

Pediatric oncology: client-centered care and the application of healthcare technologies

Oncologia pediátrica: o cuidado centrado no cliente e a aplicação das tecnologias de cuidado em saúde

Oncología pediátrica: atención centrada en el cliente y aplicación de tecnologías sanitarias

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RESUMO

Objetivo: Analisar o papel das tecnologias de saúde no cuidado oncológico pediátrico centrado no cliente, com foco na comunicação e no suporte psicossocial oferecido a pacientes e famílias. **Metodologia:** Os dados foram coletados por meio de artigos qualitativos e quantitativos, disponíveis na Biblioteca Virtual de Saúde (BVS) e em texto completo nas bases LILACS, Medline e BDENF, com recorte a partir de 2005, ano de implementação da Política Nacional de Atenção ao Câncer (PNAO). Utilizaram-se os descritores DeCS/MeSH: "Tecnologia Biomédica AND Pediatria AND Oncologia" e "Tecnologia da Informação AND Pediatria AND Oncologia". **Resultados:** Tecnologias como telemedicina, aplicativos móveis e plataformas de eHealth mostraram-se eficazes no suporte ao tratamento pediátrico, promovendo comunicação, adesão ao tratamento e suporte emocional a pacientes e familiares. **Conclusão:** As tecnologias de saúde oferecem um importante suporte ao cuidado oncológico pediátrico. Recomenda-se o desenvolvimento de políticas públicas para ampliar o acesso e garantir a segurança dos dados, promovendo um cuidado mais inclusivo e humanizado.

Descritores: Oncologia Pediátrica; Telemedicina; Assistência Oncológica.

ABSTRACT

Objective: To analyze the role of healthcare technologies in client-centered pediatric oncology care, focusing on communication and psychosocial support provided to patients and families. **Methodology:** Data were collected through qualitative and quantitative articles available in the Virtual Health Library (BVS) and in full text on the LILACS, Medline, and BDENF databases, starting from 2005, the year the National Cancer Care Policy (PNAO) was implemented. DeCS/MeSH descriptors used included "Biomedical Technology AND Pediatrics AND Oncology" and "Information Technology AND Pediatrics AND Oncology." **Results:** Technologies such as telemedicine, mobile applications, and eHealth platforms proved effective in supporting pediatric treatment, promoting communication, treatment adherence, and emotional support for patients and families. **Conclusion:** Healthcare technologies offer crucial support in pediatric oncology care. The development of public policies is recommended to expand access and ensure data security, promoting more inclusive and humanized care.

Descriptors: Pediatric Oncology; Telemedicine; Oncology Care.

RESUMEN

Objetivo: Analizar el papel de las tecnologías sanitarias en la atención oncológica pediátrica centrada en el cliente, con foco en la comunicación y el apoyo psicossocial ofrecido a los pacientes y sus familias. **Metodología:** Los datos fueron recolectados a través de artículos cualitativos y cuantitativos, disponibles en la Biblioteca Virtual en Salud (BVS) y en texto completo en las bases de datos LILACS, Medline y BDENF, con foco en 2005, año de implementación de la Política Nacional de Atención al Cáncer (PNAO). Se utilizaron los descriptores DeCS/MeSH: "Tecnología Biomédica Y Pediatría Y Oncología" y "Tecnología de la Información Y Pediatría Y Oncología". **Resultados:** Tecnologías como la telemedicina, las aplicaciones móviles y las plataformas de eHealth demostraron ser eficaces para apoyar el tratamiento pediátrico, promover la comunicación, la adherencia al tratamiento y el apoyo emocional a los pacientes y sus familias. **Conclusión:** Las tecnologías sanitarias ofrecen un importante apoyo a la atención del cáncer pediátrico. Se recomienda desarrollar políticas públicas para ampliar el acceso y garantizar la seguridad de los datos, promoviendo una atención más inclusiva y humanizada.

Descriptores: Oncología Pediátrica; Telemedicina; Atención Oncológica.

REVIEW

Introduction

Childhood cancer represents a significant challenge for global public health, standing out as the leading cause of disease mortality in children and adolescents between 0 and 19 years of age. Data from the World Health Organization (WHO) indicate that, globally, more than 300,000 new cases of pediatric cancer are diagnosed annually, with a higher prevalence in low- and middle-income countries, where access to specialized care and health infrastructure is limited¹. In high-income countries, the average survival rate for children with cancer exceeds 80%; However, in developing countries, this rate can be less than 20%, reflecting a critical disparity in access to early diagnosis, specialized treatment, and health support ^{2,3}.

The high rate of infant mortality from cancer, especially in low-income contexts, reflects the multifactorial complexity of the pathology, ranging from genetic predispositions to social and structural barriers in access to health services. In Brazil, childhood cancer ranks first among the causes of mortality from diseases in children and adolescents, with the National Cancer Institute (INCA) estimating, for the 2020-2022 triennium, an annual average of 625,000 new cases, with leukemias, lymphomas, and tumors of the central nervous system as the most prevalent types ³.

The etiology of pediatric cancer differs substantially from that seen in adults. In children, genetic factors play a more central role, while behavioral factors are preponderant in adults. In adult cancer, lifelong risk behaviors, such as smoking, sedentary lifestyle, and inadequate diet, have a significant influence on the development of neoplasms. In contrast, childhood cancer has a more hereditary nature, with less influence from external factors and generally more aggressive growth rates, making the need for early diagnosis and agile therapeutic intervention even more urgent ^{2,4}.

In this scenario, client-centered care has stood out as a comprehensive approach, contemplating not only the clinical aspects, but also the emotional and social needs of children and their families. In addition, the use of health technologies, such as telemedicine, mobile applications, and digital platforms, emerges as an essential support tool in the pediatric oncology context, especially in regions with limited infrastructure.

Psychosocial and Family Impact of Childhood Cancer

The diagnosis of childhood cancer brings with it a devastating impact on both the child and their family, generating a series of emotional, psychological, and social challenges. Children undergoing treatment face not only the physical effects of the procedures, but also radical changes in their routine, social and emotional environment. Long periods of hospitalization lead to withdrawal from school and leisure activities, causing social isolation, anxiety and helplessness, both for the patient and for family members.⁵

In several countries, the implementation of psychosocial support programs has been observed as an essential component in pediatric cancer care, promoting resilience and coping. The success of these programs is evidenced, for example, in initiatives in the United States and Europe, where psychosocial support for children and families in the treatment process has been integrated

into clinical oncology care, generating significant improvements in coping with the disease and in the quality of life of patients.^{3,5}

In addition to clinical care, emotional support from the health team and education for parents and family members play a crucial role in mitigating the anxiety and stress associated with cancer diagnosis and treatment. Studies indicate that the direct involvement of parents and caregivers, through psychological support and educational guidance, contributes to a better understanding of the treatment and to the family's adaptation to the new reality⁵.

Rationale for the insertion of health technologies in the pediatric oncology context

Recent scientific literature points out that the use of health technologies, such as telemedicine, mobile apps, and eHealth platforms, has the potential to transform pediatric cancer care. These technologies facilitate communication between the multidisciplinary team and patients, promote adherence to treatment, and offer educational and emotional support^{3,6}.

In addition to promoting inclusion and accessibility to care, technologies also enable remote monitoring and allow real-time interactions between professionals and family members, reducing the need for travel and facilitating comprehensive care. In countries such as India and some regions of Africa, where socioeconomic and geographical conditions restrict access to specialized care, telemedicine has been widely adopted successfully, enabling constant monitoring and remote support to families^{1,4}.

Objective

General Objective

To analyze the role of health technologies in client-centered care in pediatric oncology, with a focus on communication between the health team and the patient, as well as the psychosocial support offered to children and their families.

Specific Objectives

1. Identify the main health care technologies applied in pediatric oncology and their impact on the optimization of treatment and emotional support to patients.
2. Examine the evidence on the challenges and barriers in the implementation of health technologies in pediatric oncology settings, with an emphasis on areas of difficult access and in situations of inequality.
3. Develop a proposal for an educational booklet aimed at patients and families, containing information on the diagnosis, treatment and coping strategies of childhood cancer.
4. Evaluate the perspectives of the literature on the psychosocial impact of health technologies in supporting children and families during treatment, emphasizing the advantages and limitations of these tools.

Theoretical Framework

Historical evolution of pediatric oncology

Pediatric oncology began to develop as a medical specialty between the 1940s and 1950s, driven by the first attempts to treat leukemia and lymphomas in children. At that time, treatments were still experimental, and the prognosis of children diagnosed with cancer was generally unfavorable. However, the discovery and development of the first specific chemotherapies for children, as well as the improvement of therapeutic protocols, led to significant advances, increasing cure and survival rates from the 1960s and 1970s onwards ^{2,3}.

In recent decades, pediatric oncology has witnessed a substantial transformation with the integration of new treatments such as combination chemotherapies, radiation therapy, and targeted therapies. Currently, treatments follow rigorous and personalized protocols, which take into account the type of tumor and the genetic characteristics of the patient, promoting an increasingly individualized approach ^{2,6}.

Childhood cancer: pathophysiology and differences in relation to adult cancer

The pathophysiology of childhood cancer differs significantly from that observed in adults, with most pediatric neoplasms originating in precursor or embryonic cells, characterized by a rapid rate of cell proliferation. This pathophysiological profile contributes to the aggressive growth of tumors in children, who, in many cases, respond more positively to chemotherapy compared to adult cancers, whose etiology is more associated with environmental and behavioral factors acquired throughout life, such as smoking, diet, and prolonged exposure to carcinogenic agents ^{3,4}.

The most frequent types of cancer in children include leukemias, brain tumors, and lymphomas. Among them, acute lymphoblastic leukemia is the most common type and one of those with the greatest advances in terms of treatment, with cure rates of more than 80% in specialized centers. Central nervous system tumors, on the other hand, represent a greater challenge due to the complexity of the interventions required and the potential impact on neurological functions, requiring multidisciplinary support to mitigate side effects and maximize patient well-being ³.

On the other hand, in adult cancer, external and behavioral factors, such as alcohol consumption and smoking, play a preponderant role in the etiology of the disease. This difference between pediatric and adult forms of the disease highlights the need for specific treatment strategies for childhood cancer, as well as an approach to care centered on the unique needs of children and adolescents.

Methodology

Type of study and rationale for the integrative review

This study uses a qualitative approach and an integrative literature review method, a procedure recognized for its ability to synthesize and integrate knowledge from multiple types of studies. This method allows a comprehensive view of the topic and the incorporation of scientific evidence

from different methodological approaches, providing subsidies for clinical practice and guiding future investigations⁷. Integrative review is especially relevant in healthcare, where critical analysis and synthesis of evidence are essential to support clinical decisions and health policy development.

Article Search and Selection Procedures

Data were collected through qualitative and quantitative articles available in the Virtual Health Library (VHL) and in the LILACS, Medline, and BDENF databases, with an initial time limitation in 2005, when the National Cancer Care Policy (PNAO) was instituted. The following DeCS/MeSH were worked on: "Biomedical Technology AND Pediatrics AND Oncology; Information Technology AND Pediatrics AND Oncology".

Inclusion and Exclusion Criteria

Articles published from 2005 onwards that directly addressed the use of technologies in pediatric cancer care were included. Duplicate articles, case studies without comparative analysis, and articles that did not specifically address pediatric oncology were excluded.

Data Analysis and Categorization

A total of 35 articles were analyzed and categorized according to the analysis model of Stetler et al. (1998), which classifies scientific evidence into six levels⁸. The extracted information was arranged in synoptic tables to facilitate the visualization of the evidence.

Results and Discussion

After analyzing the data found, this study presents the results discussed in six categories, as follows:

Main Technologies in Pediatric Cancer Care

The integrative review revealed the growing use of several health technologies in the pediatric oncology context, especially telemedicine, mobile monitoring applications, and digital eHealth platforms. These tools have been shown to be effective in promoting client-centered care, facilitating communication between the health team and family members, and improving treatment adherence.^{9,10}

Telemedicine

Telemedicine has been widely used for remote consultations and follow-up, especially in geographically isolated areas where access to specialized hospitals is limited. Studies indicate that telemedicine reduces the need for frequent travel, providing a more economical and accessible alternative for families, who can maintain regular medical follow-up without the need for large commutes.¹¹

Mobile Apps

Mobile apps have also been identified as essential tools, allowing symptom monitoring and offering practical guidance for daily care. A relevant example is the "Stay Tuned, It Can Be Cancer" app, developed in Brazil, which offers information on warning signs for childhood cancer and guides both family members and health professionals for early identification of symptoms.¹²

eHealth Platforms

eHealth platforms are widely used for the education and emotional support of patients and families. These platforms combine information about the treatment process with emotional support modules, helping families prepare for the challenges of cancer treatment. In the United Kingdom, for example, the use of these platforms has been associated with a better understanding of treatment and greater emotional resilience on the part of families.¹³

The Psychosocial Impact of Technologies on Patient and Family Support

The results indicate that health technologies, especially eHealth tools and psychosocial support apps, play a key role in mitigating anxiety and stress for children and families during treatment. Telemedicine tools, such as remote psychological consultations, offer regular and personalized emotional support, providing continuity of psychological care, even in areas with a limited supply of specialized professionals.¹⁴

Another important benefit of these technologies is the promotion of family coping, as they provide up-to-date information on treatment and emotional support on an ongoing basis, strengthening resilience and the family support network. Studies conducted in Canada and Australia indicate that the use of these technologies improves communication between family members and the health team, resulting in a more effective supportive environment and greater acceptance of treatment by children.¹⁵

Proposal for an Educational Booklet for Patients and Families

In view of the evidence on the psychosocial impact of health technologies and the need for greater educational and emotional support for patients and their families, we propose the development of an educational booklet that seeks to fill these gaps. The booklet was designed with three fundamental pillars:

1. **Information about diagnosis and treatment:** Clear explanations about the types of childhood cancer, the stages of treatment, and the most common procedures (such as chemotherapy, radiotherapy, and surgery) were included to demystify the therapeutic process and reduce anxiety for parents and guardians.
2. **Practical guidance on daily life during treatment:** The booklet provides recommendations on the child's care routine, management of the side effects of treatments, adequate nutrition and the importance of psychological follow-up.

- 3. Emotional coping strategies:** Based on the results on the psychosocial impact of health technologies, the booklet also offers a guide to emotional coping, with tips on how to deal with stress, anxiety, and insecurity that affect both patients and their families. The inclusion of contacts of psychological support services and support networks is also a key point.

In addition to complementing the digital tools already discussed, such as eHealth platforms and mobile applications, this booklet serves as a practical and accessible resource, with relevant information for the daily lives of patients and families. It is designed to be distributed in both physical and digital formats, taking advantage of the use of eHealth platforms mentioned in the study, allowing its wide dissemination, including in remote areas. With the support of mobile applications and consultations via telemedicine, the booklet can be easily accessed by families who are not available to visit medical centers frequently.

Studies show that education and ongoing emotional support have a positive impact on treatment acceptance and strengthening family support networks. The implementation of this booklet aims to complement the use of health technologies, offering easy-to-understand information that can be reviewed at any time during the therapeutic process. In addition, the booklet offers suggestions for everyday practices that can help families navigate the daily challenges associated with childhood cancer treatment.

Challenges and Limitations in the Implementation of Technologies in Pediatric Oncology

Although the booklet represents a promising tool for educational and emotional support, its effectiveness, as well as that of other health technologies, faces the challenges of implementation. The lack of access to quality internet in rural and low-income areas prevents the continued use of telemedicine and eHealth platforms, making it difficult to expand these tools. In countries like Brazil, where regional inequalities are striking, the lack of technical resources and connectivity represents a significant barrier to the expansion of remote care.³

Another relevant challenge is ethical and safety issues. The use of digital monitoring and communication apps and platforms involves the collection of personal data from patients, raising concerns about the privacy and security of information. Strict security protocols are necessary to ensure the confidentiality of patient data, especially in areas where data protection legislation is still in the early stages of development. In some countries of the European Union, where data protection regulation is robust, the use of these technologies is safer, but in other contexts the lack of regulation poses a risk to the integrity of patients.¹³

Finally, training healthcare professionals to use these technologies is essential to maximize their impact potential. However, in regions where there is a shortage of skilled professionals, the implementation of training can be challenging, limiting the effective use of technologies in pediatric care. Continuing education initiatives and the development of technological skills are essential for professionals to be able to use these tools in an integrated way and offer more comprehensive and efficient care to pediatric patients.

Final Considerations

This study highlighted the importance of health technologies in pediatric cancer care, highlighting how tools such as telemedicine, mobile apps, and eHealth platforms can facilitate communication, promote emotional and educational support, and improve the patient and family experience. The literature review indicates that these technologies have the potential to promote more client-centered care, meeting the specific needs of children and their caregivers, and mitigating the psychosocial effects of treatment.

Health technologies have a positive impact on treatment adherence, reducing the need for travel and providing ongoing support for patients and families. However, challenges remain, especially in contexts with limited infrastructure and data security issues. The lack of access to quality internet in remote areas and the need for professional training are significant barriers that prevent the widespread adoption of these tools.

It is recommended that public policies be developed and improved to encourage access to health technologies in all regions of the country, with an emphasis on the regulation of security and privacy of patient data. The creation of initiatives for the continuous training of health professionals and for the promotion of programs to encourage the use of these technologies can contribute significantly to the effectiveness and safety of their implementation.

Future research should further explore the effectiveness of these technologies in improving quality of life and emotional support for pediatric cancer patients, especially in vulnerable contexts. Additionally, it is essential to investigate strategies that promote the long-term sustainability of these innovations, ensuring that access to and use of these technologies are aligned with local needs and are scalable.

With the advancement of health technologies, pediatric cancer care is expected to become increasingly inclusive, humanized, and centered on the needs of the patient and their family. Integrating these tools into clinical care can represent a significant step toward a future in which all children, regardless of their geographic location or socioeconomic status, can receive the care they need and deserve.

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