



RELATIONSHIP BETWEEN AGE AND THE OCCURRENCE OF DEPRESSION SYMPTOMS IN CHILDREN WITH ACUTE LYMPHOBLASTIC LEUKEMIA

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ABSTRACT

In children and adolescents, depressive symptoms often presenting as irritability, anhedonia, or behavioral changes. Despite significant advancements in survival rates due to improved therapeutic protocols, the psychological burden experienced by children with ALL. Objective: To evaluate the relationship between age and the presence of depressive symptoms in children diagnosed with ALL. Methods: A cross-sectional study was done using consecutive sampling with 40 children aged from 7 to 18 years old acquired, conducted from August to October 2024 at the outpatient unit of Adam Malik Hospital, Medan. Forty children aged 7–18 years with a confirmed diagnosis of ALL were included. Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9). Categorical variables were analyzed using the chi-square test, followed by bivariate to identify significant predictors of depression. Results: Among the 40 participants, the most age group were children ≤ 10 years old (65%). A statistically significant association was found between age group and the presence of depressive symptoms ($p = 0.001$, $OR = 33,3$). Conclusions: Age is significantly associated with the severity and presence of depressive symptoms in pediatric patients with ALL. Older children were more likely to report higher levels of depression. Psychological evaluation and targeted mental health support may be especially important in older age groups.

Keywords: acute lymphoblastic leukemia; age-related mental health; depressive symptoms; pediatric oncology; PHQ-9

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INTRODUCTION

Acute lymphoblastic leukemia (ALL) is the most prevalent cancer in children, accounting for approximately 25% of all pediatric malignancies and around 77% of all childhood leukemia cases (Siegel et al., 2013; Garniasih et al., 2022). Characterized by the uncontrolled proliferation of immature B or T lymphoblasts, ALL originates from abnormalities in the bone marrow and lymphoid organs, leading to disrupted hematopoiesis and decreased leukocyte production (Hunger & Mullighan, 2015). Despite significant advancements in survival rates due to improved therapeutic protocols, the psychological burden experienced by children with ALL remains a major concern. Studies report that up to 58% of pediatric ALL patients exhibit psychiatric symptoms, particularly depression and anxiety, which can negatively impact treatment adherence, quality of life, and overall outcomes (Khalifa et al., 2014); Nazari et al., 2014).

Depression is a common psychiatric disorder, with a global prevalence of approximately 10% in the general population and up to 20% in clinical settings. (Association, 2015). In children and adolescents, depressive symptoms can manifest subtly, often presenting as irritability, anhedonia, or behavioral changes, and may be exacerbated by chronic illness and long-term hospitalization. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) defines a Major Depressive Episode (MDE) by the presence of five or more symptoms over a two-week

period, including persistent sadness or loss of interest, changes in appetite or sleep, psychomotor disturbances, fatigue, cognitive impairment, feelings of worthlessness, and suicidal ideation. The Patient Health Questionnaire-9 (PHQ-9), adapted from DSM-5 criteria, has become a widely used and validated screening tool for identifying depression, even in pediatric populations. Its Indonesian version has shown promising results in clinical research and practice, offering a practical and culturally relevant instrument for assessing depressive symptoms (Levis et al., 2019; Spitzer et al., 1999; Kroenke et al.). Emerging evidence suggests that demographic and clinical variables—such as age, disease phase, and treatment burden—may influence the severity and likelihood of depression in pediatric ALL patients. However, findings across studies remain inconsistent due to variations in methodology, population characteristics, and assessment tools. Notably, age has been identified as a potential predictor of depression, yet the strength and nature of this association are not fully understood. By identifying age-related risks, this research hopes to contribute to early psychological intervention strategies that can support mental health alongside oncological treatment. This study aims to explore the relationship between age and the presence of depressive symptoms in children with acute lymphoblastic leukemia using the PHQ-9. This research was conducted with to study about the effect of acute lymphoblastic leukemia to depression level of children.

METHOD

This study is an observational analytical study with a cross-sectional design conducted at the Child Hematology and Oncology Clinic at Adam Malik Hospital, Medan. Data were collected through direct interviews with parents from August 1st to October 31st, 2024. The subjects of the study were LLA patients aged 7–18 years, who met the inclusion and exclusion criteria, using consecutive sampling. All patients and parents were informed about the purpose of this study and signed the informed consent form. This research has been approved by the Health Research Ethics Committee of the University of North Sumatera with No. 430/UN5.2.1.1.11/KRK/2024 and from Health Research Ethics Committee of the Adam Malik General Hospital with No. DP.04.03/D.XXVIII/7648/2024. The inclusion criteria for this study were LLA patients aged 7–18 years, diagnosed by a Pediatric Hematology and Oncology, who were taking chemotherapy from the induction phase to the maintenance phase at the Haji Adam Malik Central General Hospital. The exclusion criteria included patients LLA who is relapse, taking sedative drugs, and those are not fulfill the questioner. Parents were provided with a verbal explanation of the study, followed by obtaining written informed consent. The collected data included patient identity, diagnosis, and age group from medical record. The data in this study were processed using SPSS Statistic version 29.0 (SPSS Inc., Chicago, IL). The data are displayed as categorical data in the form of proportions. The relationship between age and the occurrence of depression was analyzed using chi square test, and bivariate analysis was used to identify associated variables.

RESULT

The total sample was 40 pediatric ALL patients who met the inclusion criteria. Based on the demographic characteristics of the study subjects, the majority of children with acute lymphoblastic leukemia (ALL) in this study were male (62.5%), aged ≤ 10 years (65%), classified as high-risk ALL (60%), received treatment for ≤ 1 year and > 1 year equally (50%), were in the maintenance phase (50%), and underwent ≤ 3 types of therapy (55%), as detailed in Table 1. The level of depression in children with acute lymphoblastic leukemia is classified into three categories: mild, moderate, and severe depression. The management provided is based on the level of depression, categorized as either not requiring intervention or requiring intervention. The majority of depression levels among children with ALL were classified as mild depression, with 14 cases (35%), while moderately severe depression was found in 9 cases (22.5%), as shown in Table 2.

Table 1.
Characteristics of Subjects with Acute Lymphoblastic Leukemia.

Characteristics	f(%)
Gender	N (%)
Male	25 (62,5%)
Female	15 (37,5%)
Age (Years)	
≤ 10 Years old	26 (65%)
> 10 Years old	14 (35%)
LLA Type	
Standart Risk (SR)	15 (40%)
High Risk (HR)	25 (60%)
Duration of therapy	
≤ 1 year	20 (50%)
> 1 year	20 (50%)

Table 2.
Proportion of Depression Levels in Pediatric Patients with Acute Lymphoblastic Leukemia

Depression Severity	f (%)
Minimal/None	12 (30%)
Mild	14 (35%)
Moderate	5 (12,5%)
Moderately Severe	9 (22,5)
Severe	0 (0%)
Therapy Groups Based on Depression Levels	n (%)
No intervention needed	31 (77,5%)
Intervention needed	9 (22,5%)

Based on table 2, it was found that 31 patients (77.5%) did not require further intervention based on their level of depression, while 9 patients (22.5%) required further intervention. In this study, the majority of children in the ≤10 years age group had depression syndrome that did not require intervention, accounting for 25 (62.5%) individuals. Meanwhile, in the >10 years age group, 8 (20%) patients required further intervention for their depression issues. This study found that age group influenced depression syndrome in children with acute lymphoblastic leukemia by 33.3 times. The relationship between age group and depression syndrome in children was statistically significant (p=0.001) and can be seen in Table 3.

Table 3.
Relationship Between Age Groups and Depression Levels in Children

Age Group	Depression Syndrome		OR	95% CI		P value
	No intervention needed	Intervention needed		Lower	Upper	
≤10 Years Old	25 (62,5%)	1 (2,5%)	33,3	3,472	319,9	0.001 ^a
>10 Years Old	6(15%)	8 (20%)				

DISCUSSION

Acute lymphoblastic leukemia (ALL) is the most prevalent hematologic malignancy in children, characterized by the uncontrolled proliferation of immature lymphoid cells in the bone marrow and peripheral blood. It accounts for nearly 25% of all childhood cancers and approximately 77% of pediatric leukemia cases. (Ma et al., 2014; Larson & Anastasi, 2007) In 2013, the Cancer Control and Supportive Care Committee (CCL) has focused efforts on childhood complications of cancer, namely: (i) infection and inflammation, (ii) malnutrition and metabolic dysfunction, (iii) chemotherapy-induced nausea and vomiting, (iv) neuro- and ototoxicity and (v) patient quality of life. (Sung et al., 2013)The adverse psychological impacts were initially thought to arise due to the psychological trauma of the cancer diagnosis and treatment itself. Other factors, such as treatment often being intense and toxic, as well as

the cancer diagnosis, cause significant stress and anxiety to the child's mental and psychological health. (Tanner et al., 2023) Previous studies have shown that children with cancer shown psychiatric abnormalities such as depressive symptoms, lower self-esteem and poorer quality of life compared to children without cancer. Depression is a common psychiatric disorder with prevalence about 3% in younger children and about 8% in adolescents. (Merikangas KR et al., 2010)

While advances in treatment have significantly improved survival outcomes, the psychosocial burden faced by children with ALL remains substantial and often under-addressed in clinical settings. In a 2018 study conducted in Canada, it was shown that around 10% to 30% of pediatric LLA patients experience psychiatric disorders. (Anestin et al., 2018). Previous studies exploring depression in pediatric ALL patients have primarily focused on its presence or timing of onset, with relatively limited attention to the severity of depressive symptoms. Although a study reported that pediatric LLA patients experience emotional difficulties similar to their peers. (Marcoux et al., 2012) Since and age at diagnosis are essential predictors that influence the experience and prognosis of individuals with cancer. (Sherief et al., 2015) (Ho et al., 2019) A review by Margaret and Eric (2006) noted that many studies failed to establish a consistent link between age and depression among pediatric cancer patients, highlighting the need for more nuanced investigations. In contrast to earlier findings, our study demonstrates a significant association between age and the severity of depression in children diagnosed with ALL. This finding is particularly important, as it suggests that age-specific factors may influence not just the presence, but the depth and complexity of depressive symptoms. Notably, our results differ from those of Rivas-Molina et al. (2015), who, in a study of children aged 7–16 years undergoing chemotherapy, found no significant relationship between age and depression severity.

Our findings are more aligned with research conducted by Heo et al. (2022), using data from the Health Insurance Review and Assessment Service (HIRA), which reported a higher prevalence of depressive disorders in the 10–18 year age group (6.2%) compared to children aged 0–9 years (2%). This age-related difference may reflect developmental disparities in emotional processing, illness perception, and coping mechanisms. Younger children may lack the cognitive and emotional maturity to fully grasp the implications of a leukemia diagnosis or the prolonged and often painful treatment journey. Additionally, their limited verbal expression may hinder the articulation of psychological distress, leading to potential underreporting of symptoms. In Adolescent population, Pain itself is associated with depression, and there likely exists a bidirectional relationship between greater pain symptoms and depression. (Kroenke et al., 2010) Adolescent also report greater concerns about body image and sexuality; fertility concerns; and cognitive dysfunction and evidence of more negative changes in quality of life and subjective distress. (Howard-Anderson et al., 2012) (Avis et al., 2005).

Most cancer patients with depression do not receive appropriate treatment for their mood disorder. A failure to appreciate the impact of depression on cancer care, ambiguity in diagnosis, and lack of access to appropriate mental health services all contribute to this gap in care. (Walker & Sharpe, 2014). In 2009, US population based Behavioral Risk Factor Surveillance System, reported that adolescent cancer survivors reported poorer mental health twice as frequently as adolescent without cancer. (Tai et al., 2012). Patients 15 years and older were at highest risk for depression severe enough to warrant hospitalization within the first year following a cancer diagnosis, and remained at elevated risk in subsequent years. (Dalton et al., 2009) In contrast, adolescents possess a greater awareness of their illness and its potential consequences, including fears surrounding mortality, changes in body image, disruption in academic and social life, and feelings of isolation. These stressors can heighten

emotional vulnerability and contribute to more severe depressive symptoms. Furthermore, adolescence is already a critical developmental period marked by identity formation and emotional sensitivity, making it a particularly vulnerable stage when intersecting with a life-threatening illness such as ALL. These findings underscore the importance of implementing age-sensitive mental health screening and intervention strategies for paediatric ALL patients. Routine psychological assessment using validated tools like the PHQ-9 can facilitate early identification of at-risk individuals, allowing timely psychosocial support tailored to their developmental needs.

CONCLUSION

The presence of group classification is associated with the severity of depression in pediatric ALL patients. Age is significantly associated with the severity and presence of depressive symptoms in pediatric patients with ALL. Psychological evaluation and targeted mental health support may be especially important in older age groups.

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