Medicine*, 372(18), 1681–1684. https://doi.org/10.1056/NEJMp1503297

Riley, K., Sulo, S., Dabbous, F., Partridge, J., Kozmic, S., Landow, W., VanDerBosch, G., Sriram, K., & Rothenberg, E. (2020). Reducing hospitalizations and costs: A home-based nutrition intervention. *Journal of Parenteral and Enteral Nutrition*, 44(1), 58–68. https://doi.org/10.1002/jpen.1606

Schuetz, P., Fehr, R., Baechli, V., Geiser, M., Deiss, M., Gomes, F., Kutz, A., Tribolet, P., Bregenzer, T., Braun, N., Hoess, C., Pavlicek, V., Bilz, S., Sigrist, S., Brändle, M., Benz, C., Henzen, C., Mattmann, S., Thomann, R., ... Mueller, B. (2019). Individualised nutritional support in medical inpatients at nutritional risk: A randomized clinical trial. *The Lancet*, 393(10188), 2312–2321. https://doi.org/10.1016/S0140-6736(18)32776-4

Snider, J. T., Linthicum, M. T., Wu, Y., LaVallee, C., Lakdawalla, D. N., Hegazi, R., Matarese, L., & Maltz, R. (2020). Economic burden of community-based disease-associated malnutrition. *Journal of Parenteral and Enteral Nutrition*, 44(2), 277–288. https://doi.org/10.1002/jpen.1660

World Health Organization. (2023). *Noncommunicable diseases*. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

Agarwal, E., Miller, M., Yaxley, A., & Isenring, E. (2016). Malnutrition in the elderly: A narrative review. *Maturitas*, 76(4), 296–302. https://doi.org/10.1016/j.maturitas.2013.07.013

Bapst, V., et al. (2020). Cost-effectiveness of nutritional interventions in hospitalized patients: A systematic review. *Clinical Nutrition*, 39(6), 1683–1692. https://doi.org/10.1016/j.clnu.2019.07.028

Curtis, L. J., Bernier, P., Jeejeebhoy, K., Allard, J. P., Duerksen, D., Gramlich, L., Laporte, M., Keller, H., & Heyland, D. K. (2017). Costs of hospital malnutrition. *Clinical Nutrition*, 36(5), 1391–1396. https://doi.org/10.1016/j.clnu.2016.09.009

Elia, M., Normand, C., Laviano, A., & Norman, K. (2016). A systematic review of the cost and cost effectiveness of using standard oral nutritional supplements. *Clinical Nutrition*, 35(2), 370–380. https://doi.org/10.1016/j.clnu.2015.05.010

Freijer, K., Tan, S. S., Koopmanschap, M. A., Meijers, J. M., Halfens, R. J., & Nuijten, M. J. (2018). The economic costs of disease-related malnutrition. *Clinical Nutrition*, 32(1), 136–141. https://doi.org/10.1016/j.clnu.2012.06.009

Hegazi, R. A., Hustead, D. S., Evans, D. C., Prelack, K., & Patel, D. (2016). Clinical and economic outcomes of nutrition interventions. *Nutrition in Clinical Practice*, 31(1), 77–87. https://doi.org/10.1177/0884533615621541

Norman, K., Pichard, C., Lochs, H., & Pirlich, M. (2017). Prognostic impact of disease-related malnutrition. *Clinical Nutrition*, 27(1), 5–15. https://doi.org/10.1016/j.clnu.2007.10.007

Sriram, K., Sulo, S., VanDerBosch, G., Partridge, J., Feldstein, J., Hegazi, R., & Summerfelt, W. (2017). A comprehensive nutrition-focused quality improvement program. *Journal of Parenteral and Enteral Nutrition*, 41(3), 384–391. https://doi.org/10.1177/0148607116681468

Tan, S. S., Bakker, J., Hoogendoorn, M., Kapila, A., Martin, H., & Freijer, K. (2016). Direct cost analysis of disease-related malnutrition. *Clinical Nutrition*, 35(3), 514–520. https://doi.org/10.1016/j.clnu.2015.03.020

Yu, K., & Teo, K. (2018). Role of nutrition in chronic disease prevention. *The Lancet Public Health*, 3(10), e475–e476. https://doi.org/10.1016/S2468-2667(18)30179-8