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The Effect Of Technology-Based Interventions On Child And Parent Outcomes In Pediatric Oncology

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Abstract

Background: Applications for electronic health (e-health) and mobile health (m-health) make up technology-based interventions.

Objectives: to assess how technology-based treatments in pediatric oncology affect parent and child outcomes.

Materials and methods: The methodology for this study was systematic review. The study's protocol (CRD42022297664) was registered in the PROSPERO database. The PRISMA (favored reporting elements for meta-analyses and systematic reviews) guidelines were adhered to in this systematic review. The population, comparison, intervention, result, and research design approach served as the foundation for the inclusion criteria in this investigation.

Results, and Conclusion: Technology-based interventions can significantly increased the lives of parents and children with tumor, easing psychological and physical symptoms, and coping mechanisms. However, due to small sample sizes and limited studies, caution is advised. Further research is needed for the best efficacy of technology-based therapies.

Key words: Technology-based interventions, parents, pediatric, and oncology.

Introduction

The prevalence of children malignancies has grown to be a significant health issue in our nation and around the globe in recent years. Worldwide, an estimated 300,000 kids and teenagers between the ages of 0 and 19 get a cancer diagnosis each year. **(1, 2)**. Positive changes in the prognosis of children malignancies have been seen in recent years due to advancements in the treatment procedures. Nonetheless, there is compelling evidence that during active treatment, home care, or survivorship—which involves rigorous treatment protocols—children, adolescents, and parents encounter a wide range of physical, emotional, and psychological symptoms connected to their cancer experience. **(3, 4)**.

Present investigation on kids with tumors and their parents indicates that technology-based therapies are being proposed. Applications for electronic health (e-health) and mobile health (m-health) include technology-based therapies; digital, web-based, and virtual reality applications are examples of e-health applications; mobile and wireless apps, on the other hand, include social media, wearable technology, messaging, and mobile applications. **(5, 6)**. Children and adolescents who get technology-based health treatments benefit from knowledge, evaluation, and feedback as well as professional communication in the field of child health, supportive networking, and real-time health issue identification. **(7, 8)**

In addition, technology-based treatments are practical, affordable, simple to use, and successful in supporting, interacting with, and keeping an eye on families. Technology-based treatments in pediatric oncology are associated with physical care, including symptom management and health status monitoring, according to published research. It has been shown that it is utilized to offer psychological assistance to improve children's and parents' psychosocial well-being, resilience, coping mechanisms, and self-effectiveness. **(9, 10)**.

In order to enhance the physical and psychological outcomes for children and parents following a childhood cancer diagnosis, research in pediatric oncology nursing has been conducted recently. According to the literature currently in publication, technology is mostly used to design research projects involving parents and children who are cancer patients. **(11, 12)**

Through technology-based initiatives, Parents and kids with tumors may get physical and psychological support from pediatric oncology nurses. Additionally, they play a crucial part in identifying the care requirements for kids with cancer and providing evidence-based, family-centered care to parents and kids. **(13)** Although the impact of technology-based programmes for children with tumors or their families has been assessed by systematic reviews and meta-analyses, more research is required to advance the body of evidence in this area. **(14)**.

Recent analysis of the literature in pediatric oncology reveals a wide range of uses for technology-based applications (like symptom control and psychological assistance). The effect of technology-based treatments on children receiving malignancy therapy or survivors and their parents, on the other hand, are not well-researched. This disparity might impede our comprehension of how technology-based therapies benefit parents and children with cancer in the field of pediatric oncology. **(15)**.

By presenting data on the efficacy of technology-based approaches to empower and assist parents and children with malignancy, this systematic review will advance the field.

Materials and methods

Methods Study design

The methodology for this study was systematic review. The study's protocol (CRD42022297664) was registered in the PROSPERO database. The PRISMA (recommended reporting elements for meta-analyses and systematic reviews) guidelines were adhered to in this systematic review.

The population, the comparison, the intervention, result, and research design approach served as the foundation for the inclusion criteria in this investigation.

Inclusion criteria

Population: investigations whose sample include parents, kids, or teenagers with malignancy up to the age of 18 (including those who are actively undergoing treatment and those who have survived the disease).

Intervention: interventions made using technology. Comparison: Standard care against the control group. Outcome: Children's psychological (stress, coping, etc.) and physical (symptom treatment) results Psychosocial effects for parents, including depression, resilience, methods of coping, and self-efficacy.

Type of study: Studies that are experimental (such as quasi-experimental ones with a control group and randomized controlled trials (RCTs)

Exclusion criteria: Research on parents and children with advanced, recurrent, or resistant cancer - Research on cancer patients who are older than eighteen (18 years), teenagers, young adults, and adult patients; - treatments for children with malignancy, such as end-of-life, death-period, and parent-after-child interventions; - Research for parents and kids with mental health diagnoses - In person studies - Qualitative studies, cost-efficacy studies, feasibility studies, study protocols, abstracts, conference proceedings, descriptive, case-control, cross-sectional, pretest–posttest experimental research with a control group, discontinuous time series, cohort, and qualitative studies

Search methods: In eight databases—PubMed, Science Direct, The Cumulative Index to Nursing and Allied Health Literature (CINAHL) Plus with Full Text, Scopus, Cochrane Library, ProQuest, PsycINFO, and Web of Science—two reviewers independently examined research papers published between 2014 and 2024. By manual searching, more records were located.

A methodical search approach utilizing research questions in accordance with medical topic headings words and combining synonyms with subjects on all items utilizing Boolean ('AND' and 'OR') operations for every database was used to conduct the literature evaluation.

The following search approach was used to assess the reviews from the specified databases. - (Child OR pediatric OR children OR adolescent) AND (cancer OR “childhood cancer” OR neoplasm OR “children with cancer” OR “pediatric cancer” OR “pediatric oncology” OR “childhood cancer survivors” OR “childhood cancer survivors” OR “teens and early adulthood survivors” OR “teens who have survived cancer” OR “children who have survived cancer”) AND (families OR parents OR “parents of cancer-stricken children” OR caregivers OR “family of children with cancer”) AND (“ web-based approaches” OR “mHealth approaches” OR “technologybased approaches” OR “eHealth” OR “digital health approaches” OR “connected health approaches” OR “smartphone app” OR “technology-assisted approaches” OR “wearable technologies” “telehealth support” OR “technology-based psychosocial approaches” OR “webbased supportive interventions” OR “videoconference-based” OR “virtual reality” OR “digital health interventions”)

Results

Table 1 displays the author, the study's year and nation, the design of the research, the sample size and composition, technology-based approaches, the length of the approach and the period of follow-up, the main results, and the theory or model that was utilized in the intervention.

The main findings of the included investigations are shown in Table 2.

Table (1): Features of the included investigations:

Authors	**Years**	**Country**	**Type of study**	**Sample characteristics**	**Intervention**	**Follow up**
Cheng and Than (16)	2021	Canada**.**	RCT	10–18-year-olds diagnosed with tumor (n = 50) (Intervention) = 25; (Control) = 25	The addition of a home visit or visit and frequent phone contact (mHealth) was a crucial component of the treatment of symptoms program. Interval of intervention : Intervention prior to or during the initial two weeks of the initial chemotherapy cycle (one to one and a half hours).	Period of follow-up : After diagnosis, at baseline, during the initial two weeks of each chemotherapy cycle, and six months after baseline, the targeted symptoms were monitored.

Wong et al. (17)	2021	China. Results show that using virtual reality to reduce Anxiety and suffering in young individuals with cancer undergoing PIC procedures is both safe and effective.	Randomized controlled trial	Children with cancer, ages 6 to 17 (n = 108) n = 54 (control) and n = 54 (intervention)	Patients were provided VR intervention five minutes before to and during PIC. The VR sounds and pictures were delivered using a gadget that gave patients a sensation of immersion during the session. When given the option to choose VR movies, these patients unanimously said that they would rather watch VR cartoons than VR museums or VR aquatic worlds, which allow viewers to tour well-known locations virtually. Time of intervention: Five minutes before to, during, and immediately after the surgery, measurements were taken.	Period of follow-up : None**.**

Wang et al.(18)	**2018**	China-Canada	Designing quasi-experiments	Parents of 92 children diagnosed with tumor (Intervention) = 43; (Control) = 49	Along with routine health education, the m-health assistance intervention was given to the parents in the intervention group. The control group's parents had 3 months of regular instruction and monitoring. The intervention is divided into two sections: the "Care Assistant (CA)" Android smartphone app and the account on WeChat. The 8 modules of the CA application for smartphones were the main intervention tool, and WeChat was utilized to update parents' data. Three-month intervention period	Period of follow-up : 3 months**.**

Luo et al. (19)	2021	China	Randomized controlled trial	parents of cancer-stricken children (n = 103) n = 51 (control) n = 52 (intervention)	According to the resilience model, which aims to enhance resilience and quality of life while decreasing depressed symptoms, the program is implemented for parents whose kids have received a cancer diagnosis using a mobile application that consists of eight modules. Duration of intervention: eight weeks	Period of follow-up: the second and sixth months
Cernvall et al. (20)	2017	Sweden	RCT	Parents of cancer-stricken kids (n = 58) n = 27 (control) n = 31 (intervention)	technology-driven support program with a psychoeducational and cognitive behavioral theory-based coping skills emphasis Ten weeks during the intervention	12-month follow-up period

Table (2) showing the main conclusions of the included research.

Authors	The main findings
Cheng and Than (16)	Children and teenagers receiving chemotherapy may have felt less fatigued after participating in the symptom treatment at home program. Furthermore, the significance of enhancing parents' and kids' understanding, coping mechanisms, and psychological readiness for chemotherapy side effects is corroborated by qualitative data.

Wong et al. (17)	Results show that utilizing virtual reality to lower pain and anxiety in young cancer patients receiving PIC approach is both safe and effective.
Wang et al. (18)	The mHealth intervention is successful in assisting parents whose children with ALL. Future research on delivering mHealth assistance for parents of children with tumors may benefit from the insights gathered from this study.
Luo et al. (19)	There is evidence that psychiatric therapies may help parents of cancer-stricken children become more resilient. Healthcare providers may assist these parents properly manage adversity, adjust to their kids' circumstances, and increase their psychological wellness by using evidence-based psychological therapies that boost resilience.
Cernvall et al. (20)	For parents who believe Internet-based therapies to be a feasible alternative and who report an elevated degree of PTSS, offering psychological therapies over the Internet shows potential as a successful delivery method. Subsequent investigations need to validate these results and also devise and assess strategies and regulations that might potentially lessen the financial strain parents can experience while their kid undergoes cancer treatment.

Discussion

Parents raising cancer-stricken children often find it difficult and stressful. Research indicates that a sizable segment of parents go through unpleasant feelings and psychological discomfort after learning that their kid has cancer. A recent meta-analysis revealed that the pooled incidences of post-traumatic stress problems, depression, and anxiety were 26%, 28%, and 21%, respectively, among parents of children with malignancy. These rates were much greater than those of parents whose children had no cancer. **(21, 22)**. Through the parental adjustment process, increased distress has been seen around the time of diagnoses. Parents who continued to report high levels of anguish up to five years after diagnosis were not in the minority, even if some parents' suffering does eventually reduce. **(22, 24)**. To improve the wellbeing of the parents, child, and family, steps must be done to lessen psychological suffering among parents of children with cancer. Parental distress is recognized to have a detrimental impact on both parents' and their children's physical and mental health. Evidence-based recommendations of psychosocial therapy for the parents of kids with malignancy state that parents should have access to therapies and psychosocial support throughout the cancer trajectory depending on their mental health needs. **(23)**.

Generally speaking, resilience refers to a person's ability to preserve wellbeing under pressure. Though opinions on whether resilience is a trait that enables people to flourish or a process of adjusting well to adversity that leads to a largely positive psychosocial consequence are divided, facing adversity and adjusting well are acknowledged as crucial components of the operational definition of resilience. **(24, 25)**. Parents of children with tumor exhibit resilience when they are able to start over and make wise decisions following diagnosis of their child's. The majority of resilience theorists agree that dynamic, active adaptation—which is both adjustable and teachable—is what leads to resilience. Increasing resilience has been seen as a potential method for avoiding

stress-related diseases and reducing psychological discomfort because it represents a paradigm change from an approach that is disease-focused to one that is health-focused.**(24)**.

The substance of existing treatments varies greatly since there is no agreed-upon theoretical structure to guide the creation and execution of resilience improvement programs. The two most popular psychological therapies are mindfulness-based therapy and cognitive behavioral therapy. **(25- 30)**.

These two treatments and their combination interventions have been shown in a prior systematic review to have modest benefits on improving resilience in a variety of groups, including regular office workers, healthcare professionals, and cancer survivors. Resilience is also promoted by social interaction-focused interventions like peer support and family-centered care. **(31 - 33)**.

It has also been created to provide multimodal resilience training with mixed treatments, and the results have been favorable. **(26)**.

The efficacy of psychological interventions on resiliency in a variety of clinical and non-clinical settings has been the subject of prior systematic reviews **(27),** but parents of children with malignancies vary from other individuals in that their resilience is shaped by their own assessments and adjustments to their children's cancer. These parents cannot directly benefit from psychological therapies for resilience building that have been shown to work in other groups. Parents of cancer-stricken children had lower resilience scores than the general population, and there was a negative correlation between their resilience and psychological distress. There aren't many psychological programs that are expressly meant to help parents of cancer patients become more resilient. **(28, 29)**. Furthermore, there is conflicting data about the efficacy of these therapies. **(30)**.

Conclusion

Technology-based interventions can significantly rise the lives of parents and children with tumor, easing psychological and physical symptoms, and coping mechanisms. However, due to small sample sizes and limited studies, caution is advised. Further research is needed for the best efficacy of technology-based therapies.

References

1. Sengul ZK, Toruner EK. Intervention protocol: technology-based psychosocial motivation for children with cancer and their parents: a randomized trial. Asia-Pacific journal of oncology nursing. 2020 Jan 1;7(1):55-63.
2. Canter KS, Christofferson J, Scialla MA, Kazak AE. Technology-focused family interventions in pediatric chronic illness: a systematic review. Journal of clinical psychology in medical settings. 2019 Mar 15;26:68-87.
3. Wesley KM, Fizur PJ. A review of mobile applications to help adolescent and young adult cancer patients. Adolescent health, medicine and therapeutics. 2015 Aug 18:141-8.
4. McCann L, McMillan KA, Pugh G. Digital interventions to support adolescents and young adults with cancer: systematic review. JMIR cancer. 2019 Jul 31;5(2):e12071.

5. Devine KA, Viola AS, Coups EJ, Wu YP. Digital health interventions for adolescent and young adult cancer survivors. JCO clinical cancer informatics. 2018 Jun;2:1-5.
6. Cheung AT, Li WH, Ho LL, Ho KY, Chan GC, Chung JO. Physical activity for pediatric cancer survivors: a systematic review of randomized controlled trials. Journal of Cancer Survivorship. 2021 Dec 1:1-4.
7. Kisecik Sengul Z, Kilicarslan Toruner E. Investigation into the Impact of Technology-Based Motivation Program Applied to the Children Followed with Cancer Diagnosis and Their Families: A Randomized Controlled Study. Ebru, Investigation into the Impact of Technology-Based Motivation Program Applied to the Children Followed with Cancer Diagnosis and Their Families: A Randomized Controlled Study.
8. Ramsey WA, Heidelberg RE, Gilbert AM, Heneghan MB, Badawy SM, Alberts NM. eHealth and mHealth interventions in pediatric cancer: a systematic review of interventions across the cancer continuum. Psycho-oncology. 2020 Jan;29(1):17-37.
9. Seitz DC, Knaevelsrud C, Duran G, Waadt S, Loos S, Goldbeck L. Efficacy of an internet-based cognitive-behavioral intervention for long-term survivors of pediatric cancer: a pilot study. Supportive Care in Cancer. 2014 Aug;22:2075-83.
10. Mehdizadeh H, Asadi F, Mehrvar A, Nazemi E, Emami H. Smartphone apps to help children and adolescents with cancer and their families: a scoping review. Acta Oncologica. 2019 Jul 3;58(7):1003-14.
11. Abrol E, Groszmann M, Pitman A, Hough R, Taylor RM, Aref-Adib G. Exploring the digital technology preferences of teenagers and young adults (TYA) with cancer and survivors: a cross-sectional service evaluation questionnaire. Journal of Cancer Survivorship. 2017 Dec;11:670-82.
12. Lim NL, Shorey S. Effectiveness of technology-based educational interventions on the empowerment related outcomes of children and young adults with cancer: A quantitative systematic review. Journal of Advanced Nursing. 2019 Oct;75(10):2072-84.
13. Salvador Á, Crespo C, Barros L. The benefits of family-centered care for parental self-efficacy and psychological well-being in parents of children with cancer. Journal of Child and Family Studies. 2019 Jul 1;28:1926-36.
14. Robb SL, Hanson-Abromeit D. A review of supportive care interventions to manage distress in young children with cancer and parents. Cancer nursing. 2014 Jul 1;37(4):E1-26.
15. Gilljam BM, Nygren JM, Svedberg P, Arvidsson S. Impact of an electronic health service on child participation in pediatric oncology care: Quasiexperimental study. Journal of Medical Internet Research. 2020 Jul 28;22(7):e17673.
16. Cheng KK, Tan LM. A pilot study of the effect of a home-based multimodal symptom-management program in children and adolescents undergoing chemotherapy. Cancer Reports. 2021 Jun;4(3):e1336.
17. Wong CL, Li CK, Chan CW, Choi KC, Chen J, Yeung MT, Chan ON. Virtual reality intervention targeting pain and anxiety among pediatric cancer patients undergoing peripheral intravenous cannulation: a randomized controlled trial. Cancer Nursing. 2021 Nov 1;44(6):435-42.
18. Wang J, Howell D, Shen N, Geng Z, Wu F, Shen M, Zhang X, Xie A, Wang L, Yuan C. mHealth supportive care intervention for parents of children with acute

lymphoblastic leukemia: quasi-experimental pre-and postdesign study. JMIR mHealth and uHealth. 2018 Nov 19;6(11):e9981.
19. Luo YH, Xia W, He XL, Zhang JP, Li HC. Psychological interventions for enhancing resilience in parents of children with cancer: a systematic review and meta-analysis. Supportive Care in Cancer. 2021 Nov;29(11):7101-10.
20. Cernvall M, Carlbring P, Wikman A, Ljungman L, Ljungman G, von Essen L. Twelve-month follow-up of a randomized controlled trial of internet-based guided self-help for parents of children on cancer treatment. Journal of Medical Internet Research. 2017 Jul 27;19(7):e273.
21. van Dijk-Lokkart EM, Braam KI, Kaspers GJ, van Dulmen-den Broeder E, Takken T, Grootenhuis MA, Streng IC, Bierings M, Merks JH, van den Heuvel-Eibrink MM, Veening MA. Applicability and evaluation of a psychosocial intervention program for childhood cancer patients. Supportive care in cancer. 2015 Aug;23:2327-33.
22. van Warmerdam J, Zabih V, Kurdyak P, Sutradhar R, Nathan PC, Gupta S. Prevalence of anxiety, depression, and posttraumatic stress disorder in parents of children with cancer: A meta-analysis. Pediatric blood & cancer. 2019 Jun;66(6):e27677.
23. Wijnberg-Williams BJ, Kamps WA, Klip EC, Hoekstra-Weebers JE. Psychological adjustment of parents of pediatric cancer patients revisited: five years later. Psycho-Oncology: Journal of the Psychological, Social and Behavioral Dimensions of Cancer. 2006 Jan;15(1):1-8.
24. Othman A, Blunden S, Mohamad N, Mohd Hussin ZA, Jamil Osman Z. Piloting a psycho-education program for parents of pediatric cancer patients in Malaysia. Psycho-Oncology: Journal of the Psychological, Social and Behavioral Dimensions of Cancer. 2010 Mar;19(3):326-31.
25. Joyce S, Shand F, Tighe J, Laurent SJ, Bryant RA, Harvey SB. Road to resilience: a systematic review and meta-analysis of resilience training programmes and interventions. BMJ open. 2018 Jun 1;8(6):e017858.
26. Griffin KH, Johnson JR, Kitzmann JP, Kolste AK, Dusek JA. Outcomes of a multimodal resilience training program in an outpatient integrative medicine clinic. The Journal of Alternative and Complementary Medicine. 2015 Oct 1;21(10):628-37.
27. Chmitorz A, Kunzler A, Helmreich I, Tüscher O, Kalisch R, Kubiak T, Wessa M, Lieb K. Intervention studies to foster resilience–A systematic review and proposal for a resilience framework in future intervention studies. Clinical psychology review. 2018 Feb 1;59: 78-100.
28. Rosenberg AR, Wolfe J, Bradford MC, Shaffer ML, Yi-Frazier JP, Curtis JR, Syrjala KL, Baker KS. Resilience and psychosocial outcomes in parents of children with cancer. Pediatric blood & cancer. 2014 Mar;61(3):552-7.
29. Jamali A, Ghaljaei F, Keikhaei A, Jalalodini A. Effect of peer education on the resilience of mothers of children with leukemia: A clinical trial. Medical-Surgical Nursing Journal. 2019 May 31;8(2).
30. Rosenberg AR, Bradford MC, Junkins CC, Taylor M, Zhou C, Sherr N, Kross E, Curtis JR, Joyce P. Effect of the promoting resilience in stress management intervention for parents of children with cancer (PRISM-P): a randomized clinical trial. JAMA network open. 2019 Sep 4;2(9):e1911578-.
31. Ye ZJ, Guan HJ, Wu LH, Xiao MY, Luo DM, Quan XM. Resilience and psychosocial function among mainland Chinese parents of children with cancer: a cross-sectional survey. Cancer nursing. 2015 Nov 1;38(6):466-74.

32. Penkman L, Scott—lane L, Pelletier W. A psychosocial program for pediatric oncology patients: a pilot study of "The Beaded Journey". Journal of psychosocial oncology. 2006 Oct 10;24(2):103-15.
33. ying Chiu S, Ho EK. Psychosocial support for parents of children with cancer. InPediatric Cancer 2012 Dec 1 (pp. 119-131). Nova Science Publishers Inc.