International Journal of Public Health Science (IJPHS)
Vol. 14, No. 3, September 2025, pp. 1232~1242
ISSN: 2252-8806, DOI: 10.11591/ijphs.v14i3.26000

Enhancing cancer patient care via nursing apps: a systematic review

Dwi Retnaningsih[1], Niken Sukesi[1], Rozaq Isnaini Nugraha[2], Reanita Anggis Deraya[1], Maulida Izzatin Ni'mah[1], Iva Anissya Putri[1], Sinta Selviana[1]
[1]Nursing Study Program, Widya Husada University, Semarang, Indonesia
[2]Information Technology Study Program, Widya Husada University, Semarang, Indonesia

Article Info

Article history:

Received Oct 2, 2024
Revised Dec 12, 2024
Accepted Mar 6, 2025

Keywords:

Application content
Cancer
Nursing applications
Quality of life
RCT

ABSTRACT

Digital health interventions have been shown to be effective in improving the quality of life for cancer patients through education, symptom management, and psychosocial support. This research aims to identify application content that can enhance the quality of life for cancer patients. The method used is a systematic review based on the population, intervention, comparison, outcome, study design (PICOS) criteria. From the search, 941 articles were found in the JSTOR database (n = 11), Science Direct (n = 54), ProQuest (n = 609), and Springer Link (n = 267), with a publication period from 2019 to 2024. The keywords used include: nursing applications, cancer, application content, quality of life, and randomized clinical trials (RCT). The inclusion criteria encompass RCT published in peer-reviewed journals, written in English, and utilizing digital applications as interventions to improve the quality of life for cancer patients. This research includes patients aged 16-80 from various countries, including China, Turkey, Ireland, Taiwan, and Australia. The results show that digital interventions such as digital storytelling, education through applications, nurse support programs, and virtual reality significantly improve patients' quality of life. The intervention content includes six main themes: medical education, symptom management, psychosocial support, multidisciplinary interventions, physical activity, and relaxation, as well as interactive digital platforms.

Corresponding Author:

Dwi Retnaningsih
Nursing Study Program, Widya Husada University
Subali Raya St No. 12, Semarang, Central Java, Indonesia
Email: dwi.retnaningsih@uwhs.ac.id

1. INTRODUCTION

Cancer is one of the leading causes of death worldwide, taking the lives of a growing number of individuals each year. The incidence of cancer is growing worldwide. In 2018, there were 18.1 million new cases of cancer. According to predictions made by Global Cancer Observatory: cancer today (GLOBOCAN), a part of the International Agency of the World Health Organization for Research on Cancer, there would be 27.5 million additional instances of cancer yearly, or 61.7% more, by 2040 [1].

Numerous technology-based therapies have been created and put into practice in an effort to enhance the quality of life for cancer patients [2]–[4]. The usage of digital platforms and mobile apps in healthcare has increased, offering chances to give patients more thorough and long-lasting support [5], [6]. Due to the physical, psychological, and social effects of the disease and its treatment—such as pain, exhaustion, worry, and social isolation—cancer patients frequently see a reduction in their quality of life [7]. Real-time monitoring, information, and emotional support may be given to patients through the use of

technology-based nursing programs [8]. To fulfill the unique demands of cancer patients and to offer efficient treatments to improve quality of life, the content of these apps must be tailored [9].

To determine which application content components are most useful in improving comfort, assisting cancer patients in managing their diseases, and offering emotional and psychological support, extensive study is required. In addition to offering evidence-based suggestions, this systematic review can help build nursing apps that better meet the requirements of patients, perhaps leading to better health outcomes and a higher quality of life [10]. Innovation in healthcare has been made possible by information and communication technology (ICT), which has made it possible for people to obtain medical information, keep track of their health, and interact with healthcare professionals more successfully [6], [11]. Applications for nurses created especially for cancer patients can offer information on the illness and its treatment, help managing symptoms, psychological support, and recommendations for rest and physical activity [12], [13]. To guarantee that it is pertinent and useful in assisting patients in managing their disease and enhancing their quality of life, the information offered by this app needs to be properly crafted.

Despite the quick rise in the creation of digital platforms and mobile applications for healthcare, prior studies have identified a number of issues that require attention. Many of the programs that are now accessible were not created with cancer sufferers' particular requirements in mind. The majority of the information now available is still generic and does not adequately take into account the various unique demands and psychological factors at every stage of cancer treatment, making it ineffective at enhancing patients' quality of life. Furthermore, current research frequently ignores the most important components of assisting patients in managing their disorders holistically, such as suitable physical activity recommendations, symptom management, and emotional support. In order to improve cancer patients' comfort, quality of life, and emotional and psychological support, this research is important since it aims to discover and optimize the content aspects of successful nursing apps. It is anticipated that the findings of this systematic review would offer evidence-based suggestions for creating nursing apps that are more patient-responsive, perhaps leading to long-term improvements in health outcomes. The research aims to identify application content that can improve the quality of life for cancer patients.

2. METHOD

2.1. Search strategy and inclusion criteria for systematic reviews

A systematic review is conducted in order to gather and examine data from different research projects that are pertinent to this subject. Utilizing the Joanna Briggs Institute Guidelines and the Centre for Review and Dissemination, we employed the PRISMA checklist of elements to assess the study's quality [13], [14]. The process of conducting a strategic literature search involves employing keywords that correspond with research topics, such as “Nursing Applications,” “Cancer,” “Application Content,” “Quality of Life,” and “randomized clinical trials (RCT)”; alternatively, one can search for relevant articles from other references by searching through databases like Journal Storage (JSTOR), Science Direct, ProQuest, and Springer Link. Journal articles from 2019 to 2024, the last five years of publication. The population, intervention, comparison, outcome, study design (PICOS) [15] criteria (population, intervention, comparison, outcome, and study design) are used to define the inclusion criteria for articles as shown in Table 1.

Table 1. Inclusion and exclusion criteria with PICOS

Criteria	Inclusion	Exclusion
Population	Cancer	Other than cancer
Intervention	A study looked at how nurses may use their training to improve the quality of life for cancer patients	There are no criteria exclusion
Comparisons	Intragroup, between-group, compared to control group, or without a control group	Qualitative
Outcome	Research that assesses how application content affects a person’s quality of life	There is no applicable app for cancer patients
Study type	RCT and experiments	Studies that do not provide empirical data
Type publication	Peer-reviewed original studies	Non-peer-reviewed studies
Years	2019-2024	Pre 2019
Language	English	Languages besides English

941 articles from 11 JSTOR, 54 Science Direct, 609 ProQuest, and 267 Springer Link were found in the results of this search. Four of the twenty-five articles that were surveyed did not fit the requirements, as they had nothing to do with the study's objectives. Consequently, twenty-one papers that satisfy the inclusion criteria and correspond with the research objectives have been selected for inclusion in this study. The title and abstract manuscripts are evaluated for topic relevance based on the following inclusion criteria: i) RCT and experiments published in English in peer-reviewed journals between 2019 and 2024, ii) study

participants with a clinical diagnosis of cancer, and iii) application of interventions to enhance the quality of life of cancer patients. The whole article is reviewed to determine if it should be included if the first review's findings do not clearly reveal its relevance. To guarantee the ultimate inclusion in the review, the whole text of the original article is read once it has been gathered. In this instance, the inclusion requirements are met by 21 articles.

2.2. Study selection, data extraction, and management

Identifying the essential components of every study, including RCT study designs, is crucial. Cancer patients make up the sample population, together with the analytic techniques, main findings, and intervention-related discoveries that may be applied to help cancer patients become more resilient. Make a table to hold the data that was taken from each study, along with any pertinent details and conclusions about the subject of the investigation. Make sure that all pertinent data is appropriately captured by meticulously extracting data from each chosen research project.

After the data has been retrieved, arrange it methodically into tables that are both manageable and accessible. To make sure the information is accurate and comprehensive, double-check the retrieved data. precisely detect any ambiguities or contradictions in the extracted data. The data are evaluated and interpreted to draw important conclusions and findings from the examined research. The Cochrane collaboration technique, which was derived from Sterne *et al*. [16], was used to assess the risk of bias in each study.

3. RESULTS AND DISCUSSION

3.1. Study characteristics

Twenty-one papers satisfied the review's inclusion requirements. RCT studies on cancer patients were used to get the articles. Figure 1 shows the flow diagram for the literature search and selection process. by being aware of how to use therapies to enhance cancer patients' quality of life, as shown in Figure 1.

3.2. Features of the respondent

The participants in the study were all cancer patients, with diagnoses including breast, lung, cervical, colorectal, gastrointestinal, or hepato-pancreato-biliary cancers, gastritis, and nasopharyngeal cancer. They received interventions to enhance their quality of life via websites, virtual reality, and mobile applications through devices such as laptops, iPads, computers, tablets, and smartphones. The respondents in this sort of RCT research ranged in age from 16 to 80 years old. China, Turkey, Ireland, Taiwan, Australia, South Korea, Sweden, Japan, the United Kingdom, Saudi Arabia, Switzerland, and Germany were some of the nations from which study findings were gathered. Table 2 displays the characteristics of respondents who talked about interventions utilizing applications to enhance the quality of life for patients with breast cancer.

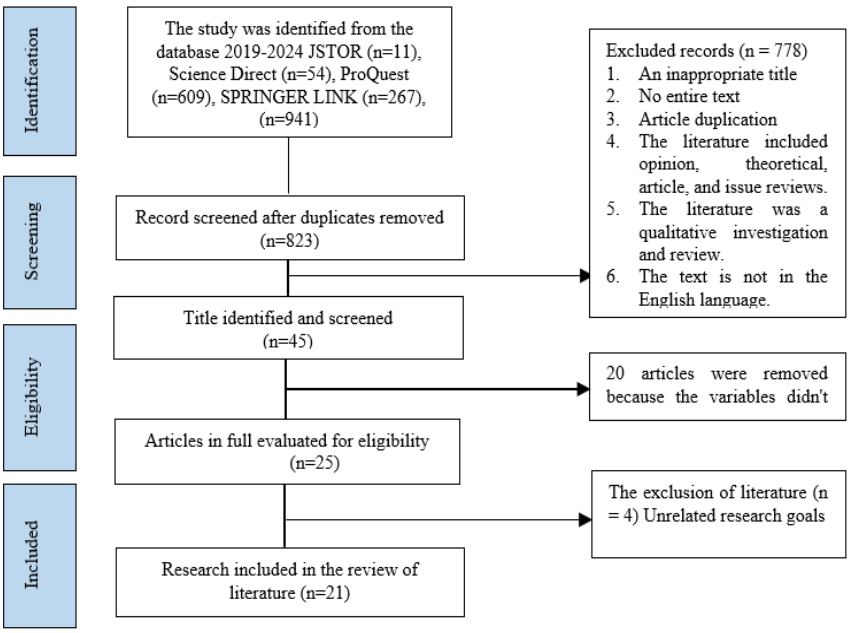

Figure 1. Flow diagram of the literature selection using PRISMA

Table 2. Features of the respondents

No	Library resource	Country	Cancer	Age (years)	Research type	Application media
1	[17]	China	Lung cancer	≤44	RCT	Phone
2	[18]	Turkey	Breast Cancer	≥18	RCT	Mobile application
3	[19]	Turkey	Breast Cancer	≥18	RCT	Phone
4	[20]	China	Breast Cancer	≥18	RCT	Phone
5	[21]	Turkey	Breast cancer	18–65	RCT	Phone
6	[22]	Ireland	Breast cancer	≥18	RCT	Ipad
7	[23]	Turkey	Cancer	18–65	RCT	Phone
8	[24]	Italy	Cancer	≥18	RCT	Virtual reality
9	[25]	Taiwan	Cancer	≥18	RCT	Tablet, or cellphone
10	[26]	Cina	Cervical cancer	18-50	RCT	Phone
11	[27]	China	Breast Cancer	18-70	RCT	Phone
12	[28]	Switzerland	Lung Cancer	≥18	RCT	Smartphone, tablet, laptop
13	[29]	Sweden	Breast cancer	>18	mixed-methods	Smartphone, tablet, laptop
14	[30]	Saudi Arabia	Colorectal	18–80	RCT	Smartphone, tablet, laptop
15	[31]	Australia	Gastrointestinal or hepato-pancreato-biliary	≥18	RCT	Smartphone, tablet, laptop
16	[32]	Taiwan	nasopharyngeal	18-60	RCT	Smartphones
17	[33]	South Korea	Cancer	≥20	RCT	Smartphones
18	[34]	Japan	Cancer	≥20	RCT	Smartphones
19	[35]	China	Gastric	≥ 18	RCT	Phone
20	[36]	United Kingdom	Cancer	≥ 16	RCT	Smartphones
21	[37]	Germany	Breast cancer	30-70	RCT	Smartphones

3.3. Both the kind of intervention and its application's content enhance cancer patients' quality of life

Through the use of programs like these, this kind of intervention enhances the quality of life for cancer patients; i) digital story telling, ii) education with mobile applications, iii) a nurse-led supportive care program was applied, iv) the phone-based support program, v) mobile app-based patient education, vi) application adhered to eMedical guidelines, vii) the teletriage protocol was applied, viii) immersive virtual reality, ix) a nurse-led exercise and health education informatics program, x) a nurse-led positive psychology intervention, xi) VR-CALM, xii) a digital lifestyle intervention on health-related quality of life, xiii) digital information, xiv) digital health, vx) iCare: a self-directed, xvi) mHealth-based continuous nursing intervention, xvii) a mobile-based symptom monitoring system, xviii) the smartphone intervention to less depression and anxiety, xix) individualized mHealth nutrition, xx) efficacy trial of a web-based psychological program, and xxi) a novel internet intervention. Through six primary themes—health education, symptom management, psychosocial support, multidisciplinary interventions, physical exercise and relaxation, and interactive digital platforms—this content offers complete care for cancer patients as shown in Table 3 (see Appendix).

3.3.1. Health education

The study's main conclusions emphasize the value of health education as the cornerstone of cancer patient assistance, particularly when it comes to digital strategies like instructional videos and web-based applications. According to this study, patients' comprehension of the significance of preserving both mental and physical health is much improved by knowledge on good psychological quality, healthy lifestyle choices, social support, and scientific activities [22]. By increasing their knowledge, patients and their families may actively engage in their care and make better treatment decisions, thereby improving the overall quality of life for cancer patients [38].

The study's findings are consistent with other research showing that individuals with a range of chronic diseases can benefit from digital therapies and health applications that enhance physical activity and everyday functioning. For instance, studies have demonstrated the advantages of digital apps in lowering blood pressure, enhancing physical function, and decreasing extended periods of sitting in older adults [39]. This study's shortcomings, however, include its incomplete investigation of the long-term impacts of digital therapies on younger cancer patients. Unexpected research indicates that while individuals with physical restrictions might need a more individualized approach, those in better physical health seem to respond more favorably to health apps [40].

The benefits of digital health education for cancer patients, with a focus on enhancing their quality of life and capacity for making decisions. In the contemporary digital age, where health and technology-based educational apps can be effective supporting aids in cancer care, this finding is significant. This study creates prospects for the development of more effective digital intervention techniques for a number of different chronic illnesses through a thorough educational approach.

3.3.2. Symptom management

Cancer patients' everyday lives can be greatly impacted by symptoms like nausea, despair, and exhaustion that are frequently encountered during treatment; thus, managing these symptoms is essential to attempts to enhance their quality of life. A handbook that offers useful techniques for 15 frequent symptoms has been shown to assist patients in lessening everyday discomfort and enhancing their mental well-being, according to important results [41]. Supporting data demonstrates that this strategy improves patients' mental health by providing individualized medical care in addition to effectively reducing physical symptoms. In order to meet the various issues faced by cancer patients, it is imperative that patients get attention that is particular to their requirements, which is made possible by individual health evaluations and suggestions for individualized treatment [42].

By placing patients at the heart of their symptom treatment, this research gives a fresh viewpoint when contrasted to other studies, such as the standard strategy, which emphasizes symptom management by healthcare professionals without direct patient engagement. The benefit of mCOPE, a mHealth program that integrates technology-based coping training using videoconferencing and mobile applications, is that it gives patients ongoing assistance that they may access whenever they need it. Nevertheless, this study's generalizability is limited, particularly due to its emphasis on younger patients with colorectal cancer, which means it is not yet able to accurately reflect the experiences of all cancer patients [43]. The study's surprising finding is that CBT-based coping training helps younger age groups have fewer symptoms, which may lead to a novel method of symptom treatment in the future.

These results highlight how crucial it is to offer programs that help patients autonomously manage their symptoms while taking into consideration their unique requirements and features. In addition to potentially improving the efficacy of interventions, the findings of this study offer important insights into how mHealth technology can be used to increase access and customize care for cancer patients, thereby improving their quality of life throughout the course of treatment and recuperation.

3.3.3. Psychosocial support

In order to assist cancer patients in managing the emotional and social strains that frequently result from their diagnosis and treatment, psychosocial support is crucial. The success of the nurse support program, which consists of four interactive sessions—learning, discussion, expert Q&A, and personal stories—as well as psychological modules intended to offer patients comprehensive assistance, is highlighted in this study [4]. According to supporting data, the program enhances patients' mental and emotional well-being, which is in line with earlier research showing that social support can lessen the detrimental effects of cancer on patients' quality of life [44]. In particular, this study highlights the underlying social and cultural obstacles that Chinese Australian women with breast cancer must surmount, including disparities in social support and the need to sacrifice themselves in order to protect others, which may be a reflection of their cultural norms. This emphasizes how crucial it is to comprehend cultural aspects when creating successful support plans for certain patient populations.

In contrast to earlier research, the results of this study are in line with data from over 30 years ago that show psychological assistance can enhance cancer patients' quality of life [45]. But this study also presents a new strength: the use of a comprehensive strategy that incorporates problem-solving therapy, education, and emotional support. The results may not be entirely generalizable to a larger population of cancer patients due to the study's limitations, which include its major focus being restricted to a group of Chinese-Australian women. This study also revealed a number of surprising findings, including the cultural influence on Chinese immigrant women's cancer coping mechanisms, which include the urge to sacrifice oneself in order to protect others. This highlights how crucial it is to modify support plans according to the patient's culture, something that has been disregarded in earlier research.

Investigating the efficacy of providing cancer patients with all-encompassing psychosocial assistance, especially to improve their social and emotional health while undergoing treatment. This study highlights the value of providing cancer patients with a comprehensive strategy that encompasses not just emotional care but also spiritual and educational elements. This study is significant because it demonstrates how culturally appropriate psychological support may enhance cancer patients' quality of life and offer insightful information for creating more successful therapies, particularly for patient populations with varied cultural origins [46], [47].

3.3.4. Multidisciplinary interventions

In order to provide a holistic approach to patient treatment, multidisciplinary interventions comprising nurses, gynecologists, psychiatric counselors, and physiotherapists have proven successful, especially when it comes to managing persistent pelvic pain. This method guarantees that different physical, behavioral, and psychological facets of the patient may be addressed concurrently, leading to a more comprehensive care plan customized to meet the patient's specific requirements. This is supported by certain

research, such as the focus on the value of healthcare professionals working together to provide more comprehensive and coordinated treatment. Patients are given useful tools to speed up their recovery and enhance their general well-being, such as the ERAS (Enhanced Recovery After Surgery) components used both before and after surgery, as well as the use of e-books with dietary and rehabilitation exercise guidelines [48].

The results of earlier studies that emphasize the value of a multidisciplinary approach in treating patients with chronic illnesses, especially persistent pelvic pain, are consistent with the findings of this study. There are, however, variations in this study's use of ERAS components and technology utilization, including e-books, which have not been thoroughly covered in earlier research. This study's primary strength is the integration of a complete strategy including several experts that tackles behavioral and psychological issues that impact patients' quality of life in addition to physical treatment. The lack of a long-term assessment of the intervention's efficacy in guaranteeing the sustainability of patient recovery, however, is the study's main weakness. Significant psychological advantages for patients are among the surprising findings, suggesting that mental support may be more important than previously thought in their physical healing process.

Investigating how multidisciplinary therapies, especially those that take a holistic approach that incorporates behavioral, psychological, and somatic elements, might aid patients with persistent pelvic pain in their rehabilitation. This study is significant because it shows that therapies that address many aspects of patients' lives can enhance their quality of life and provide more proof of the advantages of multidisciplinary teamwork in patient care. This study's importance therefore rests in its capacity to offer fresh perspectives on the treatment of chronic pain through the use of technology and a more all-encompassing approach to patient care.

3.3.5. Physical exercise and relaxation

A good diet, exercise, and relaxation are all crucial for the emotional and physical well-being of cancer patients. The study's main conclusions show that a moderately intense walking program at home, together with smart bracelet monitoring, not only keeps patients moving but also improves their general health. Furthermore, immersive experiences with soothing music and films offer a useful method of relaxation, which can lower stress and enhance patients' mental health [49]. This demonstrates how an integrated strategy that incorporates exercise, relaxation, and a nutritious diet may assist cancer patients in managing mental health issues like anxiety and despair while also enhancing their quality of life [50].

This result is consistent with other research that demonstrates the beneficial effects of relaxation and physical exercise on cancer patients' mental and physical health [51]. Nevertheless, in contrast to other research, this study also highlights the significance of monitoring with cutting-edge devices like smart wristbands, which offer real-time data to track physical activity. This study's primary strength is its comprehensive methodology, which combines these three crucial components. Its drawbacks, however, include the limited sample size and the brief research period, which may prevent the conclusions from being broadly applicable. Furthermore, despite the absence of direct psychologically oriented therapies, a surprising outcome was the favorable influence shown in patients with relation to the enhancement of mental health.

Investigating the effects of calm, exercise, and a balanced diet on cancer patients' overall health. This study demonstrates that a comprehensive strategy that incorporates all three elements can enhance quality of life and lessen the psychological symptoms that cancer patients frequently experience. The significance of this work resides in the discovery that wearable technology can provide more efficient physical activity tracking, and the incorporation of relaxing music and films provides more readily available stress-reduction strategies. Opportunities for a more all-encompassing approach to treatment are created by this research, which offers fresh perspectives on holistic care that takes into account cancer patients' emotional and physical well-being.

3.3.6. Digital interactive platform

Flexible educational solutions that may be customized to patients' requirements are provided via interactive digital platforms such as iCare and iNutrition. With access to a range of materials, such as textual courses, podcasts, and videos, in addition to counseling and nutrition consultations, this platform provides cancer patients with all-encompassing care throughout their treatment process. Furthermore, patients may remain motivated and focused on their mental health objectives thanks to the platform's capacity to monitor patient progress and offer tailored feedback. Evidence demonstrates that these digital platforms can enhance treatment compliance and increase patient comfort in long-term care [52], [53].

The findings of this study show that iCare and iNutrition not only offer instructional materials but also improve patient involvement in health management, in contrast to other research that assessed the use of digital platforms in cancer treatment [31]. Although the restricted examination of individuals from different socioeconomic backgrounds may impact access and the platform's efficacy, this study affirms the significance of offering modules that may be customized for each individual. However, the surprising findings suggest that remote counseling and instructional materials might hasten patients' mental healing, which was not addressed in earlier studies that concentrated more on the medical side of treatment.

Investigating the ways in which personalized educational and psychological assistance via interactive digital platforms might improve cancer patients' involvement in their treatment process. This study highlights the value of adaptability and accessibility in healthcare by incorporating technology to provide a more patient-centered approach. This can result in improved outcomes, particularly when it comes to patients' mental health. The results of this study offer valuable information for the creation of technologically based health solutions that can improve patients' general health.

4. CONCLUSION

This systematic review identified several application-based interventions that can help cancer patients live better lives. The findings of the study demonstrate that applications created for cancer patients offer all-encompassing assistance by addressing six key areas: interactive digital platforms, health education, symptom management, psychological support, multidisciplinary treatments, physical exercise and relaxation, and health education. A number of application kinds, such as those based on digital storytelling, mobile education, nurse-led care support programs, virtual reality-based therapies, and symptom monitoring apps, have demonstrated efficacy in enhancing quality of life. The findings of this study have significant ramifications for the advancement of medical technology, especially in terms of enhancing the lives of cancer patients. Developing mobile apps with integrated health features may be a practical solution for patients and effective option, especially when it comes to improving education, managing symptoms, and offering the required psychological support. Furthermore, the use of cutting-edge technology like virtual reality and telemedicine-based applications can enhance interdisciplinary approaches and enhance long-term health results. As part of a more comprehensive and technologically advanced cancer care system, this study promotes the further development of these applications.

ACKNOWLEDGMENTS

Our sincere appreciation goes out to: i) Research, Technology, and Community Service Directorate; ii) Higher Education, Research, and Technology Directorate General; and iii). The Republic of Indonesia's Ministry of Education, Culture, Research, and Technology, for the grant money given out in 2024. The execution of our study is greatly aided by this assistance, which is anticipated to have a real impact on the advancement of science, technology, and society.

REFERENCES

[1] M. C. Hulvat, "Cancer incidence and trends," *Surgical Clinics of North America*, vol. 100, no. 3, pp. 469–481, Jun. 2020, doi: 10.1016/j.suc.2020.01.002.

[2] M. I. Fitch, I. Nicoll, and G. Lockwood, "Cancer survivor's perspectives on the major challenge in the transition to survivorship," *Patient Education and Counseling*, vol. 103, no. 11, pp. 2361–2367, Nov. 2020, doi: 10.1016/j.pec.2020.04.018.

[3] H. Lin, M. Ye, S. W. Chan, J. Zhu, and H. He, "The effectiveness of online interventions for patients with gynecological cancer: An integrative review," *Gynecologic Oncology*, vol. 158, no. 1, pp. 143–152, Jul. 2020, doi: 10.1016/j.ygyno.2020.04.690.

[4] Z. K. Sengul and E. K. Toruner, "Intervention protocol: Technology-based psychosocial motivation for children with cancer and their parents: A randomized trial," *Asia-Pacific Journal of Oncology Nursing*, vol. 7, no. 1, pp. 55–63, Jan. 2020, doi: 10.4103/apjon.apjon_25_19.

[5] G. Jimenez *et al.*, "Digital health competencies for primary healthcare professionals: A scoping review," *International Journal of Medical Informatics*, vol. 143, p. 104260, Nov. 2020, doi: 10.1016/j.ijmedinf.2020.104260.

[6] R. Sharma and N. Kshetri, "Digital healthcare: Historical development, applications, and future research directions," *International Journal of Information Management*, vol. 53, p. 102105, Aug. 2020, doi: 10.1016/j.ijinfomgt.2020.102105.

[7] R. L. Siegel, K. D. Miller, and A. Jemal, "Cancer statistics, 2020," *CA: A Cancer Journal for Clinicians*, vol. 70, no. 1, pp. 7–30, Jan. 2020, doi: 10.3322/caac.21590.

[8] R. B. Parikh *et al.*, "Digital health applications in oncology: An opportunity to seize," *JNCI: Journal of the National Cancer Institute*, vol. 114, no. 10, pp. 1338–1339, Oct. 2022, doi: 10.1093/jnci/djac108.

[9] E. R. Dorsey and E. J. Topol, "Telemedicine 2020 and the next decade," *The Lancet*, vol. 395, no. 10227, p. 859, Mar. 2020, doi: 10.1016/S0140-6736(20)30424-4.

[10] T. H. Thomas *et al.*, "Empowerment through technology: A systematic evaluation of the content and quality of mobile applications to empower individuals with cancer," *International Journal of Medical Informatics*, vol. 163, p. 104782, Jul. 2022, doi: 10.1016/j.ijmedinf.2022.104782.

[11] A. Papa, M. Mital, P. Pisano, and M. Del Giudice, "E-health and wellbeing monitoring using smart healthcare devices: An empirical investigation," *Technological Forecasting and Social Change*, vol. 153, p. 119226, Apr. 2020, doi: 10.1016/j.techfore.2018.02.018.

[12] L. Rubio, M. López-García, M. J. Gaitán-Arroyo, J. Martin-Martin, and I. Santos-Amaya, "Palliative care undergraduate education: Do medical and nursing students need more skills in ethical and legal issues?," *Medical Hypotheses*, vol. 142, p. 110138, Sep. 2020, doi: 10.1016/j.mehy.2020.110138.

[13] R. Kaye, M. Rosen-zvi, and R. Ron, "Digitally-enabled remote care for cancer patients: Here to stay," *Seminars in Oncology Nursing*, vol. 36, no. 6, p. 151091, Dec. 2020, doi: 10.1016/j.soncn.2020.151091.

[14] M. J. Page *et al.*, "The PRISMA 2020 statement: an updated guideline for reporting systematic reviews," *BMJ*, p. n71, Mar. 2021,

doi: 10.1136/bmj.n71.
[15] M. S. Cumpston, J. E. McKenzie, J. Thomas, and S. E. Brennan, "The use of 'PICO for synthesis' and methods for synthesis without meta-analysis: protocol for a survey of current practice in systematic reviews of health interventions," *F1000Research*, vol. 9, pp. 1–9, 2021, doi: 10.12688/F1000RESEARCH.24469.1.
[16] J. A. C. Sterne *et al.*, "RoB 2: a revised tool for assessing risk of bias in randomised trials," *BMJ*, p. l4898, Aug. 2019, doi: 10.1136/bmj.l4898.
[17] J. Zhu *et al.*, "Effect of digital storytelling intervention on resilience, self-efficacy and quality of life among patients with non-small cell lung cancer (NSCLC): A randomized controlled trial," *European Journal of Oncology Nursing*, vol. 69, p. 102535, Apr. 2024, doi: 10.1016/j.ejon.2024.102535.
[18] H. Balci and S. Faydali, "The effect of education performed using mobile application on supportive care needs and quality of life in women with breast cancer: Randomized controlled trial," *Seminars in Oncology Nursing*, vol. 40, no. 4, p. 151684, Aug. 2024, doi: 10.1016/j.soncn.2024.151684.
[19] B. Y. Kucuk and P. Z. Bahceli, "The effects of nurse-led supportive care program on quality of life in women with breast cancer receiving adjuvant chemotherapy: A randomized controlled pilot study," *Seminars in Oncology Nursing*, vol. 40, no. 2, p. 151609, Apr. 2024, doi: 10.1016/j.soncn.2024.151609.
[20] X. Chen, Y. Qin, and N. Chaimongkol, "Effectiveness of a phone-based support program on self-care self-efficacy, psychological distress, and quality of life among women newly diagnosed with breast cancer: A randomized controlled trial," *European Journal of Oncology Nursing*, vol. 71, p. 102643, Aug. 2024, doi: 10.1016/j.ejon.2024.102643.
[21] D. Çınar, A. Karadakovan, and A. P. Erdoğan, "Effect of mobile phone app-based training on the quality of life for women with breast cancer," *European Journal of Oncology Nursing*, vol. 52, p. 101960, Jun. 2021, doi: 10.1016/j.ejon.2021.101960.
[22] M. Adam, S. A. McMahon, C. Prober, and T. Bärnighausen, "Human-centered design of video-based health education: An iterative, collaborative, community-based approach," *Journal of Medical Internet Research*, vol. 21, no. 1, p. e12128, Jan. 2019, doi: 10.2196/12128.
[23] A. A. Cetin, H. Bektas, and H. S. Coskun, "The effect of telephone triage on symptom management in patients with cancer undergoing systemic chemotherapy: A randomized controlled trial," *European Journal of Oncology Nursing*, vol. 61, p. 102221, Dec. 2022, doi: 10.1016/j.ejon.2022.102221.
[24] F. Burrai, S. Ortu, M. Marinucci, M. G. De Marinis, and M. Piredda, "Effectiveness of immersive virtual reality in people with cancer undergoing antiblastic therapy: A randomized controlled trial," *Seminars in Oncology Nursing*, vol. 39, no. 4, p. 151470, Aug. 2023, doi: 10.1016/j.soncn.2023.151470.
[25] Y.-L. Chang, Y.-F. Tsai, C.-L. Hsu, Y.-K. Chao, C.-C. Hsu, and K.-C. Lin, "The effectiveness of a nurse-led exercise and health education informatics program on exercise capacity and quality of life among cancer survivors after esophagectomy: A randomized controlled trial," *International Journal of Nursing Studies*, vol. 101, p. 103418, Jan. 2020, doi: 10.1016/j.ijnurstu.2019.103418.
[26] Y. Shi *et al.*, "Effects of a nurse-led positive psychology intervention on sexual function, depression and subjective well-being in postoperative patients with early-stage cervical cancer: A randomized controlled trial," *International Journal of Nursing Studies*, vol. 111, p. 103768, Nov. 2020, doi: 10.1016/j.ijnurstu.2020.103768.
[27] X. Zhang *et al.*, "The impact of VR-CALM intervention based on VR on psychological distress and symptom management in breast cancer survivors," *Journal of Oncology*, vol. 2022, pp. 1–10, Jun. 2022, doi: 10.1155/2022/1012813.
[28] M. Weber *et al.*, "Efficacy of a digital lifestyle intervention on health-related QUAlity of life in non-small cell LUng CAncer survivors following inpatient rehabilitation: protocol of the QUALUCA Swiss multicentre randomised controlled trial," *BMJ Open*, vol. 14, no. 3, p. e081397, Mar. 2024, doi: 10.1136/bmjopen-2023-081397.
[29] S. Fristedt, F. Smith, A. Grynne, and M. Browall, "Digi-Do: a digital information tool to support patients with breast cancer before, during, and after start of radiotherapy treatment: an RCT study protocol," *BMC Medical Informatics and Decision Making*, vol. 21, no. 1, p. 76, Dec. 2021, doi: 10.1186/s12911-021-01448-3.
[30] R. Wyse *et al.*, "Effectiveness and cost-effectiveness of a digital health intervention to support patients with colorectal cancer prepare for and recover from surgery: study protocol of the RecoverEsupport randomised controlled trial," *BMJ Open*, vol. 13, no. 3, p. e067150, Mar. 2023, doi: 10.1136/bmjopen-2022-067150.
[31] P. M. Livingston *et al.*, "iCare – a self-directed, interactive online program to improve health and wellbeing for people living with upper gastrointestinal or hepato-pancreato-biliary cancers, and their informal carers: the study protocol for a Phase II randomised controlled trial," *BMC Cancer*, vol. 24, no. 1, p. 144, Jan. 2024, doi: 10.1186/s12885-024-11861-2.
[32] T. Liao, L. Qiu, J. Zhu, J. Li, Y. Zhang, and L. Yang, "A mHealth-based nursing model for assessing the health outcomes of the discharged patients with nasopharyngeal carcinoma: a pilot RCT," *BMC Nursing*, vol. 21, no. 1, p. 210, Dec. 2022, doi: 10.1186/s12912-022-00993-0.
[33] M. Lee *et al.*, "Evaluating the effect of a mobile-based symptom monitoring system for improving physical function in patients with cancer during chemotherapy: study protocol for a multicentre randomised controlled trial," *BMJ Open*, vol. 14, no. 5, p. e080976, May 2024, doi: 10.1136/bmjopen-2023-080976.
[34] M. Uchida *et al.*, "Optimization of smartphone psychotherapy for depression and anxiety among patients with cancer using the multiphase optimization strategy (MOST) framework and decentralized clinical trial system (SMartphone Intervention to LEssen depression/Anxiety and GA," *Trials*, vol. 24, no. 1, p. 344, May 2023, doi: 10.1186/s13063-023-07307-y.
[35] X. Jiang *et al.*, "Feasibility of an individualized mHealth nutrition (iNutrition) intervention for post-discharged gastric cancer patients following gastrectomy: A randomized controlled pilot trial," *Nutrients*, vol. 15, no. 8, p. 1883, Apr. 2023, doi: 10.3390/nu15081883.
[36] N. J. Hulbert-Williams *et al.*, "The finding my way UK clinical trial: Adaptation report and protocol for a replication randomized controlled efficacy trial of a web-based psychological program to support cancer survivors," *JMIR Research Protocols*, vol. 10, no. 9, p. e31976, Sep. 2021, doi: 10.2196/31976.
[37] F. Holtdirk *et al.*, "Results of the optimune trial: A randomized controlled trial evaluating a novel Internet intervention for breast cancer survivors," *PLOS ONE*, vol. 16, no. 5, p. e0251276, May 2021, doi: 10.1371/journal.pone.0251276.
[38] L. Watson, C. Maheu, S. Champ, and M. I. Fitch, "Empowering oncology nurses through knowledge and practice to improve transitions following treatment and survivorship care," *Asia-Pacific Journal of Oncology Nursing*, vol. 8, no. 5, pp. 555–559, Sep. 2021, doi: 10.4103/apjon.apjon-215.
[39] C. A. Garcia Meneguci, J. Meneguci, J. E. Sasaki, S. Tribess, and J. S. V. Júnior, "Physical activity, sedentary behavior and functionality in older adults: A cross-sectional path analysis," *PLOS ONE*, vol. 16, no. 1, p. e0246275, Jan. 2021, doi: 10.1371/journal.pone.0246275.

[40] L. Marciano, A.-L. Camerini, and P. J. Schulz, "The role of health literacy in diabetes knowledge, self-care, and glycemic control: A meta-analysis," *Journal of General Internal Medicine*, vol. 34, no. 6, pp. 1007–1017, Jun. 2019, doi: 10.1007/s11606-019-04832-y.
[41] B. Magalhães, C. Fernandes, L. Lima, J. M. Martinez-Galiano, and C. Santos, "Cancer patients' experiences on self-management of chemotherapy treatment-related symptoms: A systematic review and thematic synthesis," *European Journal of Oncology Nursing*, vol. 49, p. 101837, Dec. 2020, doi: 10.1016/j.ejon.2020.101837.
[42] L. C. Lopes-Júnior and L. C. Veronez, "Personalized care for patients with cancer in the precision-medicine era," *International Journal of Environmental Research and Public Health*, vol. 20, no. 4, p. 3023, Feb. 2023, doi: 10.3390/ijerph20043023.
[43] K. A. Hyland *et al.*, "mHealth coping skills training forsymptom management (mCOPE) for colorectal cancer patients in early to mid-adulthood: Study protocol for a randomized controlled trial," *Contemporary Clinical Trials Communications*, vol. 33, p. 101126, Jun. 2023, doi: 10.1016/j.conctc.2023.101126.
[44] N. P. W. P. Sari, "Social wellbeing among women living with cancer," *International Journal of Public Health Science (IJPHS)*, vol. 9, no. 1, p. 62, Mar. 2020, doi: 10.11591/ijphs.v9i1.20414.
[45] J. B. Hopkinson, "The psychosocial components of multimodal interventions offered to people with cancer cachexia: A scoping review," *Asia-Pacific Journal of Oncology Nursing*, vol. 8, no. 5, pp. 450–461, Sep. 2021, doi: 10.4103/apjon.apjon-219.
[46] C. Bergerot *et al.*, "Global unmet psychosocial needs in cancer care: health policy," *eClinicalMedicine*, vol. 78, p. 102942, Dec. 2024, doi: 10.1016/j.eclinm.2024.102942.
[47] J. V Levesque, M. Gerges, and A. Girgis, "Psychosocial experiences, challenges, and coping strategies of chinese–australian women with breast cancer," *Asia-Pacific Journal of Oncology Nursing*, vol. 7, no. 2, pp. 141–150, Apr. 2020, doi: 10.4103/apjon.apjon_53_19.
[48] B.-J. Collett, C. Cordle, and C. Stewart, "Setting up a multidisciplinary clinic," *Best Practice & Research Clinical Obstetrics & Gynaecology*, vol. 14, no. 3, pp. 541–556, Jun. 2000, doi: 10.1053/beog.1999.0090.
[49] V. LeBaron *et al.*, "Understanding the experience of cancer pain from the perspective of patients and family caregivers to inform design of an in-home smart health system: Multimethod approach," *JMIR Formative Research*, vol. 4, no. 8, p. e20836, Aug. 2020, doi: 10.2196/20836.
[50] P. Magesh, "Food and mood-the interplay between nutrition, mood, brain, and behavior," *International Journal of Social Science and Humanities Research*, vol. 5, no. 12, pp. 1–12, 2022.
[51] C. M. P. Roscoe, A. Pringle, C. Chandler, M. A. Faghy, and B. Barratt, "The role of physical activity in cancer recovery: An exercise practitioner's perspective.," *International Journal of Environmental Research And Public Health*, vol. 19, no. 6, Mar. 2022, doi: 10.3390/ijerph19063600.
[52] Y. Chen *et al.*, "An intelligent individualized cardiovascular app for risk elimination (iCARE) for individuals with coronary heart disease: Development and usability testing analysis," *JMIR mHealth and uHealth*, vol. 9, no. 12, p. e26439, Dec. 2021, doi: 10.2196/26439.
[53] S. Hermes, T. Riasanow, E. K. Clemons, M. Böhm, and H. Krcmar, "The digital transformation of the healthcare industry: exploring the rise of emerging platform ecosystems and their influence on the role of patients," *Business Research*, vol. 13, no. 3, pp. 1033–1069, Nov. 2020, doi: 10.1007/s40685-020-00125-x.

APPENDIX

Table 3. Shows how the type of intervention and its application's content enhance cancer patients' quality of life

No	Library source	Intervention	Application content	Theme
1	[17]	Digital storytelling	Participants' knowledge and awareness of critical elements for both mental and physical health are enhanced by four movies on positive psychological quality, healthy lifestyle choices, positive social support, and productive scientific activities.	Health education
2	[18]	Education with a mobile application prepared for the supportive care needs	Diseases, diagnosis and treatment, physical symptoms, post-treatment monitoring, side effect management, everyday activities, sexual health, psychosocial changes, and care assistance are only a few of the subjects covered by the educational material in the mobile application.	Health education
3	[19]	Nurse-led supportive care program applied	For the intervention group, the nurse-led supportive care program addresses physical and psychological issues that lower women's quality of life during and after breast surgery and chemotherapy.	Psychosocial support
4	[20]	The phone-based support program (PBSP)	The PBSP consists of four three-week sessions that include learning, discussions, expert questions, and a personal story group.	Multidisciplinary interventions
5	[21]	the mobile app-based patient education	This study creates a web application for management and a mobile application for patient education that offers symptom diaries, basic information on breast cancer, and suggestions for leading a healthy lifestyle.	Health education
6	[22]	Application adhered to eMedical guidelines	Information about the basic biology of breast cancer, the various treatments used, and surgical techniques.	Health education
7	[23]	The TeleTRIAGE protocol applied	Anxiety, appetite loss, bleeding, shortness of breath, constipation, depression, diarrhea, tiredness, febrile neutropenia, stomatitis, nausea and vomiting, peripheral neuropathy, skin responses, pain, and sleep issues are the 15 primary symptoms that patients encounter, and they are covered in this book.	Symptom management

Table 3. Shows how the type of intervention and its application's content enhance cancer patients' quality of life (continued)

No	Library source	Intervention	Application content	Theme
8	[24]	Immersive virtual reality	Nine categories—Africa, hills, river-waterfalls, islands, deserts, beaches, mountains, oceans, and submarines—comprise Scenarios-ios' collection of 310 movies. Natural noises and calming music of the highest caliber may be heard in the audio scenario for a more immersive audiovisual experience.	Physical exercise and relaxation
9	[25]	A nurse-led exercise and health education informatics program	The moderate-intensity walk after meals, three to five days a week, for thirty minutes each, is part of the home running exercise program. A smart wristband is used to track activity data, blood pressure, and heart rate. E-books for food advice, physical therapy exercises, symptom management, and psychological adjustment are all included in health education.	Health education
10	[26]	A nurse-led positive psychology	The intervention team consists of 7 people, led by nurses, and involves the collaboration of multidisciplinary experts: nurse specialists, gynecologists, psychological counselors, and rehabilitation physiotherapists. The intervention lasts four phases (4 weeks), with each phase lasting one week and the intervention twice a week, 45–60 minutes per session. Each group of multidisciplinary teams makes plans for each stage, which are followed by the patient. All instructions are provided through WeChat, with referral services for face-to-face consultation or treatment if necessary.	Multidisciplinary interventions
11	[27]	VR-CALM	Patients wearing the equipment will experience it in depth in beautiful places like the beaches and the Butterfly Valley, where they can walk. They'll hear the wind and the guide once in a while, while touching the butterflies with the controller in their hands. This audio-visual experience is a comprehensive intervention model in which each patient will experience this scene at least twice and choose their favorite scene for the next intervention, ensuring consistency in the intervention for each patient.	Interactive digital platforms
12	[28]	An intervention based on a digital lifestyle for health-related quality of life	Topics include physical activity, nutrition, breathing, and relaxation.	Health education
13	[29]	A digital information	The digital information tool utilized in the project is split into two distinct but connected applications for mobile devices: one is a virtual reality (VR) application that offers a voice-guided tour of the RT department using 360-degree images to give the impression that the user has visited the department prior to beginning RT, and the other is an information application that contains data from the pre-care stage.	Interactive digital platforms
14	[30]	A digital health	Pre-recovery (such as stopping smoking) and post-operation (such as early movement, decrease of opioids, early resumption of oral and fluid meals, and breathing exercises) are examples of the patient-led components of the ERAS guidelines.	Health education
19	[35]	Individualized mHealth nutrition	A communication center, nutrition consultations over the phone, nutrition management, nutrition education, and gastrointestinal symptom management are the four components that make up the iNutrition application.	Health education
20	[36]	Trial of an online psychological program's efficacy	Topics include care and communication with the care team, dealing with physical symptoms and side effects, managing suffering, identity-related challenges, body image, and sexuality, social support and family issues, as well as problems arising after treatment.	Multidisciplinary interventions
21	[37]	A novel internet intervention	Psychological health, nutrition and exercise planning, physical activity and exercise, and sleep hygiene are among the topics covered.	Health education

BIOGRAPHIES OF AUTHORS

Dwi Retnaningsih is a Senior lecturer in Nursing Study Program, Widya Husada University, Semarang, Central Java, Indonesia, who concentrates on researching health and nursing issues both in the community setting and in health services. She published several books, research, and dedication in the field of nursing. She can be contacted at email: dwi.retnaningsih@uwhs.ac.id.

Niken Sukesi is a Senior lecturer in Nursing Study Program, Widya Husada University, Semarang, Central Java, Indonesia, who concentrates on researching nursing issues. She published several books, research, and dedication in the field of nursing. She can be contacted at email: nikensukesi2004@gmail.com.

Rozaq Isnaini Nugraha is a lecturer at Widya Husada Semarang. His research primarily focuses on innovative program design and the application of technology in this field. With a passion for advancing education and practical solutions, he strive to empower students and professionals with the knowledge and tools necessary to enhance the rapidly expanding programming scope. He can be contacted at email: rozaqin@uwhs.ac.id.

Reanita Anggis Deraya is a graduate student of nursing, Widya Husada University, Semarang, Central Java, Indonesia. She is dedicated to the field of nursing. She can be contacted at email: 2107005@student.uwhs.ac.id.

Maulida Izzatin Ni'mah is a graduate student of nursing, Widya Husada University, Semarang, Central Java, Indonesia. She is dedicated to the field of nursing. She can be contacted at email: 2007013@student.uwhs.ac.id.

Iva Anissya Putri is a graduate student of nursing, Widya Husada University, Semarang, Central Java, Indonesia. She is dedicated to the field of nursing. She can be contacted at email: 2107038@student.uwhs.ac.id.

Sinta Selviana is a graduate student of nursing, Widya Husada University, Semarang, Central Java, Indonesia. She is dedicated to the field of nursing. She can be contacted at email: 2107080@student.uwhs.ac.id.