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Nutritional Support to Improve Prognosis and Survival in Pediatric Cancer Patients: A Literature Review

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Abstract

Background: Malnutrition is common in children with cancer and is associated with worse treatment tolerance, increased infections, relapse risk and reduced survival. This review synthesizes recent evidence about the prevalence of nutritional problems in paediatric oncology, mechanisms linking nutrition to outcomes, and the effect of nutritional assessment and interventions (counselling, oral nutritional supplements, enteral and parenteral nutrition) on prognosis and survival.

Methods: A focused literature search (PubMed, PMC, Scopus, Web of Science) was performed for reviews, guidelines, consensus statements and clinical studies published 2017-2025 using terms "paediatric cancer", "malnutrition", "nutritional support", "enteral nutrition", "parenteral nutrition", "survival" and "outcomes". Priority was given to systematic reviews, consensus statements and large retrospective cohort studies and guideline documents.

Results: Malnutrition at diagnosis and during therapy remains common globally and is associated with treatment interruptions, higher infection rates and worse overall survival. Consensus statements and paediatric-focused reviews recommend early screening, standardized assessment (weight/BMI, MUAC, triceps skinfold, clinical evaluation) and proactive, tiered interventions starting with counselling and ONS and escalating to enteral nutrition (EN) or home parenteral nutrition (HPN) when indicated. Evidence shows that enteral feeding is effective at maintaining or improving weight and nutritional indices and may improve treatment tolerance; parenteral nutrition can correct severe deficits but carries higher infection risk. Observational cohort data link malnutrition to poorer survival and some studies suggest that timely nutritional interventions (standardized screening with early EN/HPN) reduce hospital admissions, improve tolerance to therapy and are associated with better short-term clinical outcomes; however high-quality randomized data examining survival as a primary endpoint are limited.

Conclusions: The preponderance of evidence supports routine nutritional screening and early, multidisciplinary nutritional intervention in paediatric oncology as part of standard supportive care. There is a need for standardized screening protocols, prospective trials of targeted nutritional strategies, and implementation research—especially in lower-resource settings—examining whether early aggressive nutrition improves long-term survival endpoints.

Introduction

Childhood cancer survivorship has improved dramatically in high-income countries owing to advances in diagnosis and therapy. However, malnutrition—both undernutrition and treatment-related wasting or selective nutrient deficiencies—remains an important and sometimes under-recognized determinant of treatment tolerance, infectious complications and survival in paediatric oncology. Nutritional decline may stem from disease biology (cachexia), tumor location (e.g., brain tumors causing dysphagia), treatment toxicities (mucositis, nausea, vomiting), metabolic demands of growth, and socio-economic factors. This review summarizes contemporary evidence on how nutritional status and nutritional support influence prognosis and survival in paediatric cancer patients and synthesizes guideline and consensus recommendations for clinical practice [1, 2].

Methods (search strategy)

A targeted literature search was performed across PubMed/PMC, Scopus and guideline repositories for publications between 2017 and 2025. Search terms included combinations of: “paediatric” or “childhood” AND “cancer” or “oncology” AND “nutrition” OR “malnutrition” OR “nutritional support” OR “enteral” OR “parenteral” AND “survival” OR “outcomes” OR “prognosis”. I prioritized systematic reviews, consensus statements, clinical practice guidelines, scoping reviews and large observational studies. Key guideline sources (ESPEN, ASPEN, PAHO) and recent paediatric nutrition consensus statements were included. Selected high-impact papers and guidelines were used to build evidence-based conclusions [3].

Results

Prevalence and forms of malnutrition in paediatric cancer

Multiple contemporary reviews and cohort studies report that undernutrition (wasting, stunting, low MUAC) is prevalent in children with various cancers, with variable rates depending on geography, cancer type and assessment method. Prevalence is higher in low- and middle-income settings and among certain tumor types (e.g., neuroblastoma, brain tumors, advanced-stage solid tumors). Nutritional status commonly worsens during therapy [1, 2].

Mechanisms linking nutrition to prognosis

Malnutrition affects immune function, impairs wound healing, increases treatment toxicity and reduces physiologic reserve — all plausibly increasing morbidity and mortality. Protein-energy deficits and micronutrient deficiencies can reduce chemotherapy tolerance, increase doses delays, and raise infection susceptibility, which may indirectly worsen prognosis. Additionally, tumor- and treatment-driven metabolic alterations (inflammation, altered protein turnover) contribute to cachexia [1, 2].

Screening and assessment approaches

Recent scoping reviews and consensus articles emphasize routine, repeated screening with simple, age-appropriate measures (weight-for-age/BMI z-scores, mid-upper arm circumference (MUAC), triceps skinfold, and clinical assessment), and flagging patients at risk for early dietitian involvement. There remains heterogeneity in thresholds and tools used across centers; standardized, validated paediatric tools are needed [4, 6].

Nutritional interventions and evidence of effect on outcomes
Nutritional counselling & oral nutritional supplements (ONS)

Guidelines and clinical practice documents recommend starting with dietary counselling and ONS for patients with inadequate intake but preserved swallowing and GI function. Counselling aims to manage nutrition-impact symptoms (nausea, mucositis) and to boost protein-energy intake. Evidence supports that counselling and ONS can prevent further weight loss and improve nutritional indices; direct evidence on survival impact is limited but improved tolerance to therapy and reduced complications are frequently reported [1, 3].

Enteral nutrition (EN) — tube feeding

Enteral nutrition (nasogastric or gastrostomy) is widely used when oral intake is insufficient. Multiple observational studies and systematic reviews (paediatric-specific and adult oncology literature extrapolated to children) show EN reliably improves weight and body composition and reduces nutritional decline. Several paediatric series report improved treatment continuity and fewer interruptions when proactive enteral feeding protocols are used. EN is preferred over parenteral nutrition when the gut is functional. Evidence for a direct survival benefit is largely observational, but EN improves intermediate outcomes linked to prognosis (treatment tolerance, infection rates, hospitalization days) [9, 10].

Parenteral nutrition (PN) / home parenteral nutrition (HPN)

PN is indicated when EN is impossible or insufficient (intestinal failure, severe mucositis with inability to feed). While PN corrects deficits effectively, adult data show higher infection risk relative to EN; paediatric studies echo infection risk concerns but also show PN can stabilize patients who would otherwise be too malnourished to receive therapy. Recent cohort data suggest HPN can reduce malnutrition-related admissions and help maintain therapy, though robust randomized survival data are lacking. Decisions must balance benefits of nutritional repletion against catheter-related complications [7, 12].

Evidence linking nutritional status/intervention to survival

Several observational studies and systematic reviews report associations between malnutrition at diagnosis or during therapy and increased mortality, relapse and treatment-related morbidity. A 2025 cohort (BMC Cancer) and other recent analyses found malnutrition (low BMI, low MUAC/TSF) correlates with significantly lower survival and higher relapse risk. Interventional evidence that nutritional support improves long-term survival is suggestive but not definitive: many studies show improved short-term clinical outcomes (reduced hospitalizations, better tolerance, fewer dose reductions), which are plausible mediators of improved survival, but randomized controlled trials with survival endpoints are sparse [4, 8].

Implementation and resource considerations

Implementation studies show benefit from standardized algorithms (screen → dietitian triage → escalate to EN/PN as needed). Resource-limited settings face higher baseline malnutrition and infrastructure challenges for EN/PN; tailored approaches and cost-effective protocols are needed. Consensus papers call for capacity building, nutrition training of oncology teams and integration of nutritional care into standard paediatric oncology pathways [5, 12].

Discussion

The literature consistently demonstrates that malnutrition is prevalent in paediatric cancer and associated with worse clinical outcomes. The mechanistic rationale linking nutrition to prognosis (immune competence, treatment tolerance, physiologic reserve) is strong. The balance of evidence supports routine screening and early intervention using a stepwise model: counselling and ONS → EN when oral intake insufficient → PN when gut failure or EN contraindicated. EN is generally preferred given lower infection risks and effectiveness at improving weight and treatment continuity; PN remains an important tool for selected patients. While observational studies link nutritional status to survival, high-quality randomized trials testing whether specific nutrition interventions (timing, composition, route) lead to improved survival as a primary endpoint are limited. Therefore, current recommendations are largely based on observational data, mechanistic plausibility and consensus expert guidance [2, 3].

Recommendations for clinicians and researchers
Clinical practice

1. Implement routine malnutrition screening at diagnosis and regularly during therapy using simple validated metrics (weight/BMI z-score, MUAC) [4].

2. Use a tiered approach: nutrition counselling and ONS early; introduce EN proactively for patients with progressive intake inadequacy; reserve PN for clear indications [3].
3. Include a multidisciplinary team (oncology, dietitian, nursing, pharmacy) and monitor for catheter-related complications if PN is used [11].

Research priorities

1. Prospective randomized trials (or pragmatic cluster trials) testing early proactive EN/HPN versus standard care with survival and relapse as predefined endpoints.
2. Standardization and validation of paediatric malnutrition screening tools across age groups and cancer types [4].
3. Implementation science to adapt interventions to low-resource settings and measure cost-effectiveness and equity outcomes [12].

Limitations of the reviewed literature

Most intervention evidence is observational, heterogeneous (in definitions, tools, interventions) and confounded by disease severity and socio-economic factors. Randomized data with survival endpoints are sparse. There is also geographic bias: high-income country data predominate for interventional studies while malnutrition burden is higher in low- and middle-income countries [4, 12].

Conclusion

Nutritional support is a critical, modifiable component of paediatric oncology care. Routine screening and timely, guideline-informed nutritional interventions (counselling, ONS, EN, PN) are recommended to maintain or restore nutritional status, improve treatment tolerance and reduce complications. Although strong mechanistic and observational evidence links nutrition to survival, more prospective trials are needed to quantify the survival benefit of specific nutritional strategies and to optimize implementation worldwide.

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