

Wilms Tumor

Global Clinical Nutrition Tool-Kit

Pediatric Wilms Tumor





Important: This document is intended as an education and planning resource for clinicians, NGOs, foundations, and caregiver-facing pediatric oncology programs. It does not replace individualized medical advice, renal dietetic assessment, oncology protocols, or institutional clinical judgment.

Global Clinical Nutrition Tool-Kit

A comprehensive globally aligned clinical and caregiver resource to nutrition across diagnosis, treatment, relapse and survivorship

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1 - Introduction

Wilms tumor (nephroblastoma) is the most common primary renal malignancy in children, typically presenting in early childhood and accounting for the majority of pediatric kidney cancers. Advances in multimodal treatment - combining surgery, chemotherapy, and, in some cases, radiation therapy - have resulted in high survival rates in many regions. However, these outcomes are not determined by oncologic treatment alone. Supportive care, particularly nutritional management, plays a critical and often under-recognized role in influencing both short-term treatment success and long-term health outcomes.

Pediatric oncology patients exist in a uniquely complex physiological state. Unlike adults, children are undergoing continuous growth and development, requiring sustained intake of energy, protein, and micronutrients to support normal biological processes.

When cancer is introduced, along with the metabolic stress of treatment, these baseline requirements increase significantly. At the same time, factors such as reduced appetite, gastrointestinal side effects, and treatment-related toxicity can limit a child's ability to maintain adequate nutritional intake. This creates a scenario in which nutritional deficits can develop rapidly and have immediate clinical consequences.

Malnutrition in pediatric cancer patients is not merely a secondary concern - it is a clinically significant condition that directly impacts outcomes. Inadequate nutritional status is associated with increased infection risk, reduced tolerance to chemotherapy, longer hospital stays, and higher rates of treatment interruption. In contrast, well-nourished patients are more likely to tolerate intensive therapies, recover more quickly, and maintain better overall physiological stability throughout the treatment process.

In the context of Wilms tumor, nutritional considerations are further complicated by the central role of the kidneys in metabolic regulation. The kidneys are responsible for fluid balance, electrolyte homeostasis, and the excretion of metabolic waste products, including chemotherapeutic agents. Surgical intervention - particularly nephrectomy - reduces renal capacity, making it essential to adopt nutritional strategies that support kidney function while avoiding excessive metabolic burden. This dual requirement - supporting growth while protecting renal health - adds an additional layer of complexity to dietary management in these patients. Beyond the immediate treatment phase, nutrition also has a lasting impact on long-term survivorship and quality of life. Pediatric cancer survivors are at increased risk for a range of late effects, including cardiovascular disease, renal impairment, and metabolic disorders. Early nutritional interventions and the establishment of healthy dietary patterns can help mitigate these risks and support healthier outcomes into adolescence and adulthood.

Effective nutritional care in pediatric oncology requires a multidisciplinary and family-centered approach. Clinicians, dietitians, nurses, and caregivers must work collaboratively to assess nutritional status, implement appropriate interventions, and adapt strategies as the child's condition evolves. Caregivers, in particular, play a crucial role in day-to-day nutritional support and must be equipped with practical knowledge and guidance to navigate the challenges of feeding during illness.

This document provides a comprehensive, clinically grounded framework for nutritional management in pediatric Wilms tumor patients. It integrates global clinical standards, evidence-informed practices, and practical caregiver strategies to support patients across all stages of care - from diagnosis and active treatment to relapse and long-term survivorship. By positioning nutrition as a foundational component of pediatric oncology care, this toolkit aims to improve treatment tolerance, enhance recovery, and contribute to better overall outcomes for children affected by Wilms tumor.

2 - Global Clinical Framework

This tool-kit is grounded in internationally recognized pediatric oncology standards established by the World Health Organization (WHO), the Children's Oncology Group (COG), and the International Society of Pediatric Oncology (SIOP). These organizations collectively define best practices in pediatric cancer care, with increasing emphasis on the integration of nutrition as a core component of treatment rather than a supplementary consideration. Across these frameworks, a consistent priority is placed on early and systematic nutritional screening at diagnosis, followed by continuous monitoring throughout the treatment trajectory. This approach recognizes that nutritional decline in pediatric oncology patients can occur rapidly due to a combination of disease burden, treatment toxicity, and increased metabolic demand.

Proactive identification of at-risk patients allows for timely intervention before malnutrition becomes clinically significant. A central principle within these global guidelines is the prevention and management of cancer-related malnutrition, which can influence treatment tolerance, infection risk, hospitalization rates, and overall survival. Nutritional care is therefore embedded within multidisciplinary oncology pathways, involving close coordination between oncologists, dietitians, nursing teams, and caregivers. This integrated model ensures that dietary strategies are tailored to the patient's clinical status, treatment phase, and individual needs.

These frameworks also highlight the need for adaptability across diverse healthcare settings. In high-resource environments, comprehensive nutritional support may include advanced interventions such as enteral or parenteral feeding, alongside detailed laboratory monitoring.

In low- and middle-income countries, where access to specialized care and nutritional products may be limited, emphasis is placed on practical, locally available dietary strategies and early caregiver education to mitigate risk.

In resource-limited settings, baseline malnutrition is more prevalent, and children may present with compromised nutritional status even before treatment begins. This amplifies the importance of early intervention, as malnutrition at diagnosis is associated with poorer clinical outcomes. Within these contexts, nutrition becomes not only a supportive measure but a critical determinant of treatment feasibility and survival.

Ultimately, the global clinical framework underscores a key shift in pediatric oncology: nutrition is no longer viewed as ancillary care, but as a foundational pillar of effective cancer treatment, requiring structured protocols, early intervention, and sustained attention throughout the continuum of care.

3 - Core Nutritional Principals

Effective nutritional management in pediatric Wilms tumor patients is built upon a foundation of well-established physiological and clinical principles. Unlike adult oncology patients, children are simultaneously undergoing active growth and development, which significantly increases their baseline nutritional requirements. When combined with the metabolic stress of cancer and its treatment, this creates a uniquely complex nutritional environment that must be carefully managed.

At the macronutrient level, carbohydrates serve as the primary energy source, supporting both basal metabolic function and the increased energy demands associated with treatment and recovery. Ensuring adequate carbohydrate intake helps prevent the breakdown of protein stores for energy, thereby preserving lean body mass. This is particularly important in pediatric oncology, where loss of muscle mass can occur rapidly and has been associated with poorer clinical outcomes.

Protein plays a central role in tissue repair, immune function, and maintenance of growth trajectories. During chemotherapy and radiation therapy, the body experiences increased protein turnover due to inflammation, cellular damage, and immune activation. Insufficient protein intake can impair wound healing, reduce immune competence, and delay recovery. However, in Wilms tumor patients - particularly those with reduced renal capacity - protein intake must be carefully balanced to meet physiological needs without placing excessive strain on the kidneys.

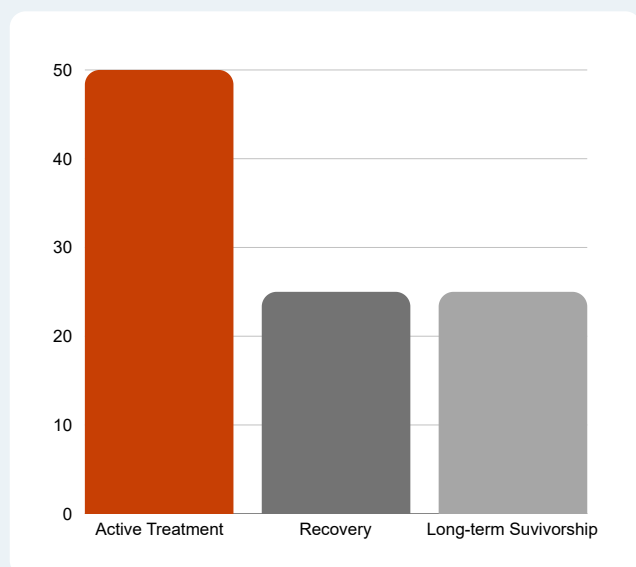
Dietary fats provide a concentrated source of energy, which is especially valuable in patients with reduced appetite or limited oral intake. Fats also play a critical role in the absorption of fat-soluble vitamins and in supporting neurological development. Incorporating healthy fats into the diet can help increase caloric density without increasing meal volume, which is beneficial for children experiencing early satiety or treatment-related fatigue.

Beyond macronutrients, micronutrient adequacy is essential for maintaining metabolic stability and immune resilience. Nutrients such as iron, zinc, and vitamins A, C, and D contribute to red blood cell production, wound healing, bone health, and infection resistance. Deficiencies in these micronutrients can exacerbate treatment-related side effects and increase vulnerability to complications. Supplementation should be guided by clinical assessment to avoid excess or interactions with treatment.

Hydration represents a critical yet often underemphasized component of nutritional care, particularly in Wilms tumor patients due to the central role of the kidneys in fluid and electrolyte regulation. Adequate fluid intake supports renal clearance of chemotherapy agents, helps maintain electrolyte balance, and reduces the risk of nephrotoxicity. Dehydration, even when mild, can significantly impact renal function and overall treatment tolerance, making consistent fluid intake a priority.

These nutritional principles must be applied within a flexible, patient-centered framework. Appetite fluctuations, treatment side effects, cultural dietary preferences, and psychosocial factors all influence a child's ability to maintain adequate intake. Rigid dietary prescriptions are often less effective than adaptable strategies that prioritize overall intake and patient comfort.

Fig/1: Nutrition Across Care Stages (Macronutrient Balance)



4 - Kidney Protection

In pediatric Wilms tumor patients, kidney protection is a central clinical priority due to the direct involvement of renal structures in both the disease process and its treatment. Many patients undergo nephrectomy, leaving them with a single functioning kidney, while others may experience treatment-related nephrotoxicity from chemotherapy agents. Nutritional strategies must therefore minimize renal workload while maintaining adequate growth and metabolic support.

One of the most important considerations is protein management. While protein is essential for growth, immune function, and tissue repair, excessive intake can increase glomerular filtration demand and place additional strain on the remaining kidney. Protein intake should be optimized rather than maximized, ensuring sufficient supply without excess. This balance is particularly important during periods of rapid growth or recovery from treatment.

Sodium intake is another critical factor, as excessive sodium can contribute to hypertension, fluid retention, and long-term cardiovascular risk - conditions that are already of concern in patients with reduced renal reserve. A diet low in processed and high-sodium foods helps maintain stable blood pressure and reduces renal stress.

Electrolyte balance must also be closely monitored. Potassium and phosphorus levels can become dysregulated in patients with impaired renal function. Dietary intake of these minerals may need to be adjusted based on laboratory values, especially in patients receiving nephrotoxic therapies or experiencing reduced kidney function.

Hydration plays a protective role in renal health, facilitating the clearance of metabolic waste and chemotherapeutic agents. Adequate fluid intake helps maintain renal perfusion and reduces the risk of acute kidney injury. Fluid recommendations must be individualized, particularly in patients with fluid balance concerns or specific treatment protocols.

Kidney protection in Wilms tumor patients requires a dynamic and individualized nutritional approach, guided by ongoing clinical monitoring. By integrating dietary management with laboratory assessment and clinical oversight, healthcare teams can help preserve renal function and reduce long-term complications.

5 - Nutrition During Active Treatment

The active treatment phase presents some of the most significant nutritional challenges in pediatric oncology. Chemotherapy and radiation therapy can profoundly affect appetite, digestion, and nutrient absorption, often leading to decreased oral intake at a time when nutritional needs are elevated.

Common treatment-related side effects include nausea, vomiting, mucositis, taste alterations, and fatigue. These symptoms can create both physical and psychological barriers to eating, resulting in inadequate caloric intake and weight loss. In younger children, these effects may be compounded by limited communication and feeding aversions.

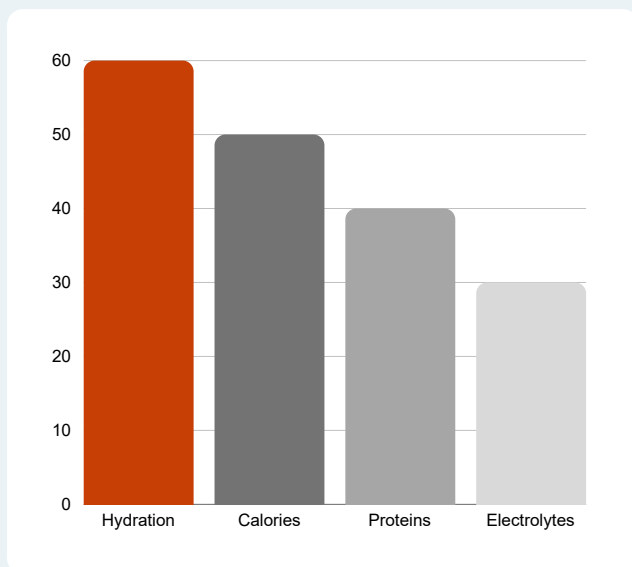
To address these challenges, nutritional strategies must prioritize flexibility and tolerance. Small, frequent meals are often more manageable than larger portions, helping to maintain a steady intake of calories and nutrients. Foods that are energy-dense, including those containing healthy fats, can provide more calories in smaller volumes, which is particularly beneficial for children with reduced appetite.

Texture and temperature modification can also improve intake. Soft, bland, or cool foods are often better tolerated in the presence of mucositis or nausea. Strong odors and highly seasoned foods may need to be avoided, as they can exacerbate nausea or aversion.

Food safety is critically important during treatment, especially in patients who are immunocompromised. Avoiding raw or undercooked foods, ensuring proper food handling, and maintaining hygiene standards reduces the risk of infection. In cases where oral intake is insufficient, oral nutritional supplements or medically formulated products may be introduced to meet caloric and protein requirements. Early intervention is key; waiting until significant weight loss has occurred can make nutritional recovery more difficult.

Nutrition during active treatment requires a responsive, patient-centered approach that adapts to changing symptoms and focuses on maintaining intake rather than strict adherence to idealized dietary patterns.

Fig.2/ Treatment Nutrition Priorities



Reassess

6 - Relapse & High Risk Nutrition

Relapsed Wilms tumor patients often face more intensive and prolonged treatment regimens, placing them at an even greater risk of nutritional compromise. The cumulative effects of prior therapy, combined with the demands of additional treatment, create a scenario in which aggressive and proactive nutritional management becomes essential.

These patients frequently experience higher metabolic stress, increased inflammation, and more severe treatment-related side effects, all of which contribute to increased energy expenditure and reduced intake. As a result, the risk of rapid nutritional decline is significantly elevated.

In this context, clinicians must adopt a lower threshold for intervention. While oral intake remains the preferred route of nutrition, it may not be sufficient in many cases. Early initiation of enteral nutrition can provide a reliable and controlled method of delivering nutrients, particularly when oral intake is inconsistent or inadequate.

When enteral feeding is not feasible due to gastrointestinal complications or severe intolerance, parenteral nutrition may be required. Although more invasive and associated with additional risks, it can be life-sustaining in maintaining nutritional status during critical phases of treatment.

Electrolyte imbalances are more common in high-risk patients and require close monitoring. Nutritional plans must be adjusted dynamically based on laboratory findings, clinical status, and treatment progression.

The psychological and emotional burden of relapse should not be overlooked. Food preferences, comfort eating, feeding fatigue, and caregiver dynamics all play a role in nutritional intake. A holistic approach, incorporating medical and psychosocial support, is essential in maintaining adequate nutrition during this challenging phase.

7 - Survivorship Nutrition

As pediatric Wilms tumor patients transition into survivorship, the focus of nutritional care shifts from acute support to long-term health optimization and prevention of late effects. While the intensity of treatment decreases, the long-term impact of therapy - particularly on renal and cardiovascular systems - requires ongoing attention.

Survivors may be at increased risk for hypertension, reduced kidney function, metabolic disorders, and cardiovascular disease, particularly if they have undergone nephrectomy or received nephrotoxic treatments. Nutrition plays a key role in mitigating these risks.

A balanced, whole-food-based diet is recommended, emphasizing fruits, vegetables, whole grains, lean proteins, and healthy fats. Reducing sodium intake remains important for maintaining healthy blood pressure and protecting renal function. Adequate hydration continues to support kidney health and overall physiological balance.

Growth and development must be closely monitored, particularly in younger children who may have experienced treatment-related delays. Nutritional intake should support catch-up growth where necessary, while avoiding excessive weight gain that could contribute to long-term health complications.

Physical activity, in conjunction with proper nutrition, is also an important component of survivorship care. Encouraging healthy lifestyle habits early helps establish patterns that can reduce the risk of chronic disease later in life.

Survivorship nutrition is not a static plan but an evolving strategy, tailored to the individual's medical history, current health status, and long-term risk profile.

8 - Clinical Nutrition Pathway

A structured clinical decision pathway provides a systematic approach to managing nutrition in pediatric Wilms tumor patients, ensuring consistency and timely intervention. This pathway typically follows a progression from assessment to intervention and escalation, guided by clinical indicators.

The first step is a comprehensive nutritional assessment, including anthropometric measurements such as weight, height, body mass index, mid-upper-arm circumference where available, growth trends, dietary intake evaluation, and relevant laboratory markers. This establishes a baseline and identifies patients at risk.

Based on this assessment, clinicians initiate oral nutrition optimization, focusing on increasing caloric density, improving meal frequency, and addressing barriers to intake. This stage often involves caregiver education and dietary modification strategies. If oral intake is insufficient to meet nutritional needs, the pathway escalates to enteral nutrition, which allows for controlled and consistent nutrient delivery while maintaining gastrointestinal function.

In cases where enteral feeding is not viable, parenteral nutrition provides an alternative route, though it requires careful monitoring due to associated risks such as infection and metabolic complications.

Continuous reassessment is essential at every stage. Nutritional needs can change rapidly due to treatment effects, disease progression, or recovery. The pathway must remain dynamic and responsive, ensuring that interventions are adjusted appropriately over time.

Fig.3/ Nutrition Escalation Pathway

Steps	Action	Practical Purpose
Step 1	Baseline nutritional assesment	Identify risk early and establish growth/ intake baseline
Step 2	Oral nutrition optimization	Increase intake with preferred foods, meal frequency, and calorie density
Step 3	Oral supplements/ fortified foods	Bridge gaps when regular intake falls short
Step 4	Enternal Nutrition	Provide reliable nutrition when oral intake is inadequate
Step 5	Parenteral nutrition	Use when enteral feeding is not possible or insufficient
Step 6	Reassessment and adjustment	Adapt plan as symptoms, renal function and treatment phase change

9 - Cargiver Guidance

Caregivers play a central and indispensable role in maintaining adequate nutrition for pediatric Wilms tumor patients. While clinical teams establish the overall nutritional strategy, it is caregivers who are responsible for the day-to-day implementation of feeding plans, monitoring intake, and responding to changes in the child’s condition. Caregiver education and support are therefore critical components of effective nutritional management.

One of the primary challenges caregivers face is navigating fluctuating appetite and treatment-related feeding difficulties. Children undergoing chemotherapy may experience sudden aversions to previously preferred foods, changes in taste perception, or discomfort associated with eating. These changes can be frustrating and emotionally taxing for both the child and caregiver.

Flexibility becomes essential. Rather than focusing on rigid meal structures, caregivers should prioritize overall caloric and nutrient intake, even if this requires adapting food choices based on the child’s preferences at any given time.

Establishing a routine of small, frequent meals - typically every two to three hours - can help maintain consistent intake without overwhelming the child. Offering calorie-dense, nutrient-rich foods in manageable portions is often more effective than attempting to encourage large meals. Creating a low-pressure, supportive mealtime environment can reduce anxiety and improve the child’s willingness to eat.

Hydration is another critical area of caregiver responsibility. Children may not always recognize or communicate thirst effectively, particularly when unwell. Caregivers should encourage regular fluid intake throughout the day, offering a variety of acceptable options such as water, oral rehydration solutions, or other clinically appropriate fluids.

Caregivers must also be equipped to recognize early warning signs of nutritional decline or clinical deterioration. These may include persistent vomiting, refusal to eat or drink, rapid weight loss, decreased urine output, or signs of dehydration such as dry lips and lethargy. Prompt communication with the healthcare team in response to these signs is essential to prevent complications.

Equally important is the emotional and psychological dimension of feeding. Mealtimes can become a source of stress during treatment, and caregivers may feel pressure to ensure their child eats enough. Providing reassurance, practical guidance, and access to professional support - such as pediatric dietitians - can help caregivers manage these challenges more effectively. Empowering caregivers with knowledge, flexibility, and support enables them to play an active and confident role in sustaining their child’s nutritional health throughout the treatment journey.

Fig.4/ Comparative Approach

Category	COG Approach	SIOP Approach
Timing	Immediate post-diagnosis support	Pre-operative stabilization
Focus	High calorie/ high protein	Hydration & stabilization
Escalation	Early enteral/ parenteral	Gradual escalation
Monitoring	Frequent labs & weight tracking	Growth & tolerance monitoring

10 - Clinical Insights & Outcomes

A growing body of evidence highlights the critical role of nutrition as a determinant of clinical outcomes in pediatric oncology. In the context of Wilms tumor, where treatment is often intensive but highly effective, nutritional status can significantly influence the child's ability to tolerate therapy, recover from treatment-related toxicity, and achieve optimal long-term outcomes.

Well-nourished patients consistently demonstrate improved tolerance to chemotherapy and radiation therapy, with fewer dose reductions or treatment delays. Adequate nutritional status supports immune function, reducing susceptibility to infections that can interrupt treatment schedules and prolong hospitalization. It also contributes to improved wound healing following surgical interventions, including nephrectomy.

Conversely, malnutrition is associated with a range of adverse outcomes. These include increased rates of infection, longer hospital stays, reduced physical resilience, and diminished response to treatment. In severe cases, malnutrition can necessitate modifications to treatment intensity, potentially compromising overall efficacy.

Beyond immediate treatment outcomes, nutrition also influences functional recovery and quality of life. Children who maintain better nutritional status during treatment are more likely to preserve muscle mass, sustain energy levels, and engage in normal developmental activities. This has important implications for both physical and psychosocial well-being.

Emerging research also suggests that early and sustained nutritional intervention may play a role in modulating long-term risk profiles, including the development of chronic conditions such as cardiovascular disease and metabolic disorders. This reinforces the importance of integrating nutrition into the broader continuum of care, rather than addressing it only when problems arise.

From a systems perspective, effective nutritional management can contribute to more efficient healthcare delivery, reducing complications, shortening hospital stays, and improving overall treatment efficiency. This is particularly relevant in resource-constrained settings, where optimizing supportive care can have a significant impact on outcomes.

Nutrition is not merely supportive - it is integral to the success of pediatric oncology treatment, with measurable effects on both clinical outcomes and long-term health trajectories.

11 - Conclusions

Nutrition is a foundational component of care in pediatric Wilms tumor, influencing every stage of the patient journey from initial diagnosis through treatment, relapse management, and long-term survivorship. While advances in oncologic therapies have dramatically improved survival rates, the full potential of these treatments can only be realized when supported by comprehensive, well-integrated nutritional care.

The complexity of nutritional management in this population reflects the interplay between growth requirements, treatment-related challenges, and organ-specific considerations - particularly the need to protect renal function. Addressing these factors requires a multidisciplinary approach, bringing together oncologists, dietitians, nurses, and caregivers to develop and implement individualized nutritional strategies.

A key theme throughout this document is the importance of early intervention and continuous monitoring. Nutritional decline can occur rapidly, but with proactive assessment and timely action, it is often preventable. Embedding nutrition into routine clinical pathways ensures that it is addressed systematically rather than reactively.

Equally important is the recognition that effective nutritional care extends beyond the clinical setting. Caregivers play a vital role in implementation, and their ability to support their child's nutritional needs depends on access to clear guidance, education, and ongoing support.

Looking forward, continued efforts are needed to standardize nutritional protocols, expand access to specialized care, and integrate nutrition into global pediatric oncology initiatives. This is particularly critical in low- and middle-income settings, where disparities in supportive care can significantly impact outcomes.

Positioning nutrition as a core pillar of pediatric cancer care - rather than an adjunct - has the potential to improve not only survival rates but also the quality of life and long-term health of children affected by Wilms tumor.

Appendix A

Fig.5/ Overview

Category	COG/ NWTS Tradition	SIOP Tradition	Nutrition Implication
Treatment Sequencing	Often emphasizes primary surgery followed by risk-adapted therapy	Often emphasizes preoperative chemotherapy followed by surgery and risk adapted therapy	Nutrition planning must anticipate different treatment timing, surgical recovery needs & symptoms patterns
Supportive Care Emphasis	Early multidisciplinary supportive care, including nutrition review when risk is identified	Stabilization before major intervention is important where preoperative therapy is used	Screening at diagnosis should occur regardless of treatment sequencing
Resouce Adaptation	Implemented mainly in high-resource cooperative group settings	Includes resource-adapted SIOP PODC and related collaborations	Locally available foods, caregiver education and pragmatic monitoring matter in lower resource settings
Renal Protection	Renal function, blood pressure and late effects are monitored in survivorship	Renal protection remains central to nephrectomy and nephrotoxic exposures	Dietary sodium moderation, hydration and individualized protein balance remain consistent priorities

Appendix B

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Wilms Cancer Foundation (WCF)

The Wilms Cancer Foundation (WCF), is a charitable organization, that supports and represents the needs of children, families and healthcare organizations affected by pediatric renal (kidney) cancer (particularly nephroblastoma commonly known as 'Wilms'). Its mission is to establish an international program of awareness, education, advocacy, early detection treatment and support to tackle the spread of the disease.

This WCF guide is for educational purposes only. It is based on international pediatric oncology standards in Canada, the United States and Europe. Seek advice from a qualified medical professional should you have any concerns or questions.

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