

Weight-for-Age Trajectories During SIOP-Based Treatment in Children With Unilateral Wilms Tumor: A 10-Year Real-World Cohort Study

Ramin Malikov¹, Reyman Ismayilzade¹, Iqbal Babazade^{2,3}, Gambar Ismayilov^{2,3}

Affiliations:

1. Department of Pediatric Surgery, National Center of Oncology, Baku, Azerbaijan
2. Medical Unit, National Defense University, Nakhchivan, Azerbaijan
3. Alturamedix Academy of Emergency & Critical Care, Baku, Azerbaijan

ORCID. <https://orcid.org/0009-0009-2858-9383>

ORCID. <https://orcid.org/0009-0004-3354-1521>

ORCID. <https://orcid.org/0009-0000-4283-3893>

ORCID. <https://orcid.org/0009-0004-8400-1867>

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Abstract

Background: Nutritional and anthropometric changes during cancer treatment may reflect disease burden, treatment toxicity, reduced intake, and changes in body composition. Longitudinal weight trajectories during Wilms tumor treatment remain insufficiently characterized. This study evaluated changes in weight-for-age percentile and their associations with clinical characteristics and survival outcomes in children with unilateral Wilms tumor.

Methods: This retrospective single-center cohort included 59 children with unilateral Wilms tumor treated according to SIOP-based principles between 2010 and 2020. Weight-for-age percentiles recorded before preoperative chemotherapy and after its completion before nephrectomy were compared using the Wilcoxon signed-rank test. Threshold transitions were assessed using exact McNemar tests, subgroup comparisons using Mann–Whitney U or Kruskal–Wallis tests, and OS and DFS using Kaplan–Meier analysis with exploratory univariable Cox regression.

Results: Median weight-for-age percentile decreased from 53.2 (IQR, 22.6–78.7) to 25.9 (IQR, 9.9–46.2), with a median within-patient change of –16.0 percentile points (IQR, –32.7 to –3.5; $p < 0.001$). Overall, 45/59 patients (76.3%) experienced a decline. The proportion below the exploratory 25th-percentile threshold increased from 28.8% to 47.5% ($p = 0.013$). Percentile change did not differ significantly across major clinical subgroups. Five-year OS was 93.5% in patients with post-treatment percentile ≥ 25 versus 82.1% in those < 25 ($p = 0.193$), while corresponding DFS rates were 87.1% and 75.0% ($p = 0.249$).

Conclusions: Children with unilateral Wilms tumor showed a significant decline in recorded weight-for-age percentile during treatment. This change was consistent across clinical subgroups and was not



significantly associated with survival outcomes. Tumor regression may partly contribute to the observed decline. Longitudinal anthropometric monitoring may be useful, but prospective studies incorporating body composition and broader nutritional assessment are needed.

Keywords: Wilms tumor; nephroblastoma; pediatric oncology; weight-for-age percentile; nutritional trajectory; SIOP; survival.

1 | Introduction

Wilms tumor is the most common malignant renal tumor of childhood and accounts for the majority of pediatric kidney cancers [1]. Contemporary multimodal treatment has resulted in long-term survival approaching 90% in many settings, although clinically meaningful heterogeneity persists according to stage, histology, and tumor biology [2].

The marked improvement in outcomes has largely resulted from international cooperative-group strategies and progressive refinement of risk-adapted therapy [3]. Within the SIOP approach, preoperative chemotherapy is used to reduce tumor burden and facilitate surgery, while postoperative treatment is adapted according to stage and histopathologic risk [4].

Current SIOP–RTSG strategies increasingly emphasize refinement of risk classification beyond conventional stage and histology, including dynamic clinical and biological characteristics observed during treatment [5]. Nevertheless, supportive-care factors that evolve during treatment have received substantially less attention than tumor-centered prognostic parameters.

Recent population-based data confirm high overall survival for Wilms tumor but also demonstrate persistent heterogeneity in outcomes, supporting continued efforts to identify clinically relevant treatment-course characteristics [6].

Nutritional status represents one such potentially important domain in pediatric oncology. Cancer, reduced oral intake, treatment-related gastrointestinal toxicity, systemic inflammation, and altered energy requirements may all contribute to changes in growth and body composition during therapy [7].

Consequently, nutritional assessment in pediatric oncology is increasingly viewed as a longitudinal process rather than a single baseline measurement. Multidimensional evaluation throughout therapy may identify clinically relevant changes that are not apparent from isolated measurements [8].

Both undernutrition and excess adiposity have been associated with treatment tolerance, morbidity, and functional outcomes in childhood cancer, although the magnitude and direction of these associations

vary considerably between diagnoses and treatment settings [9].

Assessment of body weight is particularly complex in Wilms tumor because a large abdominal tumor may itself contribute to measured body weight, while tumor regression, changes in hydration, and treatment-related alterations in body composition may influence subsequent measurements [10].

The primary aim of this study was therefore to evaluate longitudinal changes in recorded weight-for-age percentile during preoperative chemotherapy in children with unilateral Wilms tumor treated within a SIOP-based framework. Secondary aims were to examine whether these changes differed according to stage, risk group, radiologic treatment response, and radiotherapy exposure, and to explore potential associations between post-chemotherapy weight-for-age percentile and long-term survival outcomes.

2 | Materials and Methods

2.1. Study Design and Setting

This retrospective single-center cohort study was conducted at the National Center of Oncology, Azerbaijan. Consecutive pediatric patients with unilateral Wilms tumor treated according to SIOP-based principles between January 1, 2010 and December 31, 2020 were evaluated.

The study was designed and reported with reference to the Strengthening the Reporting

of Observational Studies in Epidemiology (STROBE) recommendations [11].

A total of 59 patients fulfilled the eligibility criteria and were included in the final analysis. Data were retrospectively extracted from clinical records, treatment files, radiologic examinations, pathology reports, and institutional follow-up records.

2.2. Eligibility Criteria

Patients were eligible if they were aged 0–18 years at diagnosis, had unilateral Wilms tumor, received SIOP-based preoperative chemotherapy, and had available pre- and post-chemotherapy weight-for-age percentile data together with essential clinical and outcome information.

Patients with bilateral Wilms tumor, recurrent disease at initial presentation, substantial treatment performed outside the study center, treatment not following the intended SIOP-based pathway, or unavailable key anthropometric data were excluded.

One patient had a stage value recorded as “VI” in the historical dataset. Because this category is not part of the Wilms tumor staging system used in the cohort and the original entry could not be reliably verified, this patient was excluded only from stage-specific analyses and retained in all other eligible analyses.

2.3. Treatment and Clinical Variables

All patients received preoperative chemotherapy according to SIOP-based



principles, followed by nephrectomy and regional lymph-node sampling when clinically indicated. Postoperative chemotherapy and radiotherapy were determined according to final disease stage and histopathologic risk.

Variables analyzed included age at diagnosis, sex, tumor laterality, disease stage, histologic subtype, risk group, radiologic response to chemotherapy, radiotherapy exposure, relapse, death, and duration of follow-up.

Radiologic response to preoperative chemotherapy was categorized as regression, stable disease, or progression according to the treatment-response information available in the clinical dataset.

2.4. Anthropometric Assessment

The principal anthropometric variable was the recorded weight-for-age percentile.

For each patient, two values were extracted:

1. pre-chemotherapy weight-for-age percentile, defined as the value documented before initiation of preoperative chemotherapy; and
2. post-chemotherapy weight-for-age percentile, defined as the value documented after completion of preoperative chemotherapy and before nephrectomy.

These time points were selected to represent the anthropometric trajectory during the preoperative chemotherapy interval.

Weight-for-age percentile values were abstracted exactly as documented in the historical clinical records. The specific pediatric growth-reference system used to generate these historical percentile values was not consistently documented in the available source records; therefore, no retrospective attribution to WHO, CDC, or another reference standard was made. This limitation was considered when interpreting the longitudinal percentile changes.

The within-patient percentile change was calculated as:

Δ percentile = post-treatment percentile – pre-treatment percentile.

A negative value represented a decline and a positive value represented an increase.

Patients were additionally categorized as having a decreased, unchanged, or increased percentile during treatment.

The primary endpoint was the within-patient change in weight-for-age percentile.

The post-treatment 25th percentile was used solely as an exploratory cohort-stratification threshold and was not considered a validated diagnostic cutoff for malnutrition. The 5th and 10th percentile thresholds were evaluated descriptively.

2.5. Survival Outcomes

Overall survival (OS) was defined as the interval from diagnosis to death from any cause or last known follow-up.

Disease-free survival (DFS) was defined as the interval from diagnosis to the first relapse, death, or last follow-up, whichever occurred first.

For patients without a DFS event, follow-up time was censored at the last available observation.

Survival comparisons according to post-treatment percentile <25 versus ≥ 25 were considered exploratory and were not intended to establish an independent prognostic or nutritional cutoff.

2.6. Statistical Analysis

Continuous variables were summarized using medians and interquartile ranges (IQRs), and categorical variables using frequencies and percentages.

Paired pre- and post-treatment weight-for-age percentiles were compared using the Wilcoxon signed-rank test.

Transitions across predefined percentile thresholds were evaluated using the exact McNemar test.

Continuous outcomes between two independent groups were compared using the Mann–Whitney U test. Comparisons involving three or more groups were performed using the Kruskal–Wallis test.

OS and DFS were estimated using the Kaplan–Meier method, and survival curves were compared using the log-rank test. Median follow-up was estimated using the reverse Kaplan–Meier method.

Exploratory univariable Cox proportional hazards models were used to estimate hazard ratios (HRs) with 95% confidence intervals (CIs).

Because only seven deaths and 11 DFS events occurred, multivariable Cox regression was not performed to avoid unstable estimates and model overfitting.

All tests were two-sided, and $p < 0.05$ was considered statistically significant. Exploratory findings were interpreted in conjunction with effect estimates and 95% CIs rather than on p values alone.

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 29.0.

2.7. Ethical Considerations

The study protocol was approved by the Ethics Committee of the National Center of Oncology, Baku, Azerbaijan (Protocol No. 073/2025; March 15, 2025).

The study was conducted in accordance with the principles of the Declaration of Helsinki. Because of the retrospective observational design and the use of anonymized patient data, the requirement for individual written informed consent was waived by the Ethics Committee.

3 | Results

3.1. Patient Characteristics

A total of 59 children with unilateral Wilms tumor were included. The median age at



diagnosis was 3.24 years (IQR, 1.87–4.38), and 33 patients (55.9%) were male.

Among the 58 patients with valid stage information, stage II and III disease predominated, accounting for 23/58 (39.7%) and 19/58 (32.8%) patients, respectively. Thirteen patients (22.4%) had stage IV disease and three (5.2%) had stage I disease.

Thirty-three patients (55.9%) were classified as intermediate risk and 23 (39.0%) as high risk. Blastemal and mixed histologic patterns were the most frequently recorded subtypes, each occurring in 17 patients (28.8%).

Radiologic regression after preoperative chemotherapy was documented in 50 patients (84.7%), stable disease in five (8.5%), and progression in four (6.8%).

During follow-up, 11 patients (18.6%) experienced relapse and seven (11.9%) died. Median follow-up estimated by the reverse Kaplan–Meier method was 94 months.

Baseline demographic, disease, treatment, and outcome characteristics are summarized in Table 1.

Table 1. Demographic, clinical, and pathologic characteristics of the cohort

Variable	Category	Result
Age at diagnosis, years	Median (IQR)	3.24 (1.87–4.38)
Sex	Female	26 (44.1%)
	Male	33 (55.9%)
Age group	0–24 months	23 (39.0%)

	24–60 months	29 (49.2%)
	>60 months	7 (11.9%)
Stage*	I	3/58 (5.2%)
	II	23/58 (39.7%)
	III	19/58 (32.8%)
	IV	13/58 (22.4%)
Risk group	Low	3 (5.1%)
	Intermediate	33 (55.9%)
	High	23 (39.0%)
Histologic subtype	Blastemal	17 (28.8%)
	Mixed	17 (28.8%)
	Biphasic	7 (11.9%)
	Mesenchymal	7 (11.9%)
	Triphasic	5 (8.5%)
	Epithelial	4 (6.8%)
	Other/mesoblastic	1 (1.7%)
	Anaplastic	1 (1.7%)
Preoperative chemotherapy response	Regression	50 (84.7%)
	Stable disease	5 (8.5%)
	Progression	4 (6.8%)
Radiotherapy	Yes	28 (47.5%)
Neutropenia	Any grade	29 (49.2%)
Anemia	Any grade	33 (55.9%)



Thrombocytopenia	Any grade	6 (10.2%)
Relapse	Yes	11 (18.6%)
Death	Yes	7 (11.9%)

*One patient had an unverifiable stage entry ("VI") and was excluded from stage-specific summaries; therefore, stage percentages use n=58 as the denominator.

3.2. Longitudinal Change in Weight-for-Age Percentile

The median pre-treatment weight-for-age percentile was 53.2 (IQR, 22.6–78.7), compared with 25.9 (IQR, 9.9–46.2) after completion of preoperative chemotherapy. The median within-patient change was –16.0 percentile points (IQR, –32.7 to –3.5), representing a statistically significant downward shift (Wilcoxon signed-rank $p < 0.001$).

At the individual level, 45/59 patients (76.3%) experienced a decrease in percentile, nine (15.3%) remained unchanged, and five (8.5%) demonstrated an increase.

The proportion of patients below the 5th percentile increased from 11.9% to 16.9%, although this transition was not statistically significant ($p = 0.453$). Likewise, the proportion below the 10th percentile increased from 16.9% to 25.4% ($p = 0.227$).

In contrast, the proportion below the exploratory 25th-percentile threshold increased from 17/59 (28.8%) before chemotherapy to 28/59 (47.5%) after chemotherapy. Fourteen patients moved from ≥ 25 th to < 25 th percentile, whereas three moved in the opposite direction (exact McNemar $p = 0.013$).

These longitudinal changes are summarized in Table 2.

Table 2. Change in weight-for-age percentile before and after preoperative chemotherapy

Indicator	Pre-treatment	Post-treatment	Change/transition	Statistical test	p value
Weight-for-age percentile, median (IQR)	53.2 (22.6–78.7)	25.9 (9.9–46.2)	–16.0 (–32.7 to –3.5)	Wilcoxon signed-rank	<0.001
Percentile decreased	—	—	45/59 (76.3%)	—	—
Unchanged	—	—	9/59 (15.3%)	—	—
Percentile increased	—	—	5/59 (8.5%)	—	—
<5th percentile	7/59 (11.9%)	10/59 (16.9%)	5 downward / 2 upward transitions	Exact McNemar	0.453



<10th percentile	10/59 (16.9%)	15/59 (25.4%)	8 downward / 3 upward transitions	Exact McNemar	0.227
<25th percentile*	17/59 (28.8%)	28/59 (47.5%)	14 downward / 3 upward transitions	Exact McNemar	0.013

*The 25th percentile was used only as an exploratory stratification threshold and not as a diagnostic criterion for malnutrition.

3.3. Weight-for-Age Trajectories Across Clinical Subgroups

The downward shift in weight-for-age percentile was observed across most clinical subgroups (Table 3).

Median change was -15.8 percentile points among girls and -16.4 among boys, with no evidence of a sex-based difference ($p=0.813$).

Changes also did not differ significantly across age groups ($p=0.511$).

A progressively greater numerical decline was observed with increasing stage: 0.0 percentile points in stage I, -15.1 in stage II, -16.0 in stage III, and -20.4 in stage IV. However, the overall stage-specific comparison was not statistically significant ($p=0.436$).

Similarly, the median decline was -18.5 in the high-risk group compared with -15.8 in the intermediate-risk group, but the overall risk-group comparison did not reach statistical significance ($p=0.115$).

Patients receiving radiotherapy had a median decline of -17.9 compared with -15.1 among

those who did not receive radiotherapy ($p=0.508$).

The largest numerical decline was observed among the four patients with radiologic progression during preoperative chemotherapy, with a median change of -30.3 percentile points. In comparison, median changes were -15.9 among patients with regression and -9.8 among those with stable disease. This difference was not statistically significant ($p=0.442$).

No significant difference in percentile change was detected according to subsequent relapse ($p=0.578$) or vital status ($p=0.460$).

Table 3. Change in weight-for-age percentile according to clinical subgroups

Variable/category	n	Median change (IQR), percentile points	p value
Sex			0.813
Female	26	-15.8 (-26.1 to -13.0)	
Male	33	-16.4 (-35.1 to 0.0)	



Age group			0.511
0–24 months	23	–15.8 (–35.8 to 0.0)	
24–60 months	29	–18.5 (–33.5 to –9.7)	
>60 months	7	–14.9 (–15.9 to –8.5)	
Stage*			0.436
I	3	0.0 (–13.0 to 0.0)	
II	23	–15.1 (–33.3 to –1.6)	
III	19	–16.0 (–29.0 to –1.9)	
IV	13	–20.4 (–37.1 to –13.4)	
Risk group			0.115
Low	3	0.0 (0.0 to 0.0)	
Intermediate	33	–15.8 (–35.1 to –4.1)	
High	23	–18.5 (–32.3 to –11.3)	
Radiotherapy			0.508
No	31	–15.1 (–31.6 to –3.5)	
Yes	28	–17.9 (–34.4 to –9.7)	
Chemotherapy response			0.442

Stable disease	5	−9.8 (−20.2 to 0.0)
Progression	4	−30.3 (−35.7 to −24.8)
Regression	50	−15.9 (−33.0 to −3.3)
Relapse		0.578
No	48	−15.9 (−31.5 to −2.4)
Yes	11	−17.3 (−35.3 to −11.4)
Vital status		0.460
Alive	52	−15.9 (−31.5 to −2.4)
Died	7	−28.7 (−35.3 to −11.4)

*Mann–Whitney U tests were used for two-group comparisons and Kruskal–Wallis tests for comparisons involving three or more groups. One unverifiable stage entry was excluded from the stage-specific analysis.

3.4. Exploratory Association With Survival Outcomes

Patients with a post-treatment weight-for-age percentile <25 demonstrated numerically lower survival than those with a percentile ≥25, although neither comparison reached statistical significance. These analyses were exploratory and were not intended to establish a prognostic cutoff.

Five-year OS was 93.5% in the ≥25th-percentile group and 82.1% in the <25th

percentile group (log-rank $p=0.193$; Figure 1).

Five-year DFS was 87.1% and 75.0%, respectively (log-rank $p=0.249$; Figure 2).

In univariable Cox regression, post-treatment percentile <25 was associated with an HR of 2.83 for death compared with ≥ 25 th percentile (95% CI, 0.55–14.59; $p=0.214$). The corresponding HR for DFS was 2.03 (95% CI, 0.59–6.93; $p=0.259$).

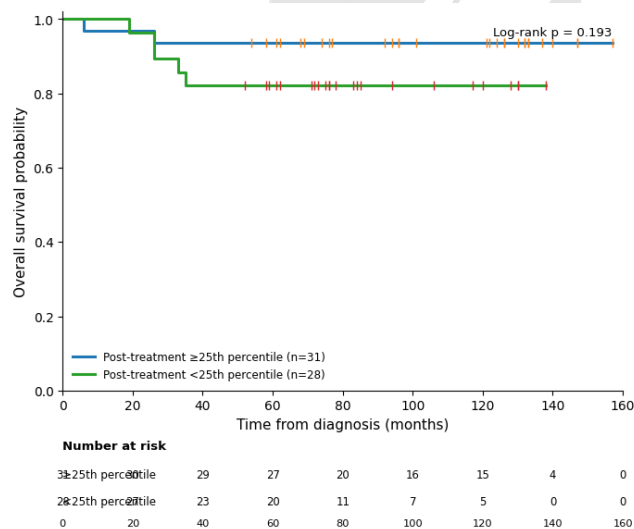


Figure 1. Overall survival according to post-treatment weight-for-age percentile: Kaplan–Meier curves comparing overall survival between patients with post-treatment weight-for-age percentile ≥ 25 and <25 . Five-year overall survival was 93.5% and 82.1%, respectively (log-rank $p=0.193$). Vertical tick marks represent censored observations. Numbers at risk are shown below the survival curves.

When percentile loss was analyzed continuously, each additional 10-point decline was associated with an HR of 1.17 for OS (95% CI, 0.85–1.61; $p=0.348$) and 1.10 for DFS (95% CI, 0.86–1.42; $p=0.441$).

Given the small number of outcome events and the resulting wide confidence intervals, these analyses were considered exploratory and hypothesis-generating rather than confirmatory.

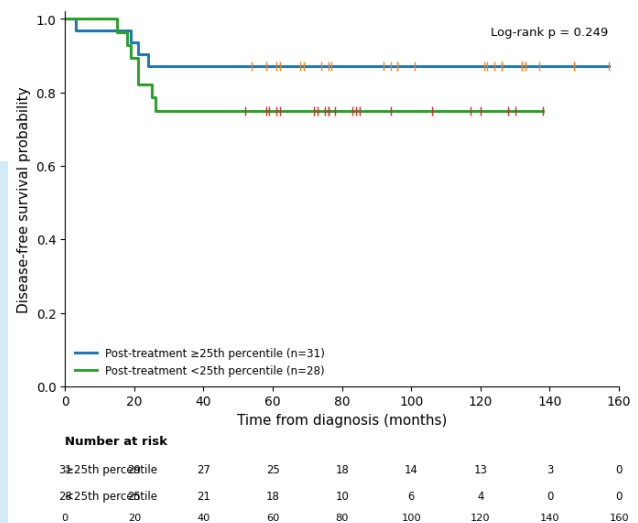


Figure 2. Disease-free survival according to post-treatment weight-for-age percentile: Kaplan–Meier curves comparing disease-free survival between patients with post-treatment weight-for-age percentile ≥ 25 and <25 . Five-year disease-free survival was 87.1% and 75.0%, respectively (log-rank $p=0.249$). Vertical tick marks represent censored observations. Numbers at risk are shown below the survival curves.



Table 4. Exploratory survival analysis according to post-treatment weight-for-age percentile

Abbreviations: CI, confidence interval; DFS, disease-free survival; HR, hazard ratio; OS, overall survival.

Endpoint	Group/exposure	n	Events, n	5-year survival	Log-rank p	Univariable (95% CI)	HR	Cox p
OS	Post-treatment percentile ≥ 25 th	31	2	93.5%	0.193	Reference	—	—
	Post-treatment percentile < 25 th	28	5	82.1%		2.83 (0.55–14.59)	0.214	
DFS	Post-treatment percentile ≥ 25 th	31	4	87.1%	0.249	Reference	—	—
	Post-treatment percentile < 25 th	28	7	75.0%		2.03 (0.59–6.93)	0.259	
OS	Each 10-point percentile decline	59	7	—	—	1.17 (0.85–1.61)	0.348	
DFS	Each 10-point percentile decline	59	11	—	—	1.10 (0.86–1.42)	0.441	

4 | Discussion

In this 10-year real-world cohort, the principal finding was a marked downward shift in recorded weight-for-age percentile during treatment for unilateral Wilms tumor. Median percentile decreased from 53.2 before chemotherapy to 25.9 after completion of preoperative chemotherapy, and approximately three-quarters of patients experienced an individual decline. Similar treatment-related changes in nutritional and anthropometric status have been reported across pediatric solid tumors, although the underlying mechanisms appear to vary

considerably by diagnosis and treatment exposure [12].

The proportion of children below the exploratory 25th-percentile threshold increased from 28.8% to 47.5%. Importantly, this threshold should not be interpreted as a diagnostic definition of malnutrition. Nutritional screening approaches in pediatric oncology remain heterogeneous, and no single anthropometric cutoff adequately captures the multidimensional nature of nutritional risk [13].



Accordingly, our results are more appropriately interpreted as demonstrating a downward weight-for-age trajectory rather than proving an increased incidence of malnutrition. Nutritional status in childhood cancer is dynamic and may change substantially between diagnosis, active treatment, and survivorship [14].

The clinical relevance of nutritional status has been investigated across several pediatric malignancies. Although many studies suggest associations with adverse outcomes, available evidence remains heterogeneous with respect to cancer type, anthropometric definition, timing of assessment, and survival endpoint [15].

This issue is especially relevant in children with large solid tumors. Conventional body weight may be influenced by tumor mass and therefore may not accurately represent lean tissue or nutritional reserves. In Wilms tumor specifically, part of the observed decline in weight-for-age percentile after preoperative chemotherapy may reflect reduction in tumor-associated body weight as the primary tumor regresses, rather than nutritional deterioration alone. Studies incorporating arm anthropometry have demonstrated that apparently acceptable body weight may coexist with clinically relevant nutritional depletion [16].

Future prospective studies in Wilms tumor should therefore complement serial body weight with height, BMI-for-age, mid-upper arm circumference, skinfold thickness, dietary assessment, and, where feasible,

direct body-composition measurements. Multidimensional nutritional assessment has increasingly been recommended in pediatric oncology because no single parameter fully characterizes nutritional status [17].

Arm anthropometry may be particularly useful in settings in which tumor mass affects total body weight. Mid-upper arm circumference provides a practical estimate of peripheral tissue reserves and may identify nutritional abnormalities not apparent from weight alone [18].

In the present cohort, percentile decline was not restricted to a particular stage or risk group. Although numerically greater declines were observed among patients with stage IV disease, high-risk tumors, and radiologic progression, these subgroup differences were not statistically significant. This supports the possibility that treatment-related changes in recorded body weight are influenced by multiple factors beyond tumor burden alone [19].

Body weight also cannot distinguish loss of skeletal muscle from changes in adipose tissue. Pediatric oncology studies have demonstrated that substantial alterations in body composition may occur despite relatively modest changes in conventional body size measures [20].

Furthermore, such changes may persist beyond active treatment. Studies evaluating children during therapy and survivorship have demonstrated lasting differences in fat mass and lean tissue compared with reference



populations, highlighting the importance of longitudinal rather than cross-sectional assessment [21].

Our exploratory survival analyses demonstrated lower numerical 5-year OS and DFS among children with a post-treatment percentile <25. However, neither comparison reached statistical significance, and confidence intervals around Cox estimates were wide. These findings should therefore be regarded as exploratory and hypothesis-generating and should not be interpreted as evidence that the 25th percentile represents an independent prognostic threshold. Previous pediatric cancer cohorts have reported associations between malnutrition, infectious complications, and survival, but these relationships should not be assumed to apply uniformly across individual tumor types [22].

Recent research has increasingly shifted from conventional weight-based assessment toward evaluation of body composition, including muscle and adipose compartments. Such parameters may provide additional information regarding functional reserve, treatment tolerance, and metabolic response to cancer therapy [23].

This issue may also have implications for chemotherapy exposure because conventional pediatric dosing commonly relies on body-surface area despite substantial interindividual variation in body composition. A recent systematic review from the SIOP Nutrition Network emphasized that relationships between

nutritional status, body composition, pharmacokinetics, and chemotherapy dosing remain insufficiently characterized in children and young people with cancer [24].

Strengths and Limitations: This study has several strengths. It represents a 10-year real-world cohort of children with unilateral Wilms tumor treated within a single SIOP-based clinical framework and includes paired pre- and post-chemotherapy weight-for-age percentile measurements for all analyzed patients. The study also evaluates longitudinal anthropometric changes together with clinical characteristics, treatment response, relapse, and long-term survival outcomes.

Several limitations should be considered when interpreting the findings. First, the retrospective, single-center design and relatively modest sample size may limit the generalizability of the results. Second, weight-for-age percentile alone does not provide a complete assessment of nutritional status. Other potentially informative parameters, including height, BMI-for-age, mid-upper arm circumference, skinfold thickness, dietary intake, laboratory nutritional markers, and direct body-composition measurements, were not systematically available.

Third, the specific historical growth-reference system used to calculate the recorded weight-for-age percentiles was not consistently documented in the source records. Therefore, the available percentile values were analyzed as originally recorded



without retrospective attribution to WHO, CDC, or another growth standard. This should be considered when comparing the present results with studies using prospectively standardized anthropometric references.

Fourth, measured body weight in children with Wilms tumor may be influenced by tumor mass. Consequently, part of the observed decline in weight-for-age percentile after preoperative chemotherapy may reflect tumor regression rather than nutritional deterioration alone. The present study could not separate these components precisely.

Finally, the relatively small number of deaths and relapses limited the statistical power of the survival analyses and resulted in wide confidence intervals. Multivariable Cox regression was therefore not performed to avoid unstable estimates and overfitting, and all survival analyses should be interpreted as exploratory and hypothesis-generating.

Despite these limitations, the consistent downward weight-for-age trajectory observed across most clinical subgroups supports the value of prospective studies incorporating standardized growth references, serial anthropometric measurements, and body-composition assessment during Wilms tumor treatment.

5 | Conclusion

In this 10-year real-world cohort, weight-for-age percentile declined significantly during preoperative chemotherapy in children with unilateral Wilms tumor. The decline was

observed across clinical subgroups and was not significantly associated with survival outcomes. Tumor regression may partly contribute to the observed weight change. These findings support longitudinal anthropometric monitoring, while emphasizing that weight-for-age percentile alone should not be considered a diagnostic marker of malnutrition. Prospective studies incorporating body composition and broader nutritional assessment are needed.

Author Contributions

R.M. and R.I. contributed to the conception and overall design of the study. R.M. supervised the clinical project and contributed to the interpretation of the clinical and surgical aspects of the cohort. I.B. and G.I. were responsible for data collection, database organization, and initial data processing. I.B. contributed to the literature review, statistical analysis planning, interpretation of the results, and preparation of the initial manuscript draft. G.I. contributed to data verification and interpretation of the clinical findings. R.M. and R.I. critically revised the manuscript for important intellectual and clinical content. All authors reviewed and approved the final version of the manuscript and agreed to its submission.

Ethics Approval

The study protocol was approved by the Ethics Committee of the National Center of Oncology, Baku, Azerbaijan.

Ethics Protocol No.: 073/2025

Approval date: March 15, 2025

The study was conducted in accordance with the principles of the Declaration of Helsinki. Because of the retrospective observational design and the use of anonymized patient data, the requirement



for written informed consent was waived by the Ethics Committee.

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This study received no external financial support.

Conflict of Interest

The authors declare that they have no conflicts of interest related to this study.

Data Availability

The data used in this study were obtained from the clinical database of the National Center of Oncology, Baku, Azerbaijan. The dataset is not publicly available because of institutional regulations and patient confidentiality requirements. De-identified data may be made available from the corresponding author upon reasonable request and subject to permission from the National Center of Oncology.

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