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Anxiety, depression and distress in pediatric oncology: Patterns from a single-center cohort

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Abstract: Children undergoing cancer treatment are at heightened risk for psychological difficulties, yet emotional symptom patterns during hospitalization remain incompletely characterized. This single-center observational cohort study examined anxiety, depressive symptoms, and psychological distress among hospitalized pediatric oncology patients at a tertiary care hospital. Anxiety was assessed using the Children's Anxiety scale, depressive symptoms were measured using the Depression Inventory and Patient Health Questionnaire, and global psychological distress was evaluated using the Distress Thermometer. Non-parametric statistical methods were applied to examine diagnosis-related differences and associations between anxiety and depressive symptoms. A total of 20 pediatric oncology patients were included. Overall, patients demonstrated elevated levels of anxiety, depressive symptoms, and psychological distress during hospitalization. Significant diagnosis-related differences were observed, with patients diagnosed with acute lymphoblastic leukemia exhibiting higher anxiety, depressive symptoms, and distress compared with patients diagnosed with acute myeloid leukemia and other malignancies. Anxiety and depressive symptoms showed a very strong positive association, indicating substantial co-occurrence and shared variance between these emotional domains. These findings indicate that emotional distress in pediatric oncology inpatients is both prevalent and highly interconnected, with diagnosis serving as a clinically meaningful context for psychological vulnerability. The results underscore the importance of integrated, diagnosis-informed psycho-oncological assessment and support the routine incorporation of comprehensive psychological screening into pediatric oncology care to facilitate early identification of high-risk emotional profiles and timely psychosocial intervention.

Keywords: pediatric oncology; anxiety; depression; psychological distress; diagnosis-specific patterns

1. Introduction

Advances in pediatric oncology have indeed led to substantial improvements in survival rates, transforming many childhood cancers from acute life-threatening conditions into chronic illnesses that require prolonged treatment and follow-up [1]. As survival rates have increased, clinical focus has broadened beyond mere biomedical outcomes to include the psychological and emotional well-being of children undergoing cancer treatment [2]. The environment of hospitalization, repetitive invasive procedures, and the uncertainties associated with treatment create an atmosphere where pediatric oncology patients are at heightened risk for emotional distress, primarily in the form of anxiety and depression [3,4]. This context highlights the necessity of comprehensive care in pediatric oncology, addressing

both physical and emotional health.

Anxiety and depressive symptoms are among the most frequently reported psychological difficulties in children with cancer. Fear regarding medical procedures, potential disease progression, separation from caregivers, and a general loss of control within the hospital environment contribute to this anxiety [5,6]. Coping with prolonged treatment courses, physical side effects, social isolation, and perceived threats to their future often leads to the emergence of depressive symptoms among affected children [7]. In clinical practice, it is noteworthy that these symptoms frequently coexist and fluctuate, reflecting intricate emotional responses to their illness rather than merely discrete psychiatric disorders [8]. Yet, much of the literature has, unfortunately, treated anxiety and depression as separate outcomes, consequently underestimating the degree to which these symptoms overlap and interact in pediatric oncology populations, thereby limiting the understanding of the overall psychosocial burden faced by these children [9].

In addition to anxiety and depressive symptoms, global psychological distress has been increasingly recognized as a clinically relevant construct in oncology care. Distress encompasses a broad range of emotional, cognitive, and behavioral responses to illness and treatment, capturing the cumulative psychological burden experienced by patients [10]. In pediatric oncology settings, this distress may reflect not only emotional symptoms but also fears related to prognosis, treatment demands, and family concerns [11]. Screening tools such as the Distress Thermometer have been widely adopted in adult oncology and are increasingly applied in pediatric populations as a rapid method for identifying patients who may benefit from further psychosocial evaluation [12].

Despite a growing recognition of psychological distress in pediatric oncology, several gaps remain in the literature. First, many studies focus on outpatient or survivorship populations, while fewer investigations examine hospitalized children during active treatment, a period often characterized by heightened emotional vulnerability [13]. Second, existing research frequently reports prevalence rates of individual symptoms without examining how anxiety, depression, and distress co-occur within the same patients [14]. Third, relatively little attention has been paid to diagnosis-related differences in psychological symptom burden, particularly in real-world clinical cohorts [15]. Understanding whether certain diagnostic groups are associated with higher emotional burden may inform more targeted psycho-oncological screening and intervention strategies [16].

Acute lymphoblastic leukemia (ALL) is the most common pediatric malignancy and is often associated with prolonged treatment duration, repeated hospital admissions, and extended periods of uncertainty. These features may contribute to heightened psychological vulnerability compared to other malignancies that have different treatment trajectories [17]. However, empirical evidence examining diagnosis-specific psychological patterns in hospitalized pediatric oncology patients is limited [1]. Furthermore, few studies have simultaneously assessed anxiety, depression, and distress within the same cohort to explore how these constructs align and overlap across diagnostic groups [18].

Within the psycho-oncology framework, there is increasing emphasis on moving beyond the assessment of individual symptoms towards a more integrated

understanding of emotional burden [19]. Conceptual models suggest that anxiety and depressive symptoms in medically ill children may represent interconnected responses to shared stressors rather than independent conditions [20]. From this perspective, examining the co-occurrence of anxiety and depressive symptoms alongside global distress may provide a more comprehensive understanding of psychological burden and inform more effective psychosocial care [21].

In this context, the present single center cohort study aimed to characterize anxiety, depressive symptoms, and psychological distress among hospitalized pediatric oncology patients and to examine diagnosis related patterns and symptom co-occurrence. By integrating symptom specific measures with a global distress assessment, this study sought to provide a nuanced description of emotional burden during active treatment. Particular attention was given to differences across diagnostic groups and to the degree of overlap between anxiety and depressive symptoms. Through this approach, the study aims to contribute clinically relevant evidence to support integrated, diagnosis informed psycho oncological assessment in pediatric oncology care.

2. Methods

2.1. Study design and setting

This study adopted a single center observational cohort design to examine anxiety, depressive symptoms, and psychological distress among hospitalized pediatric oncology patients. The study was conducted at Yinzhou People's Hospital, a tertiary care institution providing specialized pediatric oncology services. Psychological assessments were integrated into routine inpatient clinical care, allowing evaluation of emotional symptom burden in a real-world hospital context. The study was descriptive and exploratory in nature, with the primary aim of characterizing psychological symptom patterns and diagnosis related differences rather than testing causal hypotheses or intervention effects.

2.2. Participants and eligibility criteria

The study population consisted of pediatric patients admitted for cancer related treatment during the study period. Eligible participants were children with a confirmed diagnosis of malignancy who completed standardized psychological assessments during hospitalization. Inclusion criteria required availability of complete data for anxiety, depressive symptoms, and psychological distress measures. Patients were excluded if psychological assessment data were incomplete, missing, or could not be reliably scored according to standardized procedures. A total of 20 pediatric oncology patients met the eligibility criteria and were included in the final analysis. Given the exploratory design and limited inpatient cohort size, no a priori sample size calculation was performed.

2.3. Psychological measures

Anxiety symptoms were assessed using the Children's Anxiety scale, which captures emotional, cognitive, and somatic aspects of anxiety commonly experienced

by children undergoing medical treatment. Depressive symptoms were evaluated using the Depression Inventory, which measures affective, cognitive, and behavioral components of depression in pediatric populations. To further characterize depressive symptom severity, the Patient Health Questionnaire was also administered as part of routine clinical screening procedures. Global psychological distress was assessed using the Distress Thermometer, a brief screening tool widely used in oncology settings to capture overall emotional burden and identify patients who may require further psychosocial evaluation.

2.4. Demographic and clinical variables

Demographic variables included sex and age. Age was categorized into early childhood, middle childhood, and early adolescence to reflect developmentally meaningful stages while maintaining sufficient group sizes for statistical analysis. Clinical variables included primary cancer diagnosis, which was grouped into acute lymphoblastic leukemia, acute myeloid leukemia, and other malignancies. This grouping strategy was defined a priori and guided by clinical relevance and statistical feasibility, given the modest sample size. Grouping diagnoses in this manner allowed examination of diagnosis related differences in psychological symptoms without excessive fragmentation of diagnostic categories.

2.5. Data management and quality control

All data were anonymized prior to analysis to ensure patient confidentiality. Psychological scale scores were calculated according to standard scoring guidelines for each instrument. Data quality assurance procedures included checks for completeness, plausibility, and internal consistency. Range checks were conducted to identify potential data entry errors, and variable coding was verified before statistical analysis. These procedures were undertaken to minimize the risk of data processing errors influencing analytical results.

2.6. Statistical analysis

Statistical analyses were performed using SPSS software. Descriptive statistics were used to summarize demographic and clinical characteristics as well as psychological symptom scores. Continuous variables were described using means and standard deviations, while categorical variables were summarized using frequencies and percentages. Normality of psychological measures was assessed using the Shapiro-Wilk test. Given the small sample size and limited numbers within diagnostic subgroups, as well as evidence of non-normal distributions for some measures, non-parametric statistical methods were applied for inferential analyses.

Differences in anxiety symptoms, depressive symptoms, and psychological distress across diagnostic groups were examined using the Kruskal-Wallis test. Mean rank values were reported to describe relative differences between groups. Associations between anxiety and depressive symptoms were examined using Spearman rank correlation analysis. The strength of association was expressed using correlation coefficients, and shared variance between anxiety and depressive symptom measures was estimated by squaring the correlation coefficient to illustrate

symptom overlap. Diagnosis specific correlations were explored descriptively and interpreted cautiously due to small subgroup sizes.

All statistical tests were two tailed, and a significance threshold of $p < 0.05$ was applied. Given the exploratory nature of the study and the modest sample size, post hoc pairwise comparisons and multivariable regression analyses were not performed, as these approaches were considered inappropriate and potentially misleading in this context.

2.7. Ethical considerations

The study was conducted in accordance with ethical principles governing research involving human participants. All data were derived from routine clinical psychological assessments, and no additional procedures were introduced for research purposes. Patient confidentiality was maintained through data anonymization, and all analyses were performed on de identified datasets. The study posed minimal risk to participants and adhered to institutional standards for ethical conduct in clinical research.

3. Results

3.1. Participant characteristics

A total of 20 pediatric oncology patients were included in the final analysis. The study cohort consisted of 11 male patients accounting for 55.0% of the sample and 9 female patients representing 45.0%. In terms of developmental stage, the majority of patients were classified as being in middle childhood, with 11 children aged between 6 and 9 years, corresponding to 55.0% of the cohort. Early adolescence, defined as ages between 10 and 12 years, included 5 patients representing 25.0%, while early childhood, defined as ages between 3 and 5 years, comprised 4 patients accounting for 20.0%.

With respect to clinical diagnosis, acute lymphoblastic leukemia (ALL) was the predominant malignancy in this cohort, diagnosed in 14 patients, representing 70.0% of the total sample. Acute myeloid leukemia was diagnosed in 3 patients accounting for 15.0%, while the remaining 3 patients, also representing 15.0%, were diagnosed with other malignancies. A detailed summary of demographic and diagnostic characteristics is provided in **Table 1**.

Table 1. Demographic and clinical characteristics of the study cohort ($n = 20$).

Characteristic	Category	<i>n</i>	Percentage
Sex	Male	11	55.0%
	Female	9	45.0%
Age group	Early childhood (3–5 years)	4	20.0%
	Middle childhood (6–9 years)	11	55.0%
	Early adolescence (10–12 years)	5	25.0%
Primary diagnosis	Acute lymphoblastic leukemia (ALL)	14	70.0%
	Acute myeloid leukemia (AML)	3	15.0%
	Other malignancies	3	15.0%

3.2. Overall levels of anxiety, depression and psychological distress

Across the entire cohort, pediatric oncology patients demonstrated a substantial burden of psychological symptoms. Anxiety symptoms assessed using the Children's Anxiety scale yielded a mean score of 34.30 with a standard deviation of 5.30, indicating elevated anxiety levels in a large proportion of hospitalized patients. Depressive symptoms measured using the Depression Inventory demonstrated a mean score of 17.05 with a standard deviation of 4.15, suggesting the presence of moderate depressive symptomatology within the cohort.

Depressive symptom severity evaluated using the Patient Health Questionnaire showed a mean score of 7.25 with a standard deviation of 2.49, further supporting the presence of clinically meaningful emotional distress. In parallel, global psychological distress assessed using the Distress Thermometer revealed a mean score of 6.50 with a standard deviation of 1.28, with observed values extending into ranges commonly associated with significant distress in clinical settings. The overall distribution of anxiety, depression and distress scores is summarized in **Table 2**.

Table 2. Overall psychological symptom scores of pediatric oncology patients.

Measure	Mean $\pm$ SD	Minimum	Maximum
Children's anxiety (SCARED)	34.30 $\pm$ 5.30	25	45
Depression inventory (CDI)	17.05 $\pm$ 4.15	10	25
Patient health questionnaire (PHQ 9)	7.25 $\pm$ 2.49	3	12
Distress thermometer (DT)	6.50 $\pm$ 1.28	4	9

3.3. Diagnosis related differences in psychological distress

Psychological distress levels differed significantly across diagnostic groups. Non-parametric analysis using the Kruskal-Wallis test demonstrated a statistically significant difference in Distress Thermometer scores among patients with different primary diagnoses. Patients diagnosed with acute lymphoblastic leukemia exhibited the highest levels of psychological distress, as reflected by substantially higher mean rank values, compared with patients diagnosed with acute myeloid leukemia and those with other malignancies.

Specifically, patients with acute lymphoblastic leukemia demonstrated markedly greater distress burden relative to the other diagnostic groups, indicating that diagnosis was associated with meaningful variation in global psychological distress. The statistical comparison confirmed that these differences were significant, supporting the presence of diagnosis related variation in distress levels within this pediatric oncology cohort. Mean rank distributions and inferential statistics for distress by diagnosis are presented in **Table 3** and **Figure 1**.

Table 3. Diagnosis related differences in psychological distress.

Primary diagnosis	<i>n</i>	Mean rank (DT)
Acute lymphoblastic leukemia	14	13.11
Acute myeloid leukemia	3	4.83
Other malignancies	3	4.00

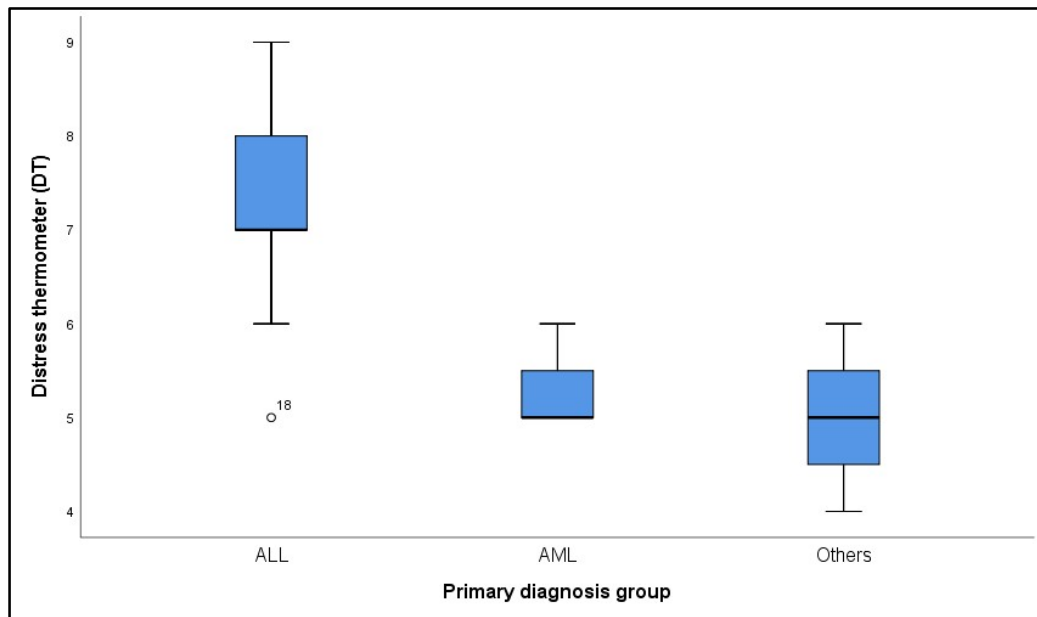


Figure 1. Distribution of psychological distress across primary diagnosis groups.

Note: Boxplots illustrate Distress Thermometer scores among pediatric oncology patients stratified by primary diagnosis. The central line represents the median, boxes indicate the interquartile range, and whiskers denote the minimum and maximum values. Distress levels differed significantly across diagnostic groups, with higher distress observed among patients with acute lymphoblastic leukemia compared with other diagnoses (Kruskal-Wallis test, $p = 0.008$).

3.4. Diagnosis specific patterns of anxiety and depressive symptoms

3.4.1. Anxiety and depressive symptom levels by diagnosis

Diagnosis specific differences were also evident for anxiety symptoms. Children diagnosed with acute lymphoblastic leukemia demonstrated the highest anxiety burden, with mean rank values indicating substantially greater anxiety compared with patients diagnosed with acute myeloid leukemia and those with other malignancies. The Kruskal-Wallis test confirmed that anxiety symptom levels differed significantly across diagnostic categories, indicating that anxiety burden varied according to cancer diagnosis.

A parallel pattern was observed for depressive symptoms. Patients with acute lymphoblastic leukemia exhibited the highest depressive symptom burden, followed by patients with acute myeloid leukemia and those with other malignancies. The difference in depressive symptoms across diagnostic groups was statistically significant, indicating that depressive symptom severity was not uniformly distributed across diagnoses. Diagnosis specific anxiety and depressive symptom levels are summarized in **Table 4**.

Table 4. Diagnosis specific anxiety and depressive symptom patterns.

Primary diagnosis	<i>n</i>	SCARED (Mean ± SD)	CDI (Mean ± SD)
Acute lymphoblastic leukemia	14	36.71 ± 4.20	19.00 ± 3.19
Acute myeloid leukemia	3	29.67 ± 2.08	13.33 ± 1.53
Other malignancies	3	27.67 ± 3.06	11.67 ± 2.08

Note: Kruskal-Wallis test for SCARED $H = 10.782$, $p = 0.005$; Kruskal-Wallis test for CDI $H = 11.114$, $p = 0.004$.

3.4.2. Co-occurrence of anxiety and depressive symptoms

Anxiety and depressive symptoms demonstrated a high degree of co-occurrence across the study cohort. Spearman rank correlation analysis revealed an extremely strong positive association between Children's Anxiety scores and Depression Inventory scores, indicating that higher anxiety levels were closely accompanied by higher depressive symptom severity among pediatric oncology patients as shown in **Table 5**.

Table 5. Correlation between anxiety and depressive symptoms.

Variables	Spearman, ρ	p -value
SCARED vs. CDI (overall cohort)	0.997	< 0.001

This association is further illustrated in **Figure 2**. When examined within diagnostic subgroups, this association remained robust within the acute lymphoblastic leukemia group, where anxiety and depressive symptoms were strongly correlated. Similar co-occurrence patterns were observed within the acute myeloid leukemia and other malignancy groups; however, these subgroup findings should be interpreted with caution due to the very small sample sizes within these diagnostic categories. Overall, the results indicate a substantial overlap between anxiety and depressive symptom burden in pediatric oncology patients, particularly among those diagnosed with acute lymphoblastic leukemia.

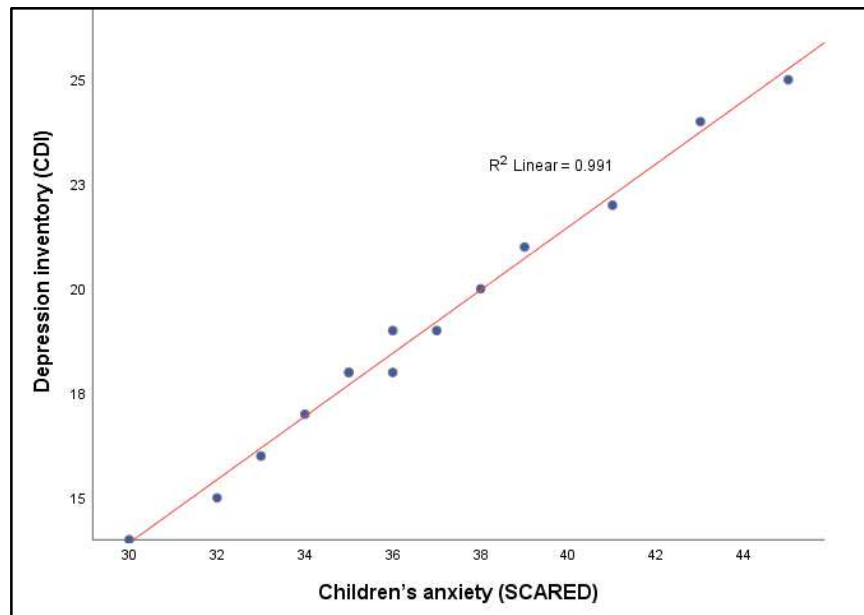


Figure 2. Association between anxiety and depressive symptoms in pediatric oncology patients.

Note: Scatter plot illustrating the relationship between Children's Anxiety (SCARED) scores and Depression Inventory (CDI) scores. A strong positive association was observed between anxiety and depressive symptoms (Spearman's $\rho = 0.997$, $p < 0.001$), with substantial shared variance between the two measures ($\rho^2 = 0.994$).

4. Discussion

This single center cohort study provides an in-depth examination of anxiety,

depressive symptoms, and psychological distress among hospitalized pediatric oncology patients, with particular emphasis on diagnosis related patterns and the co-occurrence of emotional symptoms. The findings reveal a substantial psychological burden across the cohort, with anxiety, depression, and distress demonstrating consistent convergence rather than isolated presentation. Notably, patients diagnosed with acute lymphoblastic leukemia exhibited the highest levels of emotional burden across all psychological measures, suggesting that diagnosis represents an important contextual factor in understanding psychological vulnerability in pediatric oncology [22–24].

The overall symptom levels observed in this cohort indicate that emotional distress is a prominent feature of the inpatient pediatric oncology experience. Anxiety and depressive symptoms were elevated to clinically meaningful levels, while distress thermometer scores suggested that many patients were experiencing significant global distress. These findings are consistent with psycho-oncological models that conceptualize pediatric cancer as a chronic stressor characterized by uncertainty, repeated medical procedures, and disruption of normal developmental trajectories [25,26]. Importantly, the simultaneous elevation of anxiety, depression, and distress suggests that emotional responses in pediatric oncology are rarely confined to a single domain. Instead, symptoms appear to cluster, reflecting a broader internalizing emotional response to illness and treatment related stress [27,28].

A central contribution of this study lies in the identification of diagnosis related differences in emotional symptom burden. Across all psychological measures, patients diagnosed with acute lymphoblastic leukemia demonstrated significantly higher distress, anxiety, and depressive symptoms compared with patients diagnosed with acute myeloid leukemia or other malignancies. This pattern was consistent across non-parametric analyses and was evident in both symptom specific measures and global distress assessment [29–31]. Several clinical characteristics of acute lymphoblastic leukemia may contribute to this heightened vulnerability, including prolonged treatment duration, frequent hospital admissions, extended periods of uncertainty regarding treatment response, and the psychological burden associated with long term maintenance therapy [32–34]. Although the present study does not permit causal inference, the convergence of findings across multiple psychological outcomes supports the clinical relevance of diagnosis informed psychological screening [35,36].

The Distress Thermometer emerged as a particularly sensitive indicator of diagnosis related variation in emotional burden. Higher distress scores among patients with acute lymphoblastic leukemia suggest that distress captures the cumulative impact of multiple emotional stressors rather than functioning as an isolated construct [22]. The close alignment between distress levels and both anxiety and depressive symptoms reinforces the conceptualization of distress as a global marker of psychological strain [37,38]. From a clinical perspective, this finding supports the use of distress screening as an initial point of assessment, followed by more detailed evaluation of specific symptom domains when elevated distress is identified [39].

One of the most striking findings of this study is the exceptionally strong

association between anxiety and depressive symptoms. The near perfect correlation between Children's Anxiety and Depression Inventory scores indicates substantial overlap in emotional symptom burden within this pediatric oncology cohort. This degree of co-occurrence suggests that anxiety and depressive symptoms may represent closely intertwined emotional responses to illness related stressors rather than distinct and independent conditions [27,40]. Such overlap has important implications for clinical assessment and intervention, as reliance on single domain screening tools may underestimate the complexity of emotional distress experienced by pediatric oncology patients [41,42].

Within the acute lymphoblastic leukemia subgroup, the association between anxiety and depressive symptoms remained robust, indicating tightly coupled emotional symptom patterns among patients experiencing the highest overall psychological burden. Although similar co-occurrence patterns were observed in other diagnostic groups, these findings must be interpreted cautiously due to limited subgroup sample sizes. Nevertheless, the consistency of anxiety depression co-occurrence across the cohort underscores the importance of integrated psychological assessment approaches that address overlapping emotional domains rather than treating anxiety and depression as entirely separate entities [43,44]. From a clinical standpoint, these findings highlight the potential value of diagnosis informed and symptom integrated psycho oncological care. Patients with acute lymphoblastic leukemia may benefit from early and proactive psychological screening, with particular attention to the simultaneous presence of anxiety and depressive symptoms [36,45]. Interventions that target shared emotional processes such as emotional regulation, coping strategies, and distress tolerance may be especially effective in addressing the clustered symptom profiles observed in this study [46,47]. Integrated psychosocial interventions may therefore offer advantages over symptom specific approaches in pediatric oncology settings [48].

Several limitations of this study warrant consideration. The single center design and modest sample size limit the generalizability of the findings, and small subgroup sizes restrict the precision of diagnosis specific analyses. The cross-sectional nature of the data precludes examination of symptom trajectories over time or causal relationships between diagnosis and psychological outcomes. Despite its limitations, this study provides clinically relevant insights by capturing psychological symptom patterns within a real world inpatient pediatric oncology setting. The use of routinely administered psychological measures enhances ecological validity and reflects assessment practices that are feasible within busy clinical environments. By highlighting consistent diagnosis related patterns and strong symptom co-occurrence, the findings offer a foundation for hypothesis generation and underscore the need for further research that integrates psychological assessment into routine pediatric oncology care pathways.

Future research should seek to replicate these findings in larger, multicenter cohorts to enhance statistical power and generalizability. Longitudinal designs would be particularly valuable for examining changes in anxiety, depression, and distress across different treatment phases and survivorship. Further exploration of developmental, familial, and treatment related factors may also deepen understanding of mechanisms underlying diagnosis specific psychological

vulnerability. Importantly, intervention focused studies are needed to determine whether early identification of high-risk emotional profiles translates into improved psychological and clinical outcomes for pediatric oncology patients

5. Conclusion

This study provides a detailed examination of anxiety, depressive symptoms, and psychological distress among hospitalized pediatric oncology patients within a single center clinical setting. The findings demonstrate that emotional burden is both substantial and multifaceted during active cancer treatment, with anxiety, depression, and distress showing strong convergence rather than occurring as isolated psychological phenomena. Together, these results highlight the importance of considering psychological wellbeing as a core component of pediatric oncology care alongside biomedical treatment outcomes.

A key contribution of this study is the identification of diagnosis related differences in emotional symptom burden. Patients diagnosed with acute lymphoblastic leukemia consistently exhibited higher levels of anxiety, depressive symptoms, and psychological distress compared with patients diagnosed with other malignancies. This pattern suggests that diagnosis may serve as a clinically meaningful context for identifying children at elevated psychological risk during hospitalization. Although causal mechanisms cannot be inferred, the consistency of diagnosis related gradients across multiple psychological measures underscores the relevance of diagnosis informed psycho oncological assessment.

The strong co-occurrence observed between anxiety and depressive symptoms further emphasizes the need for integrated approaches to psychological screening and intervention. Rather than conceptualizing anxiety and depression as distinct and independent conditions, the findings support a more holistic understanding of emotional distress in pediatric oncology, in which overlapping symptoms reflect shared responses to illness related stressors. Incorporating both global distress screening and symptom specific assessment may therefore enhance the identification of children who require targeted psychosocial support.

This study contributes clinically relevant evidence to the growing field of pediatric psycho oncology by highlighting diagnosis specific vulnerability and the interconnected nature of emotional symptoms during hospitalization. These findings support the routine integration of comprehensive psychological screening into pediatric oncology practice and provide a foundation for future research aimed at refining assessment strategies and developing interventions that address the complex emotional needs of children undergoing cancer treatment.

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