

How Can We Use Symptom Clusters in Nursing Care of Children with Leukemia?

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ABSTRACT

The incidence of childhood cancers has been gradually rising worldwide. The rate of leukemia, which is the most common cancer type in childhood, has been increasing as well. In recent years, multiple chemotherapeutic agents, radiotherapy and bone marrow transplantation have been using in leukemia treatment. Children receiving treatment for leukemia may experience many symptoms due to the disease and its treatment. These concurrent symptoms may have a complex relationship. The aim of this paper is to review and compile current literature data related to symptom clusters used to explain multiple symptoms that occur in a complex structure due to leukemia and its treatment. Symptom clustering is used in oncology nursing to explain the complex relationship among multiple symptoms and to find out the effects that symptoms have on each other and patient outcomes. There are generally two statistical approaches

to modeling symptom clusters. One is to establish the symptom clusters by grounding on clinical experiences, while the other is to establish them according to the results of statistical analysis and then clinical experiences. With the latter method, symptom clusters can be established more objectively and more number of symptoms can be assessed. In the literature, there are four instruments available for the measurement of a large number of symptoms in children. It is important to increase use of symptom clusters in nursing care for a better understanding of the relationship among multiple symptoms experienced during leukemia treatment, a more effective symptom management, and a more holistic care.

Key words: Child, leukemia, nursing, symptom cluster

Introduction

The incidence of childhood cancers has been gradually rising. The overall incidence rates of childhood cancers vary between 50 and 200 cases per million children across the world.^[1] The incidence of childhood cancers in the USA is

stated to have risen 0.6% in a year.^[2] In the United Kingdom, an average of 1756 children are diagnosed with cancer per year.^[3] In Turkey, approximately 2500–3000 children are diagnosed with cancer each year.^[4] The most common

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childhood cancers are leukemias. Leukemia accounts for about one-third of childhood cancers.^[1] Acute lymphoblastic leukemia (ALL) represents 75%–80% of leukemias in children.^[5] Acute myeloid leukemia (AML) is the other common type of leukemia in children.^[5,6]

There are various methods to treat leukemia. The most common treatment for leukemia is chemotherapy which uses multiple chemotherapeutic agents. Radiotherapy is rarely preferred when the central nervous system (CNS) or testis involvement occurs. After the child has achieved remission, bone marrow transplantation can also be used according to the health status of the child.^[7,8] Leukemia treatment is planned to take up to 2–3 years, including all treatment phases. Because boys are at higher risk for relapse than girls, the duration of treatment for boys may be several more months.^[2,5]

Clinical signs and symptoms of both ALL and AML may occur in a similar way because of bone marrow and organ infiltration. Initial symptoms are found as pale skin, fatigue, weakness, loss of appetite, and fever. Bone marrow infiltration by blast cells leads to anemia, neutropenia, and thrombocytopenia. The symptoms pale skin, fatigue, tachycardia, dyspnea may occur due to anemia; hyperthermia, sweating, risk of infections may occur due to neutropenia; and coagulation problems, petechiae, purpura, mucous membrane bleeding and rarely gastrointestinal bleeding and intracranial hemorrhage may occur due to thrombocytopenia.^[6,7] In the case of periosteum and joints involvement, the symptoms such as bone and joint pain, unable to stand on the foot is reported. Organ involvement leads to lymphadenopathy and hepatosplenomegaly, and genitourinary system involvement leads to painless testicular swelling. Less commonly, headache, changes in mental status, and lethargy may occur in the case of CNS involvement.^[7,9]

The symptoms experienced by children may also lead to other symptoms such as sleep impairment, behavioral changes, fatigue, loss of appetite, and lack of concentration.^[10-14] All of these symptoms have adverse impacts on children's and their parents' daily life activities and quality of life.^[15,16] Moreover, parents experience increased stress and burden of care during the treatment process.^[17,18] It is reported that factors such as dysfunctional family, inadequate economic resources, and failure to reach medical resources increase the burden of parents.^[17]

During diagnosis and treatment process of leukemia, children experience several symptoms concurrently. This situation is called as a symptom cluster when symptoms are both related and occur simultaneously. Symptom cluster identification enables the specification of concurrent and relatively related symptoms included in a cluster. It may also

provide a better understanding of the structure of multiple symptoms and a more effective symptom management.^[19,20]

The aim of this paper is to review and compile the current literature data about the concept of symptom clusters and the methods to identify symptom clusters. The paper was designed to provide brief information about the meaning of symptom clusters and the identifying and analyzing the symptom clusters for nursing implementations. For this reason, this paper discusses symptom clusters under four subtitles as follows: “Symptom Clusters”, “Statistical Approaches to Modeling Symptom Clusters”, “Instruments for Symptom Clustering in Children”, and “Nursing Care and Symptom Clusters”.

In the direction of the aim, the questions of review were generated as follows:

- What is the concept of symptom cluster
- Are there statistical approaches to modeling symptom clusters
- What are the common instruments that measure multiple symptoms in children with cancer and are suitable to perform identification of symptom cluster
- What is the advantage of symptom clusters in nursing care?

Search Strategies

A literature search of symptoms in children with cancer was conducted using PubMed, CINAHL, and Ovid Medline. Keyword searches included the terms of symptom, symptom cluster, child, adolescent, cancer, and oncology. Articles were reviewed if they contained any information regarding symptom clusters or multiple symptoms in children with cancer.

Studies were included if they were published after 2000; population consisted of children or adolescents; and population consisted of patients with cancer. Exclusion criteria were as follows: Not published as a full article and not published in English. This search yielded 26 articles that some of them contained information about symptom clusters and some of them was about multiple symptoms in children. Two authors reviewed the studies for the eligibility criteria and the scope of the review.

Symptom Clusters

Symptom clusters are three or more concurrent symptoms that are related to each other.^[21] According to Kim *et al.*, a symptom cluster includes two or more concurrent symptoms that are interrelated. Symptom clusters consist of groups of symptoms. The relationship among symptoms within a symptom cluster may be stronger than that among symptoms across other symptom clusters.^[20] Symptoms within a cluster do not need to have the same etiology. For

instance, pain within a symptom cluster may be caused by cancer itself, while fatigue within the same cluster may be caused by cancer treatment.^[20,21]

The concept of symptom cluster was first used in the field of psychiatry and psychology. Then, it has been used in general medicine, and in nursing, particularly in the field of oncologic nursing.^[20,22]

Symptom cluster has been used for classification and diagnosis of psychological disorders in psychiatry and psychology for more than 30 years. At the beginning, symptom clusters were determined relying on clinician's impression and expert consensus. Later, statistical analyses such as factor analysis were performed to define the extent of and relationship among symptoms within a symptom cluster.^[20] The concept of symptom cluster has been used also in general medicine for about 30 years. It is generally used as a statistical-based term referring to symptoms that are related. The use of cluster concept in general medicine is similar to that in psychiatry and psychology.^[20]

Symptom clustering is particularly used for patients with cancer to analyze the complicated structure of multiple symptoms caused by cancer and its treatment, to understand the effects that symptoms have on one another and patient outcomes and to provide an effective symptom management.^[22] An intervention for one of the symptoms involved in a symptom cluster may be effective on the other symptoms of the same cluster. For example, providing relief for patients may be effective on symptoms pain, nausea, and fatigue.^[19] Studies indicate that symptom clusters may influence the severity of symptoms, and the child's functional status and quality of life.^[21,23,24]

Statistical Approaches to Modeling Symptom Clusters

There are generally two main approaches to identifying symptom clusters. The first method is to perform statistical analysis based on clinical experiences (deterministic model). The second is to establish symptom clusters based on directly statistical analyses without any prior assumption regarding the relationships among symptoms (heuristic model).^[25,26]

In the first method identifying symptom clusters by grounding on clinical experiences, a symptom cluster is constituted of symptoms which are considered to be related based on clinical experiences, and then, the statistical analyses are performed. In this method, clusters include not more than two or three symptoms.^[26,27] The most common example of these clusters is the cluster including the symptoms nausea and vomiting. The clusters including the symptoms fatigue, pain, sleeping problems or fatigue, pain, and depression are the other most common

clusters.^[10,21,28] To look at the relationship among symptoms within a cluster, Pearson or Spearman correlation is performed. However, this method has disadvantages because of the selected symptoms. During identification of relationship among selected symptoms with correlation analyses, relationship with other symptoms can be missed. Accordingly, symptoms which may be included in a cluster cannot be accurately identified.^[26,27] Studies relevant to symptom clustering recommend using wide-ranging instruments that interrogate a large number of symptoms at the same time.^[27]

The second method is to identify symptom clusters based on statistical analyses. This method does not necessitate an assumption grounded on clinical experience to derive a symptom cluster.^[25,26] It is considered that symptom clusters are constituted more objectively with this method.^[27] This method also gives us the opportunity to use instruments that interrogate many symptoms. These instruments measure the most common symptoms as well as other dimensions such as symptom severity and distress caused by symptoms. Thus, using the instruments, one can measure stated dimensions at the same time and the same measurement.^[22,27]

There is not a consensus on statistical methods to be performed for identification of symptom clusters using instruments that measure multiple symptoms. However, the most common methods that have been used recently are factor analysis and cluster analysis.^[22]

Factor analysis is a statistical method that investigates the relationship among many variables. In studies on symptom clusters, factor analysis is used to determine the common factors that explain the correlation between symptoms. In oncology studies, it is preferred for identification of symptom clusters when there are complex relationships among multiple symptoms.^[26]

Cluster analysis is a statistical method that is focused on classification and is trying to put similar symptoms together into a cluster and separate this cluster from other clusters. Frequently, agglomerative hierarchical methods are utilized. Hierarchical methods arrange the clusters into a hierarchy so that the relationships between the different groups are apparent. Agglomerative methods begin with each symptom as a cluster, and then group symptoms until all symptoms are in one cluster. The results of this type of analysis are generally presented in a tree-like diagram called a dendrogram. An arbitrary cutoff in the measure of association defines final symptom clusters. Final clusters derived with the analysis are investigated in terms of appropriateness for clinical sense. Cluster analysis does not guarantee conceptual meaningfulness but only a trigonometric solution.^[26,27,29]

Two methods could be used to determine the symptom clusters in children with cancer. Variable number of symptom clusters including different symptoms were found in the research which use deterministic model or heuristic model^[10,13,14,30,31] Hockenberry *et al.* used the first method and defined one symptom cluster in their previous study.^[10] Later, they changed the method and used the agglomerative hierarchical cluster analysis in the same data. In the secondary data analysis, they found two symptom clusters.^[13] The recent studies that examined the symptom clusters in children with cancer used the agglomerative hierarchical methods, such as exploratory factor analysis and cluster analysis, to identify symptom clusters.^[14,30,31]

Instruments for Symptom Clustering in Children

Most common instruments used to measure multiple symptoms both physical and psychological in children are presented below. Features of the instruments for symptom clustering in children are shown in Table 1.

Memorial symptom assessment scale 10–18

Memorial Symptom Assessment Scale (MSAS) was originally designed for use in adult oncology patients. Then, MSAS 10–18 was adapted for use in children with cancer aged 10–18 by Collins *et al.* based on the adult version. The MSAS 10–18 consists of 30 symptoms and three subscales. It is an instrument rated on a 4 or 5 point Likert-type scale measuring three dimensions which are frequency, severity and distress associated with symptoms.^[32] There are different electronic tools developed based on MSAS 10–18.^[39,40]

Memorial symptom assessment scale 7–12

The MSAS was revised by Collins *et al.* for use in children with cancer aged 7–12. The MSAS 7–12 interrogates eight symptoms. It is an instrument rated on a 3 or 4 point Likert-type scale measuring three dimensions which are frequency, severity, and distress associated with symptoms.^[33]

Therapy-related symptom checklist for children

The Oncology Treatment Toxicity Assessment Tool for adult oncology patients was revised for children with cancer aged 5–17 and renamed as Therapy-Related Symptom Checklist for Children (TRSC-C). It includes 30 symptoms

and measures severity of these symptoms on a 5 point Likert-type scale. It also includes a checklist which questions whether a method is implemented for the symptoms and examines the effectiveness of these interventions.^[34,35] TRSC-C has an electronic format.^[36]

Symptom screening in pediatrics tool

The Symptom Screening in Pediatrics Tool (SSPedi) was developed for screening symptoms experienced by children 8–18 years of age with cancer undergoing active treatment by Tomlinson *et al.* This instrument is not including symptom assessment. It screens only symptoms with 15 items.^[37] It is rated on a 5-point Likert-type scale that interrogates the distress caused by symptoms.^[37] The SSPedi has both paper and electronic format to be filled out.^[38]

Nursing Care and Symptom Clusters

Nursing care of children undergoing treatment for cancer aims to manage symptoms and adverse effects which may occur during treatment, to prepare an appropriate environment for the child’s age and developmental characteristics, and to reduce adverse effects of treatment on growth and development.^[41] Nurses play various roles in nursing management of symptoms experienced by children undergoing treatment for cancer. The nursing care includes educating the child and family about disease, treatment and possible symptoms, providing proper information about the process, and protecting the child from side effects due to treatment. The importance of psychological support for children and their families, maintenance of child’s daily routine and social life should not be forgotten throughout the treatment process.^[41,42]

To provide an effective nursing care, it is important for nurses providing care for children with cancer, to comprehend the structure of multiple symptoms that have complex relationships. Nurses need to discover possible relationships and impacts among concurrent symptoms. This will enable them to be more successful at symptom management. For example, relaxation techniques can help with the symptoms pain, nausea, and fatigue experienced by the child or a medication used for one symptom can ease other related symptoms. Thus, a single implementation can be effective in managing multiple, concurrent, and related symptoms. Moreover, nurses can have positive impact

Table 1: Features of the instruments for symptom clustering in children

Instrument	Number of items	Children’s age (year)	Dimensions	Type of scales	Mode of administration
MSAS 10-18 ^[32]	30	10-18	Frequency, severity, and distress	4 or 5 point Likert-type scales	Paper (different electronic tools based on it)
MSAS 7-12 ^[33]	8	7-12	Frequency, severity, and distress	3 or 4 point Likert-type scales	Paper
TRSC-C ^[34-36]	30	5-17	Severity	5-point Likert-type scale	Paper and electronic
SSPedi ^[37,38]	15	8-18	Bother	5-point Likert-type scale	Paper and electronic

MSAS: Memorial Symptom Assessment Scale, TRSC-C: Therapy-related symptom checklist-child, SSPedi: The symptom screening in pediatrics tool

on overall health status of patients with an appropriate symptom management and by identifying the effects of symptom clusters on quality of life, functional status, and other significant parameters.^[19-21]

In one study, Yeh *et al.* derived symptom clusters in children with cancer and also examined whether each cluster differed based on the functional status. They indicated that children with good function reported more side effects related to gastrointestinal irritations and pain cluster. Furthermore, they found that fatigue, sleep, and depression were clustered together like other studies.^[30] Therefore, it is essential for nurses to understand the relationships of symptoms from a larger perspective.

Pediatric nurses should evaluate the frequency, severity, and distress of physical and psychological symptoms of children with cancer regularly with symptom clustering instruments. Concurrent symptoms and relationships of symptoms between each other could be understood using symptom cluster. Nurses could use symptom cluster in their interventions to prevent concurrent symptoms, provide effective symptom management with possible single implementation, maintain child's daily routine, functional status, and improve quality of life. Eventually, symptom clusters that include concurrent and related symptoms can improve nursing care. Figure 1 includes a summary of symptom clusters and nursing care process.

Conclusion

Children undergoing treatment for leukemia experience several symptoms due to the disease and the treatment.^[2] Symptom clustering method is used to identify the relationship among multiple and coexisting symptoms.^[20,21]

It is important for a nurse who provides care for a child with leukemia to know that there can be a complex relationship among multiple symptoms which occur due to the disease throughout the process. The identification of symptom clusters that present concurrent and correlated symptoms enable nursing care to be planned for both physical and psychological symptoms of the child. This will ensure an effective approach in planning, implementing, and evaluating. Considering symptom clusters in the evaluation of symptom management can give a broader perspective to nurses. Consequently, nurses put holistic approach into practice while providing care for the child and the family.

It is seen that the use of symptom clusters in children undergoing treatment for leukemia or other cancers is limited in the literature. Symptom clusters research with children should be conducted in specific diagnosis groups. It is essential to promote symptom clusters in nursing care and nursing interventions.

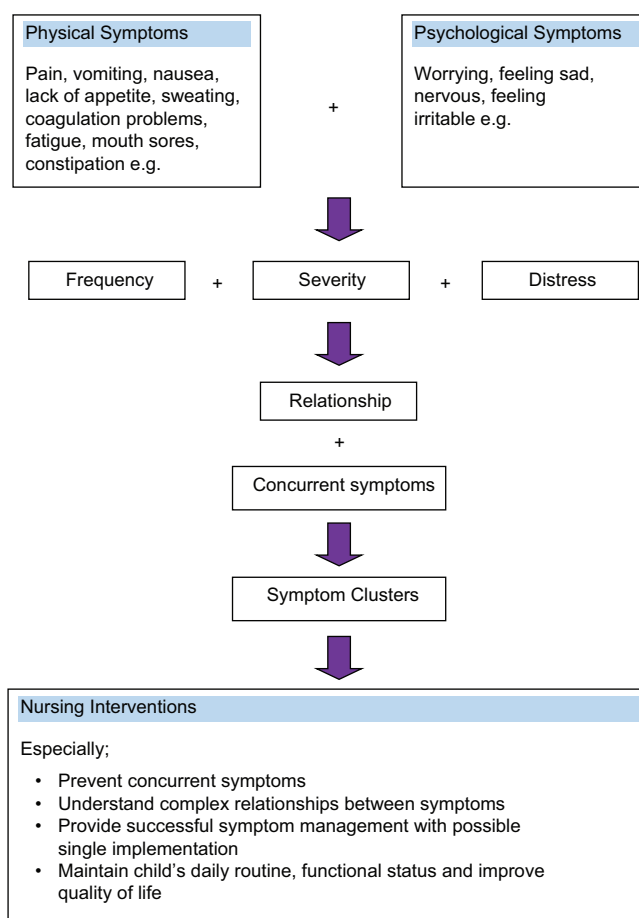


Figure 1: Nursing care and symptom cluster

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Conflicts of interest

There are no conflicts of interest.

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