

# The Manifestations of Social Maladjustment in Children With leukemia at Different Ages: A Descriptive Qualitative Study based on Phenomenology

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## Research Article

**Keywords:** leukemia, children, social adaptation, qualitative research

**Posted Date:** February 5th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-153206/v1>

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# Abstract

## Background

Leukemia is a pediatric malignancy with the highest incidence rate and large onset age span. Children with leukemia at different ages show various social maladjustments after illness, which are mainly reflected in psychological and behavioral changes. It is of great significance to improve children's social adaptation level and purposefully prevent children from having social adaptation problems.

## Objective

To describe the social adaptation problems faced by Chinese children with leukemia at different ages, and to provide the basis for formulating targeted preventive intervention strategies.

## Method

The purpose sampling method was adopted to conduct semi-structured interviews on 20 Chinese children with leukemia and their main caregivers, and the Colaizzi phenomenological research method in the qualitative research was used to organize and analyze the data.

## Results

The existing social adaptation problems of children with leukemia at different ages were summarized. In terms of psychological maladjustment, children with leukemia aged 2~7 years showed "fear and excessive attachment"; Children with leukemia aged 8-18 years are characterized by "Impatience, irritability and anxiety". In terms of behavioral maladjustment, children with leukemia aged 2~7 years have the problem of "less independent behavior" and "dependence on electronic products"; Children with leukemia aged 8-18 years showed "learning obstruction" and "indulging in mobile games".

## Conclusions

Develop targeted intervention strategies based on the physical and mental characteristics of children with leukemia at different ages to improve their existing social adaptation problems. Pay attention to early intervention in the social adaptation of children with leukemia. Predictably improve the social adaptation level of children to prevent more adaptation problems, so that children can smoothly return to their families and society and improve their quality of life in the long term.

## Introduction

Leukemia ranks first in incidence among pediatric malignancies, and is a major disease that seriously threatens the lives and health of children[1]. From 2016 to 2018, the average annual incidence of leukemia among children aged 0–14 in China was 42.9 per million and the number of leukemia cases every year was about 8,000[2]. Leukemia might occur in children at any age, but the peak age is generally

between the birth and fourteen years old. With significant progress in treatment methods, leukemia and other blood system tumors have changed from fatal diseases to chronic diseases[3]. At present, the 5-year long-term survival rate of children with leukemia is 87.8%[4]. The burden of childhood cancer in China ranks second in the world[5], and the health burden of childhood leukemia survivors accounts for the highest proportion. Two-thirds of childhood leukemia survivors have long-term health complications due to treatment, including psychosocial problems related to their illness experience[3].

Social adaptation means that in the process of interaction between individuals and their environment, people ultimately maintain a dynamic balance with the social environment through adapting to the environment, adjusting themselves or changing the environment to maintain the stability of physical and mental activities[6]. Children with leukemia are in a special period of growth and development. Two to three years of repeated hospitalization, isolation from their peers and poor life experience have led to various social adaptation problems in children with leukemia due to changes in their living environment[7]. The study found that the incidence of maladjustment risk of childhood cancer survivors led by leukemia is as high as 23%[8], which is mainly reflected in psychological and behavioral changes. The social adaptability of children with malignant tumors such as leukemia is significantly lower than that of normal children of the same age[9]. Therefore, it is urgent to improve the social adaptation of children with leukemia.

China attaches great importance to the special group of children with leukemia. National Health Medical Development [2018] No. 16 pointed out: We must commit to the treatment of children with leukemia, perfect the monitoring and evaluation intervention mechanism, and provide comprehensive and full-cycle health services. At present, there have been relevant researches on the social adaptation of children at all ages or left-behind children, children with autism and other special groups of children. A few scholars are also concerned about the social adaptation ability of children with malignant tumors. However, there is no study on the problems related to social adaptation in children with leukemia. The study has three main purposes. The first one is to explore the social adaptation status and problems faced by children with leukemia at different ages. The second one is to provide theoretical basis for accurately evaluating the social adaptation level of children with leukemia and early prevention and intervention of their social adaptation problems. The last one is to help improve the social adaptation level of children with leukemia, so that children with leukemia can smoothly return to their families and society.

## **Materials And Methods**

### **Participants**

This study adopted the purposive sampling method to select children with leukemia admitted to the Department of Hematology Oncology, Children's Hospital of Chongqing Medical University between August 2020 and November 2020 as the study object. A research[10] had shown that, 8 years of age and older children and teenagers have independent self-reported health and psychological feeling ability, based on which, the inclusive criteria for children with leukemia were: (1) children diagnosed with

leukemia by clinical bone marrow examination, unlimited disease types, including acute and chronic leukemia, various subtypes such as lymphocytes and myeloid leukemia; (2) The age of the included children with leukemia was divided as follows: According to whether the child has the ability to independently report, the children from the age of 2 to 18 years old were divided into two groups. One group was 2 to 8 years old, and the interviewees in this group were replaced by the primary caregivers of the children. The other group was 8 to 18 years old, and the interviewees in this group were the children themselves. (3) Children with leukemia stayed in hospital for more than 1 week. (4) At least one of the child and his main caregiver could communicate effectively. (5) Child and his main caregiver volunteered to participate in this study and signed an informed consent form. The exclusion criteria for children with leukemia were: (1) The child had mental illness or a history of mental illness; (2) The child had other major diseases, such as other malignant tumors, severe cardiovascular diseases and other organic diseases; (3) The child and their main caregiver had language expression and communication barriers. The researchers obtained general information of the children with the help of the head nurse. The final sample size was composed of 20 children, and there were 12 boys and 8 girls. The general information of the children with leukemia is shown in Table 1.

**Table 1 General information of children with leukemia**

Number	Gender	Age(y/m)	Leukemia subtype	Number of hospitalizations	Main caregiver
1	Female	3/5	common ALL	6	Parents
2	Male	4/1	common ALL	12	Mother
3	Male	10/1	T-ALL	15	Father
4	Female	12/10	APL	6	Mother
5	Female	11/1	Pre-B ALL	11	Father
6	Male	5/5	B-ALL	22	Mother
7	Female	13/6	common ALL	4	Grandmother
8	Male	4/3	common ALL	3	Father
9	Male	7/11	common ALL	2	Parents
10	Male	15/1	APL	6	Mother
11	Female	2/1	AML	1	Parents
12	Male	9/1	ALL	Not sure (relapse)	Father
13	Male	12/11	ALL	2	Mother
14	Female	4/8	AML	4	Mother
15	Female	11/6	AML	3	Mother
16	Male	5/11	T-ALL	3	Parents
17	Male	10/9	AML	3	Mother
18	Male	6/2	common ALL	Not sure (relapse)	Mother
19	Male	9/1	T-ALL	1	Mother
20	Female	6/10	common ALL	1	Mother

NOTE: y: year; m: month; common ALL: Acute common lymphocytic leukemia; T-ALL: Acute T lymphocytic leukemia; APL: Acute promyelocytic leukemia; Pre-B ALL: Acute Pre-B Lymphocytic Leukemia; B-ALL: Acute B lymphocytic leukemia; ALL: Acute lymphocytic leukemia; AML: Acute myeloid leukemia

### Compliance with ethical requirements

This study was approved by the Ethics Committee of Children's Hospital of Chongqing Medical University in 2020, and the batch number is (2020) Ethical Review (Research) No.5. Before the interview, the researchers introduced themselves to the leukemia children and their caregivers and let them know the

purpose, content of the study and the necessity of on-site recording. In addition, researchers should strictly follow the principle of confidentiality, replace the names of the children with numbers, and not reveal children's information. An informed consent form was signed by the children's main caregiver, and interviews were recorded throughout the entire process. This study completely followed the principle of voluntariness. All children had the right to withdraw at any time during the study.

### **Data collection**

Between August 2020 to November 2020, conduct face-to-face semi-structured interviews with the interviewees using the phenomenological research method in the qualitative research theory method. The interview was arranged in a quiet and suitable place, and each interview lasted about 30-40 minutes. The content of the interview outline drawn up for different age groups is shown in Table 2. Encourage interviewees to fully express their feelings and thoughts maintaining a neutral attitude during the interview, and objectively record non-verbal symbolic information such as tone, intonation and expression. After the interview, the data would be sorted out. If there were unclear questions, a second interview could be arranged with the interviewee to clarify the unclear information and ensure the accuracy of the collected data. Data were collected until no new themes emerged, i.e., the interview would be terminated once data saturation was achieved.

### **Table 2 Semi-structured interview outline for children of different age groups**

	<b>2 to 7 years old (interview the main caregiver of the child)</b>	<b>8 to 18 years old (interview the child himself)</b>
<b>Interview outline</b>	☒What was your child's life like during a day in hospital? Were there any discomforts? (Life and treatment)	☒What was your life like during a day in hospital? Was there anything you were not used to? (Life and treatment)
	☒Who was currently taking care of children and what was the mode of getting along with them? Could children take care of themselves? How about hands-on ability?	☒Who was currently taking care of you, and how did you get along? Could you take care of yourself?
	☒Does the child usually have any hobbies? Did the child like something or do something after being sick?	☒Do you usually have hobbies? Did you like something or do something after you are sick?
	☒Did your child change before and after the illness? What are the changes? (Character, behavior, emotion, etc.)	☒Did you change before and after your illness? What are the changes? (Character, behavior, interpersonal communication, learning, etc.)
	☒Does the child often experience anxiety, fear or repeated bad moods? Why? (Crying, tantrum, etc.)	☒Do you often experience anxiety, fear or repeated bad moods? Why? (Shortness of breath, palpitation, etc.)
	☒Does the child have siblings, and how does the child get along with them?	☒Do you have siblings and how do you get along with them?
	☒How does the child get along with strangers and did they cooperate with the medical staff for treatment?	☒Did you feel that you were basically isolated from the outside world because of illness? Why?
	☒What help and support did the child get during the hospitalization?	☒What help and support did you get during your hospital stay?
	☒Do you think it would be difficult for your child to return to a normal life after being discharged from the hospital? If so, please give us an example?	☒Would you have any plans for your life after you leave the hospital? Are there any difficulties in returning to a normal life? If so, please give us an example?

## Data analysis

Within 24 hours after the interview, the recording materials and the researchers' on-site observations would be converted into written text materials in time, and the data would be analyzed using the 7 steps of Colaizzi phenomenological research and analysis: (1) Read the collected information carefully and be fully familiar with it; (2) Analyze the data word by word, identify and extract important and meaningful statements related to the research question; (3) Construct/code meaning of recurring and meaningful opinions; (4) Collect the coded opinions, find meaningful common concepts, and form the prototype of the theme; (5) Describe each topic in detail, and extract and add typical original statements from interviewees; (6) Put similar themes and their descriptions together for repeated comparisons, identify

and extract similar views, construct and sublimate themes; (7) Return the generated topic structure to the interviewee for verification of the content.

## Quality Control

Before the formal interview, conduct pre-interview based on the preliminary outline of the interview, so as to correct and improve the topic and make the interview more fluent and practical[11]. The researcher had first learned the interview skills and related precautions, and started the interview after equipping with a certain interview ability. When selecting interview subjects, fully consider the representativeness of the research subjects, and select samples based on the age, gender, disease diagnosis, number of hospitalizations, education level of the main caregiver and family economic status. Before collecting data, establish a friendly and trusting relationship with children and their main caregivers, reduce the Hawthorne effect, and conduct quality control through self-reflection and other methods[12]. After the interview, the recording was converted into text information, and the second person would check the original material with the final material. After data analysis, the researcher would confirm the final information with each interviewee, checking whether it is consistent with their feelings, and ensuring the truthfulness and accuracy of the data. When summarizing information, we should start from the perspective of the interviewee to improve the credibility and objectivity of the results.

## Results

Children with leukemia at different ages presented different social adaptation states, and the existing social adaptation problems were not completely the same. As children with leukemia grow older, various social adaptation problems may occur. Analyzing the social adaptation problems and their causes at various ages is of great significance for the targeted improvement of the current status of maladjustment of children with leukemia and the improvement of their level of social adaptation. The social adaptation problems of children with leukemia at different ages summarized in this study are shown in Fig 1.

### Psychological maladaptation in children with leukemia aged 2 to 7 years

This study found that with the increase in hospitalization time and the number of hospitalizations, the level of social adaptation of children aged 2 to 7 years had an increasing tendency. Children with outgoing personality and good family support adapted better, but most children showed obvious psychological maladjustment in the initial stage of hospitalization, which was summarized as follows:

#### (1) Fear

Fear was the adverse emotional reaction of a child after a long period of hospitalization and a series of operations required for diagnosis and treatment. It was also a manifestation of the child's psychological maladjustment. The child cried because he was afraid of injections and waist puncture, and his low coordination affected the treatment of the disease.

*N1: "The child cried when she saw the medical staff."*

*N8: "The child was afraid of injections, and would cry. We worry that the child will shrink and become timid in the future."*

*N9: "The child was feared and was afraid of the injection at first. When hearing the injection, he started crying and was afraid of waist piercing and taking medicine. He didn't cooperate at the beginning. He was still a bit uncooperative after two months."*

*N11: "Child was afraid of injections. She was afraid when she arrived at the hospital and saw the nurse uniform."*

## **(2) Excessive attachment**

Early childhood is an important stage for the formation of the sense of security and optimism. During hospitalization, children had to experience changes in their living environment and were forced to undergo various treatments. They were prone to insecurities. In addition, with the caregivers' love and compassion for the children, many children had strong attachment emotions, and more of them manifested separation anxiety[13]. It was difficult for children to produce joyful emotions, which also affected learning and development in other fields.

*N1: "The child was very dependent on me (his mother) and could not leave without me (his mother)."*

*N16: "After the child was sick, his attachment emotion was stronger and depended on us (parents) more."*

*N20: "She was very dependent on me (mother) after she was sick, I (mother) had always taken care of her."*

## **Psychological maladaptation in children with leukemia aged 8 to 18 years**

This study found that there were differences in the psychological adaptation problems faced by children with leukemia at different ages. As the children grow older, their cognitive level continues to improve, and their understanding of disease knowledge increases. Children aged 8 to 18 years had more psychological activities than children aged 2 to 7. Generally speaking, children with outgoing personality, wide-ranging hobbies and positive family education had a good social adjustment, however, some children aged 8 to 18 faced the following psychological adjustment problems:

### **(1) Impatience and irritability**

The side effects of drugs and long-term hospitalization had changed the children's temperament, and they were prone to irritability and tantrums. In addition, adolescents are in a psychological transition period, and their independence and self-awareness are increasing. Some children have rebellious psychology and often conflict with caregivers, which would not only affect the development of the parent-child relationship, but also is not conducive to the recovery of children's diseases.

*N5: " After I got sick, I got a bad temper. I became a little irritable and lost my temper with my mother."*

*N17: "After I got sick, I was very upset. If they (parents) talked too much, I would be very impatient and quarrel. Sometimes it was annoying after hearing them talk too much, and I wanted to give up."*

## **(2) Anxiety**

Most children were afraid of bone puncture, waist puncture, chemotherapy, etc. These treatments brought them a series of discomfort. Before each operation, the children would feel nervous and anxious but with a good cooperation, which is significantly different from the fear of young children. In addition, with the improvement of children's cognitive abilities, older children were not satisfied with their learning, interpersonal communication needs due to hospitalization, and they were more worried about the adverse effects of treatment and physical appearance Change.

*N12: "The waist piercing was too painful and the bone piercing hurt more. I was afraid, but there was no other choices. I was worried that the indwelling needle could not be pierced so that I needed many times because my blood vessels were not good for piercing."*

*N17: "I was afraid of bone piercing and chemotherapy. I suffered from stomach pain during chemotherapy, but I cooperated with the doctor."*

*N7: "I also checked the information and learned about the disease. I was worried about recurrence. I could only take one step at a time. I had a bad interpersonal relationship in junior high school. I worried about changes in appearance so that people who were familiar with me would have strange eyes on me."*

## **Behavioral maladaptation in children with leukemia aged 2 to 7 years**

The age of 2 to 7 years is a critical period for the development of children's social behavior, which includes social communication and life ability. This study found that children aged 2 to 7 years with leukemia were prone to behavior changes due to the influence of their own diseases and surrounding environment during hospitalization, which hindered the positive development of their social behavior. Summarize their behavior maladjustment as follows:

### **(1) Decrease in independent behavior**

The children had a decline in physical function due to the disease and treatment. Coupled with a strong psychological attachment, they gradually lost the existing self-care ability in behavior and reduced their independent behavior. The infant stage is a period of extremely rapid physical and functional development of children. The formation of the bad habit of over-dependence would affect the development of their initiative and independence.

*N2: "The child couldn't take care of himself well. He was very dependent on me (his mother), and I had to feed him for meals."*

*N16: "The child was more dependent after being sick and he could take care of himself before."*

## **(2) Dependence on electronic products**

Children with leukemia between 2 and 7 years old were limited in their range of activities during the hospitalization. Communication between peers was reduced, and the frequency of using electronic products was higher. Many caregivers also used mobile phones as a placebo for children when they cry. The children relied on electronic products, and most of them liked watching cartoons or browsing Tik Tok on mobile phones.

*N11: "The child prefer to spend time on mobile phone after she was sick, and she would cry if we didn't give it to her, so we (parents) usually gave it to her."*

*N16: "The child was very addicted to electronic products, and he would be angry if he was not allowed to play."*

*N20: " The child liked spending time on mobile phones after he was sick, and he often looked at his mobile phone in the ward."*

## **Behavioral maladaptation in children with leukemia aged 8 to 18 years**

Children with leukemia in their adolescence have a rapid development of intelligence and cognitive ability. Compared with their early childhood, they have more social needs and thirst for learning. Long-term and repeated hospitalization had caused the children to face many challenges of role conversion and environmental changes. Some children had insufficient self-regulation ability, and it was inevitable that bad behavior changes would occur. The summary was as follows:

### **(1) Learning was blocked**

The experience of repeated hospitalization made the children with leukemia aged 8 to 18 years had to take time off or leave school, and be unable to go to school for a normal study life. Their study time was reduced and academic performance declined. What's more, communication and interaction with teachers and classmates were also relatively reduced, for which the children felt distressed and worried about profound impact on the future study life.

*N10: "After I got sick, I only worried about the decline in grades."*

*N11: "I couldn't go to school in hospital and I felt very uncomfortable."*

*N15: "I was worried about delaying my studies and repeating the grade. I was taking a leave of absence to be hospitalized."*

*N19: "For going to school, I wanted to hang out with my classmates. I also felt that illness had delayed a lot."*

### **(2) Addicted to electronic products**

During the hospitalization, due to environmental changes and limitations, the children with leukemia aged 8 to 18 years had been separated from their peers for a long time, and their hobbies and social needs could not be met. Mobile games became the main entertainment of the children. Long-term use of electronic products and indulging in mobile games had further reduced the interaction between the child and others, which is not conducive to the development of children's social skills, and also affects their return to normal learning and life.

*N5: "Because I was hospitalized, I played more games, and I would be very upset if my rank dropped."*

*N13: "I can talk with you while playing games, I usually play games almost all day."*

*N17: "I liked playing games during my hospital stay as it was too boring."*

*N19: "I like playing games with friends, and I used to play games during hospitalization."*

## Discussion

**Children with leukemia at different ages had different degrees of social adaptation problems, and it was of great significance to formulate targeted early intervention strategies**

The findings of this study demonstrated that in terms of psychological adaptation, children with leukemia aged 2 to 7 years mainly had adverse emotional reactions such as fear and excessive attachment. Children with leukemia aged 8 to 18 years mainly showed irritability, anxiety and worry, indicating that children with leukemia at different ages performed different psychological stresses. Han J[14] concluded that the feelings of 7~14-year-old leukemia children at the initial hospitalization period were mainly sadness, fear and worry, impatience and irritability, which was consistent with the findings of this study. However, they did not clarify the difference in the psychological changes of children with leukemia in childhood and adolescence. Other related studies had shown that children and adolescents with leukemia are more likely to have symptoms such as anxiety and depression than their peers[15], and their suicidal tendency and absolute risk of post-traumatic stress in adulthood are higher than those of normal adults[16], suggesting that the psychological adaptation problems of children with leukemia had far-reaching effects. From hospitalization to discharge and adulthood, they may be affected by negative emotions.

In terms of behavioral adaptation, children with leukemia aged 2 to 7 years in this study generally had the problem of reduced independent behavior; children with leukemia aged 8 to 18 years faced learning difficulties. There were differences in the life needs of children with leukemia at different ages. Young children had poor autonomy and stronger attachment emotions. They hope to be taken care of by their parents and medical staff, and gain a sense of security in the close attention of caregivers[14]; Older children pursued higher-level needs and began to pay attention to learning; in addition, children at any age were dependent on or addicted to electronic products, but children at different ages paid attention to different content, which was directly related to the increasing popularity of electronic products and the

fact that children are exposed to electronic products at a younger age. A study has shown[17] that excessive use of electronic products could bring psychological problems such as insecurity, depression, tension, and anxiety, also lead to staying up late, impaired parent-child relationship, impaired school relationship and various behavioral problems which are not conducive to the physical and mental health of children. Other studies have shown that the overall detection rate of neurotic behavior problems in children with leukemia is higher than that of normal children of the same age[18], and survivors of childhood leukemia are more likely to have symptoms such as antisocial behavior and impaired social skills than their peers[15]. The risk of their unemployment in adulthood is also 50% higher than that of the general population[19]. After being ill, children with leukemia, from short-term treatment to long-term survival, have behavioral maladaptation varying in different ages, showing a long-term and persistent trend.

Lake A[20] proposed that early childhood experience will affect their life. In view of the continuous development of children, during the hospitalization of children with leukemia, it is imperative to identify and timely intervene in their social adaptation problems. According to the physical and mental characteristics of children with leukemia at different ages, early intervention strategies are formulated for social adaptation, which can fundamentally prevent or reduce the occurrence of social maladjustment in children with leukemia.

### **Analyze the social adaptation problems of children with leukemia at different ages and provide suggestions for the formulation of early intervention strategies**

#### **(1) Psychological maladaptation:**

☒ Fear and attachment: According to the findings of this study, for children with leukemia between 2 and 7 years old, medical staff should pay attention to their emotional reactions during hospitalization, and first ensure a comfortable and warm environment when conducting diagnosis and treatment. Anwei Xie[21] found that children with leukemia hoped that pictures of kids could be hung on the wall during waist puncture, and that medical staff could wear overalls with colorful cartoon patterns, which may eliminate the children's fear on the hospital environment and medical staff. Liu Qun[22] stated that the implementation of comfort care could obviously eliminate the nervousness and fear of children with leukemia, and medical staff should pay attention to a kind attitude and establish a trusting relationship with the children, increasing the children's sense of security and improving their attachment mood.

☒ Impatience, irritability, anxiety and worry: First of all, because of the lack of disease-related knowledge, children feel anxious about the prognosis of the disease. Medical staff should give timely explanation and help to promote them to adapt to a series of changes brought by the disease and better cooperation with the treatment. During hospitalization, through resilience intervention in stress management[23], children's coping ability and appropriate use of relaxation techniques can be improved, such as taking deep breaths to relieve pain. In addition, sand play therapy is a kind of psychotherapy suitable for children with emotional and behavioral disorders[24], which can be considered for children with leukemia. The therapy helps children express and talk frankly in their hearts in a safe environment, clarify and

change distorted and unhealthy modes of thinking, and liberate themselves from negative and repressed emotions.

## **(2)Behavioral maladaptation:**

☒Decrease in independent behavior: Children need careful care, but caregivers should not overprotect, so as not to deprive children of the opportunity to learn independently and hinder the development of their hands-on ability. In view of this, caregivers should change the concept of completely replacing children with care, maintain the children's self-care ability as far as possible within the children's ability, and encourage the children at appropriate time, praise their positive and correct behaviors to enhance their self-confidence. Providing care alternately is recommended so as to avoid over-dependence on one caregiver.

☒Learning interruption: For children with leukemia aged 8 to 18, their learning needs have to be met. In view of the vigorous development of online education during the Covid-19 epidemic, children with leukemia could use online resources to learn independently. In addition, during their hospitalization, children of similar ages could be arranged to live in the same ward when conditions are available, and a relatively quiet ward environment with a better learning atmosphere could be provided as much as possible, so as to alleviate the trouble that children could not study normally due to hospitalization.

☒Reliance on or addiction to electronic products: Children with leukemia of all ages have problems using electronic products for a long time during hospitalization. On the personal side, encourage children to develop more hobbies and social skills, and strengthen communication with others ; On the family side, caregivers need to strictly require and supervise the children at all times, adopt a positive and optimistic family parenting method[25], accompany the children to extensively expose to the strange world, and turn video games into one of the children's interests, rather than all of them; In terms of social support, it is recommended to set up leisure activity areas in the ward. During the period of diagnosis and treatment, on the premise of safety, increase the ways of leisure and entertainment for children, and strengthen the communication and interaction between peers, so as to effectively prevent children from indulging in electronic products due to long time alone. In addition, with the popularization of smartphones, some medical institutions have promoted the cognitive, physical and mental health of children and adolescents through virtual "toys" based on digital media[26], and electronic games have been initially used in child health and health management[27]. In the future, we can design scientific and practical health management game software for children with leukemia, or game-based social adaptation assessment tools for children with leukemia, so that children are able to correctly evaluate and promote physical and mental health through games. At the same time, it is helpful for children to use electronic products scientifically and rationally.

## **Research limitations**

This study is a qualitative study. The sample size is determined on the principle of data saturation. The number of interviews is limited, and there may be incomplete and inaccurate summary topics. In addition,

this study adopts purpose sampling and there are certain limitations in the representativeness of the demographic characteristics of the selected children, and the deficiencies in the study could be further improved in the future.

## **Conclusion**

In this study, 20 children with leukemia or their caregivers were interviewed by phenomenological research methods, and the current situation of social adaptation of children with leukemia at different ages was discussed. This paper summarized the psychological and behavioral adaptation problems they face and put forward targeted early intervention strategies, which provided a reference basis for clinically promoting the social adaptation of children with leukemia. In the future, in order to reduce and improve the social adaptation problems of children with leukemia and ultimately improve their long-term quality of life, we could strengthen the research on early identification and intervention of social adaptation of children with leukemia, deeply explore the key influencing factors of social adaptation of children with leukemia, and construct early warning and intervention strategies for the risk of social adaptation of children with leukemia.

## **Declarations**

### **Ethics approval and consent to participate**

All procedures performed in study involving human participants was in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was approved by the Ethics Committee of Children's Hospital of Chongqing Medical University in 2020, and the batch number is (2020) Ethical Review (Research) No.5. All study participants give their written informed consent prior to their participation, and the informed consent was obtained from the caregivers only and not the children under 18.

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

The data presented in this study is available from the corresponding author on request.

### **Competing interests**

The authors declare that they have no competing interests

### **Funding**

## Authors' contributions

Xinyue Tang wrote the main manuscript text and Qian Liu and Yixuan Liu prepared figure 1. Lu Yu and Yang Liu provided help and support in collecting data. Chunhai Gao provided methodological guidance. Lin Mo checked the manuscript. All authors reviewed the manuscript.

## Acknowledgments

Not applicable.

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## Figures

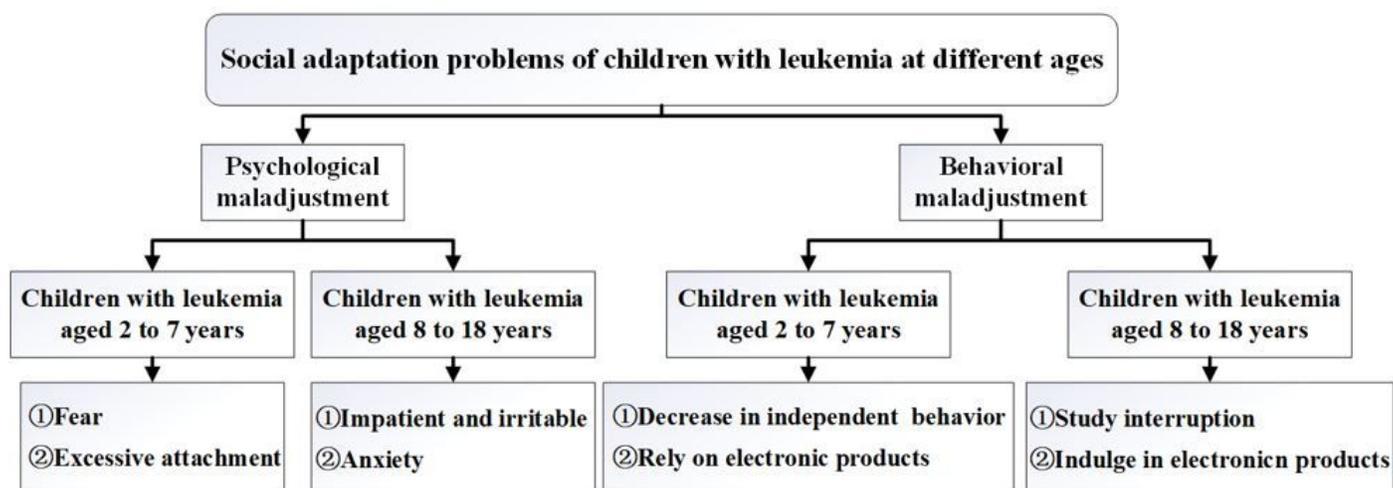


Figure 1

Social adaptation problems of children with leukemia at different ages