Arab American University
Faculty of Graduate Studies
Department of Health Sciences
Ph.D. Program in Nursing

The Effect of Using Augmented Virtual Reality on Pain, Stress, Anxiety, and Self-Efficacy among Patients with Cancer Undergoing Chemotherapy in the West Bank

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Declaration

I declare that, except where explicit reference is made to the contribution of others, this dissertation is substantially my own work and has not been submitted for any other degree at the Arab American University or any other institution.

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Dedication

To the one who loved life and sought its path... To the one who worked hard and succeeded... To the one who inspired me hope before and still, whose presence continues to care for me, I dedicate this work.

Student Name: Farid Salih Mustafa Abu Leil

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The Effect of Using Augmented Virtual Reality on Pain, Stress, Anxiety, and Self-Efficacy among Patients with Cancer Undergoing Chemotherapy in the West Bank

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Abstract

Background: Cancer considered a serious illness often leads patients to experience emotional and psychological distress. Cancer management, including chemotherapy, can significantly impact a patient's daily functioning and quality of life, contributing to added stress and further deterioration in mental health. To overcome these negative impacts, non-pharmacological interventions such as augmented reality have been employed in hospitals and clinics in recent years. Augmented reality has been found to alleviate pain and psychological symptoms for patients undergoing chemotherapy.

Aim: This study examined the effect of using augmented virtual reality on pain, stress, anxiety, and self-efficacy among patients with cancer undergoing chemotherapy sessions in the West Bank hospitals in Palestine.

Methodology: A randomized control trial design was conducted between June and September 2023 including a pretest and posttest. The study took place at three large hospitals in north Palestine specializing in care for patients with a cancer diagnosis specifically within the chemotherapy units The sample consisted of 150 participants, with 75 in the interventional group using augmented virtual reality and 75 in the control groups treated with the usual routines care.

Result: The majority of the participants 110 (73.3%) experienced breast cancer. More than half of them 79 (52.7%) have two chemotherapy sessions. There was a significant difference in mean pain score between the interventional and control groups ($p< 0.05=0.001$). The mean pain scores of the interventional group ($M = 2.6$, $SD\pm 1.7$) were lower than those of the control group ($M = 4.6$, $SD\pm 2.8$), there was a significant difference in general self-efficacy scores mean between the interventional and control groups ($p< 0.05=0.047$). The mean of the general self-efficacy scores in the interventional group ($M = 31.0$, $SD\pm 6.7$) was higher than that in the control group ($M = 28.8$, $SD\pm 6.8$), there was a significant difference in the stress mean scores between the interventional and control groups ($p< 0.05=0.001$). The mean stress scores in the interventional group ($M = 17.7$, $SD\pm 2.8$) were lower than that in the control group ($M = 19.2$, $SD\pm 2.5$), there was a significant difference in the anxiety levels between the interventional and control groups ($p< 0.05=0.001$). Also, the analysis revealed that 41(54.7%) of the interventional group had minimal anxiety while only 20 (26.7%) of the control group had similar results.

Conclusion: Various strategies are available to reduce the pain, stress, and anxiety associated with cancer therapy. Using augmented virtual reality techniques through goggles has been shown to significantly decrease pain, stress, and anxiety while enhancing self-efficacy among patients with cancer undergoing chemotherapy sessions. Therefore, using augmented virtual reality is highly recommended and should be included in the standard of care provided to patients with cancer.

Keywords: Anxiety; Augmented virtual Reality; Pain; Self-efficacy; Stress.

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List of Definitions of Abbreviations

Abbreviations	Title
AVR	Augmented Virtual Reality
MOH	Ministry of Health
RCT	Randomized Control Trial
IARC	International Agency of Research on Cancer
PSS	Perceived Stress Scale
GAD	Generalized Anxiety Disorder
IV	Intravenous
IVAD	Implanted Venous Access Device
NPRS	Numeric Pain Rating Scale
GSE	General Self-Efficacy Scale
SPSS	Statistical Package for Social Science
SE	Self-efficacy

Chapter One :Introduction

1.1 Background

Cancer is anticipated to overtake all other causes of death by the end of the 21st century, becoming the biggest obstacle to the increase of life expectancy (Bray et al., 2018). During the last ten years, cancer incidence has risen globally, and during the next twenty years, the incidences will likely increase by up to sixty percent (World Health Organization, 2003). Worldwide, cancer has become the leading cause of premature death. The prevalence of cancer will certainly rise globally over the next fifty years (Bray, 2021).

For patients with cancer pain is a daily occurrence. (Snijders et al., 2023). Around 40% of patients with cancer experience pain (Wilkinson & Branco, 2020). This pain becomes chronic, negatively impacts the patient's quality of life and worsens the health outcome (Duarte et al., 2023).

Patients with cancer also experience negative emotions such as anxiety and stress, as most patients encounter multiple stressors during the disease process (Antoni & Penedo, 2023). Chronic stress experienced by patients with cancer can significantly impact their healing process. stress can contribute to genetic instability and increased vulnerability in cancer cells, potentially leading to poorer prognosis outcomes (da Costa et al., 2023). Also, anxiety negatively impacts both psychological and social well-being (Lee et al., 2021). Moreover, in clinical settings for patients with cancer, especially during various kinds of procedures, including chemotherapy sessions, there was obvious anxiety observed in patients (Mausbach et al., 2020). Anxiety among cancer patients was found to increase the risk of death (Wang et al., 2020).

In the inpatient and outpatient cancer care settings, non-pharmacologic interventions as well as pharmacological agents can be employed to alleviate or manage side effects in patients with cancer (Chirico et al., 2020). Thus, the development of nontoxic, safe, and efficient treatment agents for cancer treatment is of vital significance (Tian & Liu., 2020). Chemotherapy is now considered a successful pharmacological treatment for a wide variety of cancers (Behranvand et al., 2022). The major aim of chemotherapy is to suppress cell spread and tumor growth, therefore thwarting invasion, and metastasis. Chemotherapy drugs mainly work on cell function through DNA, RNA, or protein formation (Amjad & Kasi, 2020).

In recent years, there has been a shift in healthcare towards more technologically advanced interventions such as the use of augmented virtual reality (AVR) technology in healthcare for the treatment of various physical and mental health conditions (Kim, 2020). AVR facilitates real-time interaction and navigation within 3D environments. This technology enables patients to experience immersive simulations of settings that might be impractical or inaccessible in their everyday lives, such as jungles, beaches, mountains, waterfalls, and more (Pensieri & Pennacchini, 2016; Chirico et al., 2016). AVR has found its way into various industries, revolutionizing how we interact with the world around us. From gaming and entertainment to education and healthcare, AVR is reshaping experiences across the board. In gaming, AVR immerses players in interactive environments, blurring the lines between virtual and real worlds. In education, AVR brings learning to life, offering interactive simulations and visualizations that enhance understanding (Ferrari et al., 2019).

AVR also offers a promising solution to the limitations of traditional shoulder rehabilitation methods. By overlaying digital information onto the real world, AVR systems can provide immersive, interactive, and personalized experiences. This review examines existing AVR applications, analyzing their tracking methods, visualization, feedback mechanisms, and clinical outcomes. findings highlight the potential advantages of AVR, including its ability to enhance patient engagement, motivation, and adherence to rehabilitation protocols. AVR can also provide real-time feedback, allowing for more precise and targeted exercises. Additionally, the portability of many AVR systems makes them suitable for home-based rehabilitation, expanding access to care (Viglialoro et al., 2019).

Furthermore, AVR used in patients with stroke; Upper limb dysfunction is a common consequence of stroke, often resulting from motor weakness, ataxia, or spasticity. While traditional rehabilitation methods have shown some efficacy, there is a growing interest in exploring innovative approaches, such as AVR. AVR offers the potential to provide engaging, interactive, and personalized rehabilitation experiences, potentially improving patient motivation and outcomes. This study aims to assess the acceptability of a smartphone based AVR game for upper limb rehabilitation in stroke patients (LaPiana et al., 2020). Visualization can be a valuable resource for patients with cancer who are dealing with the mental strain of cancer (Feliu et al., 2021; Abrahams et al., 2016). AVR can be a valuable tool for medical staff to visually inspect patients' stages of the oncological process

and improve patient engagement and understanding, leading to better outcomes and experiences during treatment sessions (Gorini et al., 2011).

A comprehensive review of studies found AVR interventions are highly effective in treating various psychological symptoms in patients with cancer. AVR has been shown to significantly reduce anxiety, pain, depression, fear, and distress. These findings highlight the potential of AVR as a valuable tool for improving the overall well-being of patients with cancer (Wu et al., 2023). More else, regards patients who underwent surgery AVR can effectively reduce preoperative anxiety in patients. When compared to traditional education methods, AVR was shown to be more effective in calming patients before surgery (Rizzo et al., 2023).

AVR applications have consistently shown their effectiveness as non-pharmacological alternatives for pain management during oncology radiation sessions (Martin-Gomez et al., 2021). These technologies offer a distraction-based approach that can help patients cope with the discomfort associated with radiation therapy. By immersing patients in virtual environments or overlaying digital elements onto the real world, AVR can divert attention from physical pain, reducing perceived discomfort and improving overall patient experience. Finally, AVR can be tailored to individual patient preferences and needs, providing a personalized and engaging pain management experience. This adaptability can enhance the effectiveness of AVR for pain relief during radiation therapy (Martin-Gomez et al., 2021).

1.2 Statement of the Problem

Cancer is a leading cause of mortality globally and in the West Bank. According to available data, cancer is the second source of disease that cause death, accounting for 16% of all deaths in the West Bank (UNFPA and Palestinian Ministry of Health, 2019). Health interventions for patients with cancer vary widely depending on the individual's diagnosis and prognosis. Chemotherapy, for example, may be administered as a therapeutic intervention for various reasons (Siegel et al., 2012). This prompts the inquiry about: How can emerging technologies such AVR headsets contribute to improving the quality of life and treatment experiences for patients with cancer?

Chemotherapy infusion in general can result in increase the level of stress and anxiety that patients experience, which can negatively impact their well-being and recovery

(Gustafson, 2017). Also, patient with cancer experience pain during chemotherapy sessions and it is considered as one of the oncological therapy obstacles (Manzini et al., 2020).

AVR has emerged as a promising tool for addressing a range of challenges in healthcare. Studies have shown that AVR can effectively reduce anxiety, pain, and depression in patients with cancer (Wu et al., 2023). Moreover, AVR has been used to improve preoperative anxiety (Rizzo et al., 2023) and manage pain during radiation therapy (Martin-Gomez et al., 2021). In rehabilitation, AVR has demonstrated its potential to enhance patient engagement, motivation, and outcomes for shoulder rehabilitation (Viglialoro et al., 2019) and stroke recovery (LaPiana et al., 2020)."

To mitigate the adverse effects and challenges associated with chemotherapy while offering a non-pharmacological intervention for cancer patients, AVR has gained traction in hospital and clinic settings for a range of applications. These include aiding individuals with injuries and facilitating exposure therapy for phobias (Bryant et al., 2020; Ijaz et al., 2020; Pulijala et al., 2018). Patients with Cancer undergoing chemotherapy sessions often find the visualization benefits of AVR particularly impactful, especially when experiencing apprehension about their treatment or grappling with cancer-related issues (Feliu et al., 2021; Abrahams et al., 2016). Furthermore, employing AVR as an intervention has shown promise in enhancing the quality of life for patients with cancer, as evidenced by reductions in pain and other psychological symptoms (Reynolds et al., 2022).

The absence of such research represents a critical gap in the current understanding of how AVR can be utilized to improve the psychological and physical health outcomes of patients with cancer in Palestine. Addressing this gap is essential not only for enhancing patient care but also for informing healthcare practices and policies in the region. Moreover, investigating the effectiveness of AVR in this specific context could provide valuable insights into how culturally sensitive and region-specific interventions can be developed and implemented.

This study seeks to address this gap by examining the effect of using AVR on pain, stress, anxiety, and SE among adult patients with cancer undergoing chemotherapy in the West Bank. By doing so, it aims to contribute to the development of evidence-based, innovative therapeutic interventions that can be integrated into the holistic care of patients with cancer, ultimately improving their treatment experiences and outcomes.

1.3 Significance of the study

Using AVR can decrease the psychological side effects for patients with cancer who received chemotherapy (Ioannou et al., 2020). This intervention will enhance their emotional and mental status and decrease their pain, stress, and anxiety resulting in increased quality of life and SE.

The use of AVR in managing pain, stress, anxiety, and SE among adult patients with cancer undergoing chemotherapy in the West Bank holds significant promise. AVR can effectively reduce perceived pain levels by immersing patients in a virtual environment that distracts them from the discomfort associated with chemotherapy. Additionally, AVR provides a relaxing and engaging distraction, which helps in reducing stress and anxiety, leading to improved psychological well-being and better coping mechanisms. Enhancing SE, or the belief in one's ability to execute behaviors necessary to achieve specific goals, is crucial for cancer patients. AVR interventions empower patients by giving them a sense of control and achievement in managing their symptoms, thereby boosting their SE. Furthermore, AVR offers a non-invasive, innovative approach that complements traditional cancer treatments without side effects, making it a valuable addition to holistic cancer care. By addressing pain, stress, anxiety, and SE. AVR has the potential to significantly improve the overall quality of life for patients with cancer, contributing to better physical health outcomes and a more positive treatment experience. This study will also add to the growing body of research on the use of AVR in medical settings, providing evidence-based insights that can inform clinical practice and guide the development of new therapeutic interventions. Conducting this study in the West Bank provides valuable data on the effect of AVR in a specific cultural and regional context, helping to tailor interventions to meet the unique needs of adult patients with cancer in this area and addressing any region-specific challenges or considerations. By exploring the impact of AVR on these critical factors, this study aims to offer a comprehensive understanding of how technological interventions can enhance cancer care and patient outcomes.

The significant promise of AVR in managing pain, stress, anxiety, and SE among adult patients with cancer undergoing chemotherapy in the West Bank not only holds potential for improved patient outcomes but also presents an opportunity to enhance nursing education. As future healthcare providers, nursing students stand to benefit from understanding and utilizing innovative interventions like AVR in their practice. Integrating education on AVR into nursing curricula can equip students with the knowledge and skills

necessary to effectively leverage this technology when they become employees. By incorporating AVR into their learning experiences, nursing students can gain valuable insights into its applications, enabling them to provide holistic and patient-centered care in their future roles. Thus, this study contributes not only to advancing patient care but also to enriching nursing education by highlighting the relevance and benefits of emerging technologies in healthcare delivery.

Moreover, this study will output a database with information on this new technology that might help researchers to build up their studies in this field. Stakeholders and policy makers in the Ministry of Health can adopt this technology in their oncology departments since the AVR devices are available in the area.

In summary, this study represents a milestone in the advancement of cancer care in Palestine, offering hope for improved patient outcomes and paving the way for future research and innovation in healthcare delivery. Through collaborative efforts and a commitment to excellence in patient care, we endeavor to harness the potential of AVR to make a meaningful difference in the lives of patients with cancer in Palestine and beyond.

1.4 Purpose of the study

The main purpose of this study was to examine the effect of using AVR on pain, stress, anxiety, and SE among adult patients with cancer undergoing chemotherapy in the West Bank hospitals in Palestine.

1.4.1 Specific Objectives

This study included the following objectives

1. To evaluate pain levels among the control and interventional groups of patients with cancer before and after AVR therapy during chemotherapy session.

2. To evaluate stress levels amongst the control and interventional group of patients with cancer before and after the AVR therapy during chemotherapy session.

3. To evaluate anxiety levels amongst the control and interventional group of patients with cancer before and after the AVR therapy during chemotherapy session.

4. To evaluate SE levels among the control and interventional groups of patients with cancer before and after the AVR therapy during chemotherapy session.

1.5 Research questions

1. What is the effect of AVR therapy on pain levels score compared with routine care during chemotherapy session among patients with cancer?
2. What is the effect of AVR therapy on the stress levels compared with routine care during chemotherapy session among patients with cancer?
3. What is the effect of AVR therapy on the anxiety compared with routine care during chemotherapy session among patients with cancer?
4. What is the effect of AVR therapy on the general SE compared with routine care during chemotherapy session among patients with cancer?

1.6 Study Hypothesis

1. AVR therapy significantly reduces pain levels compared with routine care during chemotherapy sessions among cancer patients.
2. AVR therapy significantly reduces stress levels compared with routine care during chemotherapy sessions among cancer patients.
3. AVR therapy significantly reduces anxiety levels compared with routine care during chemotherapy sessions among cancer patients.
4. AVR therapy significantly improves general SE compared with routine care during chemotherapy sessions among cancer patients.

1.7 Conceptual and Operational Definitions of the study variables

1.7.1Conceptual definitions

Concerning the study variables, the following conceptual definitions were developed:

Augmented Virtual Reality: Augmented Reality (AVR) refers to a technology that superimposes digital information, such as images, sounds, and other sensory enhancements, onto the real world through devices like smartphones, tablets, or specialized headsets. AR integrates virtual elements into the user's perception of the real world, enhancing their sensory experience and providing interactive and immersive environments (Zhou et al., 2008).

Pain: An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage (Collett, 1995).

Stress: It is a state of mental or emotional strain or tension resulting from adverse or demanding circumstances (Lazarus & Folkman, 1984).

Anxiety: It is a state characterized by a feeling of apprehension, uneasiness, or dread resulting from the anticipation of a real or imagined threat or danger (Shah et al., 2014).

Self-Efficacy: It refers to an individual's belief in their capacity to execute behaviors necessary to produce specific performance attainments (Bandura, 1997).

1.7.2Operational Definitions

Concerning the study variables, the following operational definitions are developed:

Augmented virtual reality Therapy: AVR as therapy in this study was implemented using the Meta Quest 2 Headset Casting Wi-Fi Quick Start Guide, Glass Spacer, VR headset, 2 Touch Controllers (L&R) with Smartphone02-00187-899 "10.24D x 7.36"W x 4.96"H Oculus, which overlays digital information onto the real-world environment experienced by patients with patients. The AVR system operated on its own software platform, providing access to a vast library of downloadable VR games, apps, and experiences., e.g., interactive 3D models, calming virtual environments (Billinghurst et al., 2015). It's used during chemotherapy sessions to measure its effects on pain, stress, anxiety, and SE.

Pain: The McCaffery-Beebe Pain Rating Scale for assessing the pain scale; "It is standardized and a numeric pain rating scale from one to ten (0-10) that shows the severity of the present, best, and worst pain levels on a scale of 0 (no pain) to 10 (worst pain imaginable)" (Mccaffery & Beebe, 1989).

Stress: was measured in the current study using the Perceived Stress Scale (PSS-10). The PSS consists of 10 items, each rated on a 5-point Likert scale ranging from 0 (never) to 4 (very often) (Cohen,1983).

Anxiety: ""The GAD-7 originates from Spitzer et al., 2006. Respondents rate how often they have been bothered by each symptom over the past two weeks on a 4-point Likert scale: 0 (not at all), 1 (several days), 2 (more than half the days), and 3 (nearly every day).

Self-Efficacy: SE measured using the General Self-Efficacy Scale (GSE), a widely used and validated instrument developed to assess individuals' beliefs in their ability to deal effectively with a variety of stressful situations (Schwarzer & Jerusalem, 1995). The GSE consists of 10 items designed to capture respondents' perceived self-efficacy in dealing with different challenges and demands. Each item is rated on a 4-point Likert scale ranging from 1 (not at all true) to 4 (exactly true) (Schwarzer & Jerusalem, 1995).

1.8 Summary

The global burden of cancer has escalated significantly over recent decades, emerging as a leading cause of mortality worldwide. With projections indicating a further increase in cancer incidences, particularly in low and middle-income countries, the urgency for effective prevention and management strategies has never been greater. Cancer imposes substantial physical, emotional, and socioeconomic burdens on individuals and societies, underscoring the critical need for ongoing research and innovative interventions in the field.

In Palestine, cancer ranks as the second leading cause of death, highlighting the pressing need for improved treatment modalities and supportive care services. Chemotherapy, a cornerstone of cancer treatment, often elicits distressing side effects and psychological strain among patients, including pain, stress, anxiety, and diminished self-efficacy.

In response to these challenges, emerging technologies such as AVR offer promising avenues for enhancing the quality of life and treatment experiences for cancer patients. By overlaying digital information onto real-world environments, AVR provides immersive and interactive experiences that can alleviate pain, reduce stress and anxiety, and bolster self-efficacy.

However, despite the potential benefits of AVR, its application in the Palestinian healthcare system remains unexplored. This study aims to address this gap by investigating the effect of AVR therapy on pain, stress, anxiety, and self-efficacy among adult patients with cancer undergoing chemotherapy in West Bank hospitals.

By evaluating the impact of AVR therapy on patient outcomes and experiences, this research seeks to contribute valuable insights to the literature and inform future interventions in cancer care. Ultimately, the findings of this study have the potential to inform policy and practice, paving the way for the integration of AVR technology into oncology departments and improving the overall quality of care for cancer patients in Palestine.

Chapter Two :Literature Review

2.1 introduction

The use of AVR in healthcare has gained significant attention over the past decade, In the context of cancer treatment, particularly chemotherapy, patients often experience heightened levels of pain, stress, and anxiety, which can negatively impact their overall well-being and treatment outcomes This literature review aims to explore the current body of research on the application of AVR in managing pain, stress, anxiety, and self-efficacy among patients with cancer, with a particular focus on those undergoing chemotherapy. The review examined existing studies that have investigated the effectiveness of AVR in reducing these symptoms, the mechanisms through which AVR operates, and the potential benefits and limitations of its use in clinical settings. Moreover, the literature review contextualized these findings within the specific socio-cultural and healthcare environment of the West Bank, where unique challenges and opportunities may influence the adoption and effectiveness of AVR interventions.

By critically analyzing the existing literature, this chapter will identify gaps in knowledge and highlight areas for further research, ultimately contributing to a better understanding of how AVR can be integrated into cancer care to improve patient outcomes in the West Bank and beyond.

2.2 Searching strategies

Any research domain can be developed methodically and incrementally with the help of literature studies. The majority of research topics are rapidly evolving, so being able to perform high-caliber literature reviews with reasonable efficiency is crucial (Bandara et al., 2015).

The exploration of innovative interventions to alleviate the psychological and physical burden of cancer is critical, given the substantial global increase in cancer incidence and the associated challenges in patient care. AVR has emerged as a promising technology in healthcare, offering immersive experiences that can potentially mitigate pain, stress, anxiety, and enhance SE among patients. This literature review delves into the current research on the application of AVR in oncology, with a particular focus on its impact on adult patients with cancer undergoing chemotherapy. The review aims to

synthesize existing evidence, identify gaps in the literature, and provide a foundation for the present study.

To ensure a comprehensive and systematic review of the literature, the following search strategy was employed. Databases including PubMed, Scopus, Web of Science, and Google Scholar were searched for peer-reviewed articles published in the last five years (2018-2023); there are some quotations that were taken before 2018 as they fall within old theories that were cited or from research related to scientific research tools used. The search terms included "augmented virtual reality," "AVR," " patients with cancer," "chemotherapy," "pain management," "stress reduction," "anxiety," and "self-efficacy." Boolean operators (AND, OR) were used to combine these terms effectively. Reference lists of relevant articles were also reviewed to identify additional studies. Finally, the total of studies included in this study (173).

2.3 Inclusion and Exclusion Criteria for the previous study

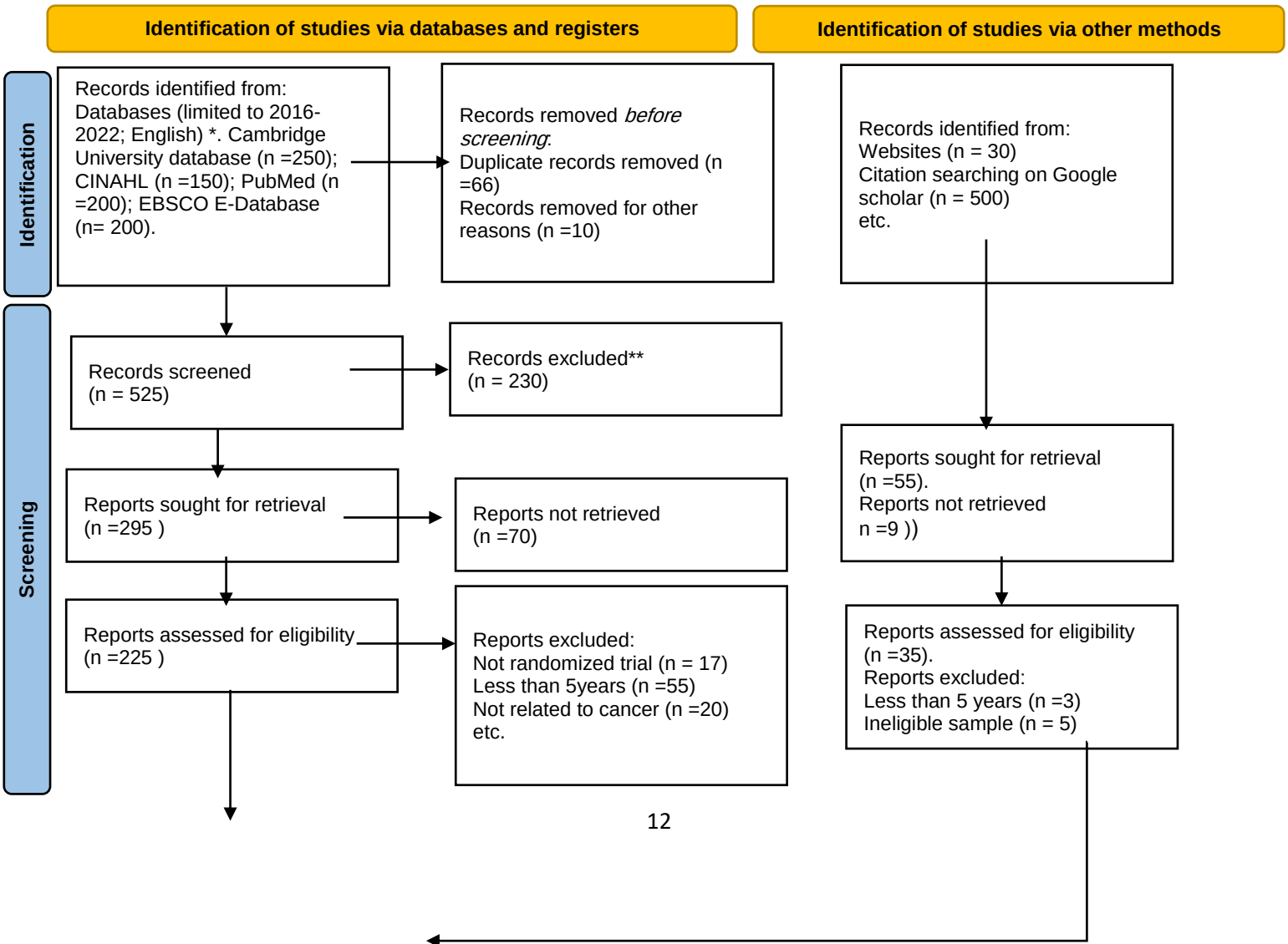
The inclusion criteria were as follows: studies published in English between 2018 and 2023, To ensure a comprehensive understanding of the topic and the variables. I have included older studies; These earlier articles provide valuable historical context, definitions, and initial findings that are essential for comparing past and present research trends, as well as for identifying the trajectory of technological advancements and their implications over time. research focusing on the use of AVR in cancer treatment settings, studies assessing the impact of AVR on pain, stress, anxiety, or self-efficacy among adult patients with cancer, and peer-reviewed articles, including randomized controlled trials, cohort studies, and qualitative research. Exclusion criteria included studies not available in full text, research focusing on pediatric patients with cancer, and articles that did not specifically address the four main outcomes of interest (pain, stress, anxiety, and self-efficacy).

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart presented below encapsulates the meticulous process undertaken to synthesize the existing literature on this topic. By systematically searching through diverse databases (Cambridge University database, CINAHL, PubMed, EBSCO E-Database); and meticulously analyzing relevant articles.

This chart represents a comprehensive overview of the research landscape surrounding the intersection of AVR technology and cancer care. This flow chart is not

merely a graphical representation; rather, it symbolizes a journey of discovery, where each node represents a crucial step in unraveling the potential of AVR in transforming the chemotherapy experience for patients with cancer. From database exploration to article screening and inclusion, every stage underscores the meticulousness and rigor employed in this study. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart presented below encapsulates the meticulous process undertaken to synthesize the existing literature on this topic. By systematically searching through diverse databases and meticulously analyzing relevant articles, this chart represents a comprehensive overview of the research landscape surrounding the intersection of AVR technology and cancer care. This flow chart is not merely a graphical representation; rather, it symbolizes a journey of discovery, where each node represents a crucial step in unraveling the potential of AVR in transforming the chemotherapy experience for patients with cancer. From database exploration to article screening and inclusion, every stage underscores the meticulousness and rigor employed in this study.

The paragraph below shows Systematic Literature Review Flowchart (PRISMA) that included in the study:



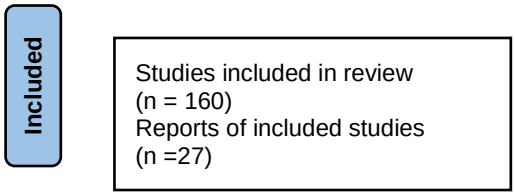


Figure 1.1 Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

2.4 Previous Literature

This section includes previous literature related to:

1. Epidemiology of cancer:
2. AVR Definitions.
3. History Background.
4. Application of AVR in Cancer Management.
5. Pain related patients with cancer.
6. Stress related patients with cancer.
7. Anxiety related patients with cancer.
8. SE related patients with cancer

2.4.1 Epidemiology of cancer

Cancer is a primary cause of mortality and a significant barrier to raising life expectancy (Nagai & Kim, 2017). It's crucial to adhere to the chemotherapy regimen as indicated. Reduced dosages or treatment interruptions can reduce the likelihood of long-term remission or cure. Distress, anxiety, stress, and pain from treatment side effects are significant contributors to illness and a factor in cancer patients' premature treatment termination. So, it is crucial to develop interventions that help people tolerate chemotherapy better, live better lives, and improve their chances of survival. Distraction, a coping technique that is emotion-focused, may be one of these interventions (Bray et al., 2021). Studies show that using AVR in pediatric hospitals is safe, acceptable, and beneficial for both children and medical staff and helpful as a distraction method (Suitability, Practicability and Endurability). AVR can help children relax and manage anxiety and pain

during procedures and extended hospital stays, ultimately improving their overall experience (Bernaerts et al., 2022).

Breast, lung, colorectal, prostate, and stomach cancers are among the most prevalent cancers in the world (Al-Shamsi et al., 2022). In Ireland, the cancer risk was the highest about (49.7%), while African Republic had the lowest risk at 6. 6%. Eastern Asia reported the most cases, 6.0 million (31.1% of the total), with 3.6 million deaths (36.3%). North America reported 2.6 million cases (13.3%) with a 7% share of cancer deaths, while South-Central Asia recorded 1.95 million cases (10%) and 1.3 million (12.6%) deaths. Europe reported 4.4 million incidences, with 1.9 million (20%) deaths (Chhikara& Parang, 2023).

Breast and prostate cancer had the highest lifetime risk among females and males, by 4.6% and 5.9% respectively (Zheng et al., 2020). Breast cancer is the most common cancer that recurs in women in the Eastern Mediterranean Area (Al-Shamsi et al., 2022).

Table 1.2: Ranking of the Most Common Cancer Types in Arab Countries, Based on GLOBOCAN 2020 Data:

	Country	1st	2nd	3rd	4th	5th
1	Algeria	Breast	Colorectum	Lung	Prostate	Bladder
2	Bahrain	Breast	Colorectum	Lung	NHL	Leukemia
3	Comoros	Cervix uteri	Prostate	Breast	Esophagus	Liver
4	Djibouti	Breast	Cervix uteri	Colorectum	NHL	Prostate
5	Egypt	Liver	Breast	Bladder	NHL	Lung
6	Iraq	Breast	Lung	Colorectum	Leukemia	NHL
7	Jordan	Breast	Colorectum	Lung	Bladder	Leukemia
8	Kuwait	Breast	Colorectum	Thyroid	Prostate	NHL
9	Lebanon	Breast	Lung	Prostate	Colorectum	Bladder
10	Libya	Breast	Colorectum	Lung	Bladder	Prostate
11	Mauritania	Breast	Cervix uteri	Prostate	Liver	Colorectum
12	Morocco	Breast	Lung	Colorectum	Prostate	NHL
13	Oman	Breast	Colorectum	NHL	Stomach	Leukemia
14	Palestinea	—	—	—	—	—
15	Qatar	Breast	Colorectum	Prostate	Leukemia	NHL
16	Saudi Arabia	Colorectum	Breast	Thyroid	NHL	Leukemia
17	Somalia	Breast	Cervix uteri	Colorectum	Prostate	Leukemia
18	Sudan	Breast	Colorectum	NHL	Prostate	Leukemia
19	Syria	Breast	Lung	Colorectum	Prostate	Leukemia
20	Tunisia	Breast	Lung	Colorectum	Bladder	Prostate
21	UAE	Breast	Colorectum	Thyroid	Leukemia	Prostate
22	Yemen	Breast	Colorectum	Leukemia	Stomach	NHL

Table 1.2: Note 1: Source: International Agency of Research on Cancer (IARC)/GLOBOCA
*Palestine’s report was unavailable

Note2: reprinted from: Al-Shamsi, H.O., Iqbal, F., Abu-Gheida, I.H. (2022). Introduction. In: Al-Shamsi, H.O.,] Abu-Gheida, I.H., Iqbal, F., Al-Awadhi, A. (eds) *Cancer in the Arab World*. Springer, Singapore. https://doi.org/10.1007/978-981-16-7945-2_1

Unfortunately, the population of the West Bank-Palestine suffers from a high burden of various cancers, including lung, breast, blood (leukemia), anal, bladder, colon, rectal, gastrointestinal carcinoid, pancreatic, endometrial, kidney, liver, and skin (Salem, 2023). Statistics reveal that lung cancer is the leading cause of death among men, accounting for approximately 22.8% of cancer-related fatalities, followed by breast cancer in women with around 21.5%. Meanwhile, prostate cancer claims approximately 9.5% of lives among men, while colon cancer takes the lives of 11.4% of women (Abu-Rmeileh et al., 2016).

Regarding risk factors for cancer, studies show that more than one-third of the seven million global cancer-related deaths are attributable to lifestyle choices, with alcohol and tobacco use playing particularly significant roles (Danaei et al., 2005). Furthermore, obesity has been found to be significantly correlated with an increased risk of developing various types of cancer (Tzenios, 2023). Finally, research suggests a link between environmental variations across different districts and cancer risk, as well as disparities in access to preventive strategies due to factors like availability and cost (Berenguer et al., 2023).

In Palestine, the incidence rate was 117.8 per 100,000 populations in 2019. The rate has shown a steady, albeit slow, increase since 2013 (79.5 per 100,000 population) and 2016 (86.4 per 100,000 population). The observed increase in cancer cases may not necessarily reflect a true growth in incidence. Improved reporting or changes in diagnostic practices could be contributing factors. In 2019, breast cancer reigned supreme as the most prevalent cancer, accounting for a staggering 16.9% of all diagnosed cases. This translates to an incidence rate of 19.9 per 100,000 people. Following closely behind was colorectal cancer, claiming 12.6% of cases with an incidence rate of 14.8 per 100,000. Rounding out the top three, lung cancer, though constituting only 7.2% of all cases, exhibited a concerning incidence rate of 8.4 per 100,000 (Halahleh et al., 2022).

2.4.2 Augmented Virtual Reality (AVR) Definitions

AVR is a cutting-edge technology that combines virtual and real-world elements to enhance user experiences by overlaying digital content onto the real environment, creating an interactive and immersive experience. AVR integrates virtual elements with the physical world, allowing users to interact with both simultaneously through the use of sensors,

cameras, and advanced computing, providing an enriched interactive experience (Suzuki et al., 2022). It is defined as a system that enhances the real world with virtual elements, creating an interactive experience that improves user perception and interaction with their environment by employing head-mounted displays, hand-tracking devices, and spatial mapping to integrate virtual objects into the user's field of view (Carmigniani et al., 2011). AVR enhances the real-world experience by overlaying digital information and virtual objects onto the user's physical environment, providing a more comprehensive and immersive user experience, which is useful in fields such as gaming, education, and healthcare (Billinghurst et al., 2015). AVR involves overlaying computer-generated imagery and information onto the real world to create a composite view that augments the user's perception of their physical surroundings, enhancing real-world experiences by adding virtual elements for real-time interaction (Chen et al., 2020). Furthermore, AVR blends virtual objects and information with the real environment to create an enhanced perception of reality, using various hardware and software components to integrate virtual content seamlessly with the physical world, thereby enriching the user's interaction and experience (Javornik, 2016).

2.4.3 History of Augmented Virtual Reality (AVR)

AVR technology, which immerses users in simulated environments, has evolved significantly since its inception in the 1960s with pioneers like Ivan Sutherland developing the first head-mounted display system (Sutherland, 1965). Initially, AVR found its footing in entertainment and gaming, but the 1990s saw advancements with consumer-level systems despite early limitations (Pimentel & Teixeira, 1993). By the early 2000s, AVR was used in medicine for surgical training, enabling risk-free practice for medical professionals (Satava, 2001), and has since expanded to therapy for phobias, PTSD, and anxiety disorders by providing controlled environments for confronting fears (Maples-Keller et al., 2017). Educational institutions utilize VR for immersive learning experiences, making complex subjects more engaging (Radianti et al., 2020), Similarly, military personnel benefit from AVR simulations for mission rehearsals, tactical training, and equipment operation, leading to enhanced readiness and effectiveness in real-world scenarios (Rizzo et al., 2017). In architecture and urban planning, AVR allows the creation of interactive 3D models of buildings and cities, facilitating better decision-making and client presentations (Portman et al., 2015). The real estate industry uses AVR for virtual property tours, which became particularly valuable during travel restrictions (Portman et al., 2015).

2.4.4 Application of AVR in Cancer Management

In middle-aged cancer patients, integrating virtual program has been shown to be effective in enhancing patients' control over nausea and pain subsequent to cancer medications (Majid et al., 2020).

In addition, an interventional study with thirteen adolescent cancer patients used a questionnaire to evaluate the effects of AVR on pain, anxiety, and SE. The results of this study demonstrated a beneficial relationship between SE, pain levels, and overall life satisfaction by showing a significant rise in both pain management and SE among these cancer patients. Related to pain intensity there was a truly significant in decreasing the pain regards those who use the AVR as interventions in this study (Sharifpour et al., 2021).

In another study on pain management in cancer patient; 17 participants were involved in a 2018 study using AVR. The results showed that one of the greatest upsetting parts of treating cancer is having cannulation techniques done. With its incredibly realistic and immersive virtual environment, AVR distraction shows promise in reducing pain and stress associated with needle-related procedures. This study evaluated the specific AVR intervention's usability for cancer-stricken youngsters having implanted venous access device (IVAD) injections. The results showed that the AVR program for (IVAD) access procedures were safe and well-received by medical staff, children and adolescents with cancer. According to responses from participants and observation, the AVR gear and software were modified to add features that were linked to possible intervention efficacy, like more interaction, immersion, and enjoyment (Birnie et al., 2018). Similarly, in a systematic review conducted in 2022, the qualitative studies that were included in this systematic review revealed that using AVR for female patient with breast cancer improved their pain level (Zhang et al., 2022).

Many studies discovered the role of AVR to improve the living conditions of breast cancer patients undergoing cancer treatments. Those patients are commonly pleased with the usage of these techniques for this objective. However, there is limited research on the usage of AVR with the middle-aged tumor patients undertaking cancer medications, or research on the different types of virtual reality programs (Kim et al., 2018; Wochna et al., 2020;).

Furthermore, several academics have found benefits of using AVR to help mental well-being in teens with cancer (Li et al., 2011). Yet, there is an incomplete amount of scholarly work on the use of virtual reality in the young cancer patients. Previous studies

recommend that virtual reality may be not expensive, can enhance the way of life, and may help in managing the main effects and complications of chemotherapy among women with breast cancer (Chirico et al., 2016).

There is some evidence suggesting that AVR may alter the perception of time through medical procedures, the findings of these studies support the idea that AVR can effectively distract patients and help them focus on something other than the procedure, making it seem to pass more quickly. This was demonstrated in a study of patients taking cancer drugs for colon and breast cancer who reported that AVR made the procedure seem shorter than it actually was (Chirico et al., 2016). A current meta-analysis assessed the indication supportive of the usage of AVR amongst clients in critical inpatient therapeutic regimen. The review found that only two studies demonstrated the impact of AVR on the progressive distortions of outcomes, or the alteration of the perception of time, during medical procedures (Dascal et al., 2017).

It is important to note that the distortion of outcomes because of AVR is a result of a change in patients' perception of pain while using AVR, not as a result of a change in the amount of time they perceive to have passed due to the use of virtual reality. This means that the impact of AVR on the actual progression of time is still an understudied in this field. This little knowledge in cancer health care may be helpful for the reason that it is well known that some patients experience more fulfilment with their care if they take their cancer drugs during the session to be shorter (Schneider et al., 2011).

Patient-centered AVR involvement for cancer patients must be appropriate or flexible diverse to reply to the interests and needs of different patient groups. There is limited research aimed at identifying the characteristics of patients who will benefit most from AVR technology, and it is important to consider factors such as visual, motor, or vestibular impairments when designing AVR for patients with acquired brain injuries. (Indovina et al., 2018; Brassel et al., 2021).

In addition to not taking multiple criteria into account for the clients, there is a paucity of knowledge about AVR therapies that are appropriate and available for patients with chronic diseases. For cancer patients, this gap is particularly difficult because of the precise limitations on the use of AVR with this population, such as the potential need to only use one hand to avoid interfering with drips or cannulas and the simplicity of learning the game mechanics and controls due to a variety of AVR experiences. Understanding what

types of AVR are adequate and possible to patients with chronic conditions may be used to notify decisions about the design and features of VR applications, including those for cancer patients (Ahmadpour et al., 2020).

A randomized controlled study in 2021 anxiety and pain reduced more in those patients who received chemotherapy and used AVR compared to those who used chemotherapy alone (Burrai et al., 2023). AVR as a distraction tool for pain can have a wider application in medical procedure. There is a view that AVR can be employed in various medical intervention like burn patients and chemotherapy patients. In this review it was clearly shown that using virtual reality decreased pain (Indovina et al., 2018).

A systematic review examined 23 articles about breast cancer in women and interventions focused on examining the role of using virtual reality on pain in all these articles. The findings revealed that using AVR decreases the pain associated with cancer and then improves the quality of life and the emotional health status (Pittara et al., 2020).

In a quasi-experimental study conducted in 2021 to investigate the level of perceived self-efficacy in a group of people coping with chemotherapy, the study revealed that using this technology AVR has an effect in raising the level of perceived self-efficacy and even the vital signs of these clients, such as blood pressure and the pulse in the post intervention group (Birkhoff, 2021).

The effects on SE were examined in a quasi-experimental pretest–post-test design using AVR among 13 adolescent cancer patients. This research found that there was significant increase in pain and decrease in SE among those cancer patients in dealing and coping with their disease process and prognosis and more else the SE was related to the degree of pain that they have and even to the value of their life. Related to SE there was a significant in increasing in the SE regards those who use the AVR as interventions in this study (Sharifpour et al., 2021)

A literature review about using virtual reality for the psychological emotional purposes specifically on mood and stress found that in all the articles through database there was a strong evidence in decreasing stress by using the AVR (Roche & Siegel, 2019).

Anxiety is one of the predominant signs that can be seen in cancer patients. An Italian study examined the use of AVR techniques on women with breast cancer. Most of them aged 50 years and older and received chemotherapy in Italy. The study showed that the

intervention group who used AVR significantly improved in their anxiety levels, reporting a mean lower than the control group. This study recommended using AVR as a technique to decrease anxiety in patients with cancer (Chirico et al., 2020). Moreover, in a randomized control study of 33 patients aged 49 years older AVR was used as a technique in reducing anxiety and depression for a female who was diagnosed with breast cancer before starting chemotherapy. The study revealed that using AVR significantly improved preemptive anxiety for patients who participated in the intervention than those in the control group (Torres García et al., 2023). Also, another study employed a quasi-experimental design to investigate the level of anxiety among a group of people and their coping with chemotherapy. The study revealed that using this technology (AVR) had a significant effect in reducing the level and anxiety and even the vital signs of these clients like blood pressure and the pulse in the post intervention group (Birkhoff, 2021).

In Jordan, at the King Al Hussein Cancer Hospital, a study examined the effect of using AVR to see if it has an impact in decreasing pain and anxiety among women with breast. The sample was randomly selected and consisted of 80 females c. The study showed that there was decrease in pain and anxiety levels (Mohammad & Ahmad, 2019). Another randomized control trial study (Where) on 196 patients in a cancer center examined the anxiety levels after using virtual reality for patients with breast cancer. The study revealed immediate decrease in the anxiety level for the participants and they were interested in AVR (Shin et al., 2023).

In the USA, researchers examined pain and anxiety among 97 cancer patients. They used AVR during medical procedures, the result showed that pain and anxiety evaluated after using AVR decreased significantly (Glennon, 2018). A systematic review that was conducted in 2023 on breast cancer patients who used AVR, 18 articles met the study purpose. The aim of the study was to examine AVR outcomes, such as anxiety, perception of time, discomfort, exhaustion, levels of stress associated with chemotherapy, and depression intensity. In addition, variety of movement, power, and activity were also assessed. The results revealed that using virtual reality helps participants to reduce their anxiety, pain and stress (Yazdipour et al., 2023). In a qualitative study of using AVR to decrease pain and signs associated with it, which included 20 colorectal cancer patients, the investigator applied VR for 30 minutes then met with the participants to show up feeling and experiences after using VR. All information was gathered in per and post interventions.

The study revealed that there was an increase in satisfaction and reduced pain, and a stress and anxiety (Kelleher et al., 2022).

A review of breast cancer patients using AVR, mentioned that AVR, as subset of interactive audiovisual technologies, offers a novel approach to education and therapeutic therapy. AVR is an experience that simulates life in 3^D dimensions. It was originally developed for training soldiers, but it is now becoming increasingly used in the medical community for the treatment of fears, anxiety, and depression as well as in medical teaching (Khan et al., 2022).

2.4.5 Pain in Patients with Cancer

A literature review conducted between 2011-2020 of randomized studies, revealed many side effects of chemotherapy and radiotherapy in cancer patients including oral mucositis and pain. These side effects severely reduce the quality of life for patients and expose them to extreme pain (Kusiak et al., 2020).

In a systematic review of randomized clinical trials on pain among patients with cancer, of more than 4000 patients across 26 RCT studies; all of them has reported significant pain levels in cancer patients (Oldenmenger et al., 2018).

Another review article in 2018 which investigated the psychological and physical effects of cancer on patients, reported that cancer frequently results in severe pain, which has a negative impact on an individual's standard of living and the quality of life even extending to those who are closest to them. These effects can be felt in the individual's physical wellness, thoughts, mentality, and social relationships (Arnstein, 2018).

One study sent a postal survey to 1332 women in Norway who had at least 6 years of chemotherapy and surgery sessions for breast cancer. This study showed that pain affects about 60% of women receiving treatment for breast cancer, regardless of the stage of the disease, regards the survey. (Bredal et al., 2014).

Another systematic review investigated the occurrence and intensity of pain among cancer patients from 2044- 2014.The search revealed that pain is the predominant sign among cancer patients. To effectively control patients with cancer pain, it is necessary to develop and implement interventions in the next ten years, as well as remove obstacles to effective pain treatment (Van Den et al., 2016).

In research on pain management in patients with cancer using non-pharmacological approaches, the results showed that in addition to bodily discomfort, pain also results in emotional pain, which is affected by the person's psycho-social-cultural environment. When choosing pain treatments, we should take into account the cause of the pain as well as any aggravating circumstances (Deng, 2019). Furthermore, it was shown that the severity of pain can interfere with the patient's daily life and activity (Liu et al., 2023).

One study examining the quality of life among 105 patients with cancer and their ability to cope investigated the severity, occurrence, stress and steadiness of pain and obstacles for pain management. This study revealed that 69 % of participants described moderate to severe pain, and higher pain intensity were associated with more distress, thus interfering with daily life activities (Rodriguez et al., 2019).

2.4.6 Self-efficacy among Patients with Cancer

A meta-analysis of randomized control trials on the effects of e-health on self-management and SE. revealed a decline of SE as one of the consequences of living with cancer and demonstrated that multi methods of interventions like e-health would be effective in increasing SE (Xu, A et al., 2019).

Another meta-analysis involving randomized trails aimed to explore the psychological interferences on SE in patients with cancer. The effect of SE expectations was assessed to be = 0.274 (P <.001) based on 79 RCTs. The studies mentioned that self-efficacy among patients with cancer was directly linked to psychological behaviors such as pain, stress, and coping mechanism (Merluzzi et al., 2019).

A cross sectional descriptive study with more than 100 patients examined the relationship between self-efficacy and quality of life and health literacy. The study revealed that there was correlation between SE and quality of life (Ozkaraman et al., 2019).

in a cross-sectional study by chin in Taiwan with 201 patients' SE was significantly related to quality of life indicating that enhancing SE can improve the quality of life (Chin et al., 2021).

Bandura defines Self-efficacy as the person's ability to implement behavior for a desired outcome (White, 2019, as cited in Bandura, 2001). SE has a crucial role in patients with cancer. The higher a patient's SE the more adaptation and coping will be achieved and the better the quality of life (Dewi et al., 2023). Patients with cancer exhibit high levels of

SE. which is associated with the levels of fatigue and distress. In other words, as SE increases, negative psychological symptoms tend to decrease (Kurt & Altan, 2022).

Finally, in a study involving 253 gastric patients with cancer, a questionnaire was given to the participants before the chemotherapy sessions to examine coping and resilience. The results revealed that there is a positive relationship between SE and increasing hope and resilience (Wu et al., 2021).

2.4.7 Stress among Patients with Cancer

A group of 33 oncology clients were provided with virtual reality sessions to assess the effect in decreasing pain and distress during chemotherapy treatment in a cancer center. The levels of pain and distress among the participants was high. After the virtual reality sessions, the participants were relaxed and felt cool and the clients were optimistic about the practice. The study revealed a decrease in the oncology clients' pain and distress during the intervention (Ashley et al., 2021). Another study conducted in a cancer center in the USA recruited 91 participants, of whom 50 participants remained in the study during chemotherapy intravenous (IV) infusion. The patients were selected randomly, and the intervention group used a virtual reality class during the IV session. The results revealed that the clients experienced feelings of relaxation, low distractions, calmness and low frustration. Additionally, statistical measurements showed a significant increase in relaxation, with no reported pain or stress (Scates et al., 2020).

In a study focusing on virtual reality as an intervention to enhance the quality of life for women with metastatic breast cancer, restlessness, anxiety, and pain were just a few of the incapacitating physical and psychological symptoms that clients with metastatic breast cancer reported as having a significant effect on their overall quality of life. The study revealed that fatigue, pain, depression, anxiety, and stress levels decreased after the procedure and/or 48 hours later (Reynolds et al., 2022).

In a literature review conducted through PubMed from 2018-2019 on cancer patients, the research revealed that once the patients with cancer were diagnosed, stress and other psychological factors affected them, leading to negative life fluctuations (Seiler & Jenewein, 2019).

2.4.8 Anxiety among Patients with Cancer

A systematic review was conducted to assess using virtual reality during cancer patient treatment periods. Results revealed that patients provided good verbal responses, and there were no distinctions in how they perceived or accepted AVR. Among the selected studies, eight looked at AVR strategies for distraction, while seven studies carried out AVR programs for psychoeducation. Positive results from AVR programs were corroborated by patients' feedback. From the results of this review, there was a decrease in pain and anxiety among those who used AVR (Matejek, 2022).

In a research conducted on patients aged 18 to 65 years of age with initial stage cancer in Southern Medical University Cancer Center, AVR improved depression, anxiety and insomnia (Zeng et al., 2022).

In a systematic review published in 2021 about breast cancer, it was noted that therapy for breast cancer is linked to a number of behavioral and physical side effects. Oncological treatment frequently results in adverse reactions such as emotional stress or dysfunction in the body. Becoming disabled by breast cancer could arise as a result of functional problems and activity avoidance brought on by pain. Breast cancer patients can benefit from virtual reality by having a secure environment to perform a range of therapies and provide assistance to patients throughout treatments. This systematic review's objective was to compile a summary of the studies utilizing virtual reality interventions in British Columbia. Eleven studies which met the search requirements were chosen for evaluation, and the analyze was carried out in compliance with the recommended reporting items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The result revealed that anxiety was relieved among these women (Zasadzka et al., 2021).

Framework of the Study:

Scientific research benefits from building on conceptual framework derived from a prior understanding of the phenomena (Markovic, 2019). The framework was created to include important terms that are listed in the bibliography and provide an appropriate structure for appropriately developing the research (Markovic, 2019).

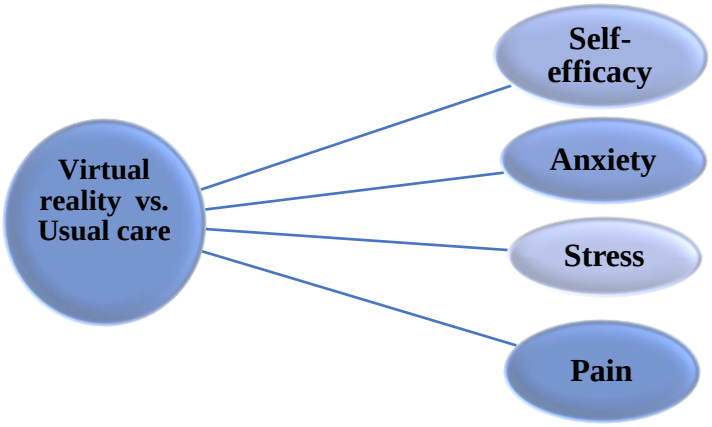


Figure 2.1: Conceptual framework of the study

2.6 Conclusion

The current body of literature supports the effect of AVR in reducing pain, stress, and anxiety, and enhancing self-efficacy among cancer patients. However, the application of AVR in the Palestinian healthcare system remains unexplored. This review sets the stage for the present study, which aims to investigate the impact of AVR on adult cancer patients undergoing chemotherapy in the West Bank, thereby addressing a critical gap in the existing research.

By understanding the potential of AVR to improve the quality of life for cancer patients, this study could pave the way for more widespread adoption of this technology in oncology care, particularly in regions where such interventions have not yet been fully explored.

Chapter Three :Methodology

3.1 Introduction

This study aims to explore the potential benefits of AVR as an intervention for individuals experiencing chronic pain, high levels of stress, and anxiety, while also examining its impact on SE. Utilizing a quantitative, interventional design, participants was randomly assigned to either a AVR intervention group or a control group. The methodology section was comprehensively detailed, including the following key components: Study Design, which describes the interventional design and the rationale behind the use of AVR as an intervention; Setting and Participants, providing information on the recruitment process, inclusion and exclusion criteria, and the demographic characteristics of the participants; Intervention, detailing the AVR sessions, including the content, duration, and frequency, as well as the control group conditions; Measures, outlining the tools and scales used to assess pain, stress, anxiety, and SE at various time points; Procedure, offering a step-by-step outline of the study protocol from baseline assessments to follow-up evaluations; Data Analysis, explaining the statistical methods and software used to analyze the collected data; and Ethical Considerations, discussing the ethical guidelines followed, including informed consent, data confidentiality, and the approval from the institutional review board. This structured approach ensures a rigorous and ethical investigation into the effects of AVR on pain, stress, anxiety, and SE, providing a clear framework for reliability and validity.

3.2 Research Design

The design of this study was a randomized control trial (RCT), the design including a pretest, and posttest, the purposes were to find a cause-and-effect association between an independent and dependent variable. The current study was registered as randomized trial with this link (abuliel, farid. 2023. "The Effect of using Augmented Reality on Pain, Stress, Anxiety, and Self-Efficacy among Patients with cancer undergoing Chemotherapy in the West Bank." AEA RCT Registry. October 04.https://doi.org/10.1257/rct.12172-1.0). RCTs are the most effective method in scientific, medical and clinical study for examining the safety and effect of novel treatments. RCTs serve as the foundation for approvals decisions and are utilized by government regulatory agencies to address clients-related inquiries. Furthermore, RCTs are the most reliable form of research when it comes to evidence quality, quality. However, concerns often arise regarding their external validity—or the

degree to which the findings can be predicted to a larger patient population and is frequently asked due to the fact that since the standardized and controlled study conditions used in these trials may not accurately reflect the complexities of clinical realities (Kabisch et al., 2011). Consequently, RCTs are unable to generate accurate results until they're designed, carried out, evaluated, and published in an approach that is both suitable for the question being asked and in terms of methodology. Before considering an RCT's significance to client attention, its overall efficacy has to must be seriously evaluated (Kabisch et al., 2011).

The participants divided into two groups, the intervention group, which receives AVR, and the control group, which receives standard treatment. The study used a pretest and posttest design to assess the effect of AVR on the study variables (pain, stress, anxiety and self-efficacy).

3.3 Setting

This study conducted at three large hospitals in north Palestine specializing in care for patients with a cancer diagnosis and specifically within the chemotherapy as shown in table 2. These hospitals are governmental settings cover the north district of west bank-Palestine. Their capacities vary and considered as referral hospitals for capacity related issues. As for Hospital (1), it contains 20 beds with total of 620 patients, while Hospital (2) contains 15 beds with total of 450 patients, and Hospital (3) has the smallest number of beds with total of 230 patients and a limited number of seven beds to serve cancer patients or even to hematology patients, these hospitals have an adequate number of qualified nurses to deal with cancer patients. However, what is noticeable is the small number of medical nursing staff, with an average of only five nurses in the morning. Sometimes, Hospital (3) may have only two nurses. These patients were not being able to receive any services after this time. Patient with cancer needs to go to the emergency department for any necessary follow-up care if they have any needs. Cancer and oncology department in these hospitals is called (daycare clinic), as it includes a full staff, including clinical pharmacists, in addition to the nursing staff. Additionally, there is a pharmacy in the cancer section that is different from the pharmacy in the general hospital. Following the doctor's morning visit, the clinical pharmacist and nurse work together to create a list of prescription medications. The pharmacist produces the drugs in compliance with the guidelines and standards designed specifically for cancer patients while working in a confined, sterile environment within a secured room (Ministry of Health. Palestine, 2023).

Table 1.3: Setting of study: name, numbers of patients and number of beds.

Hospital	Number of Patients	Number of Beds
Hospital (1)	620	20
Hospital (2)	450	15
Hospital (3)	230	7

Table 1.3: this table show the setting of study: name, numbers of patients and number of beds. For confidentiality reasons, hospitals name has been omitted.

3.4 Population and Sampling

Patients with cancer undergoing chemotherapy typically visit the day therapy department for their scheduled treatment, which can vary in length but usually lasts at least one hour. The process typically involves cannulation, injection with chemotherapy drugs, infusion of the drugs, and flushing of the lines before removing the cannula. Patients may also have blood tests before their session, which can increase the amount of time spent in the clinic. These details provide a good understanding of the typical chemotherapy treatment process and the environment in which the study took place. The representative sample consisted of cancer patients undergoing chemotherapy sessions at the aforementioned hospitals. Pretests, interventions, and posttests were conducted between March and August 2023.

Participants were selected using a convenience sample and then randomly allocated to intervention or control groups. Patients with Cancer scheduled to receive chemotherapy at the targeted hospitals were assigned to groups using a computer-generated list. The first patient on the list was assigned to the intervention group, the second to the control group, and so on.

The sample size was calculated using G. Power 3.1.9.2 software, Second Version. With a Power of 0.80, alpha of .05, and a medium effect size of 0.5 (Mohammad & Ahmad., 2019). The calculated sample size was based on an independent t-test and was determined to be 128 participants. To overcome the attrition rate and refusal to participate, the final sample included 150 participants. They were distributed in two equal groups: 75 in the interventional group and 75 in the control group from all hospitals. Randomization carried

out using a computerized random number generator to ensure that each participant has an equal chance of being placed in either group. To ensure the integrity of the study and minimize bias, a single-blind approach implemented; the head nurse help in registration and allocate the participants the first registered name to the intervention group the second to the control group and so on.

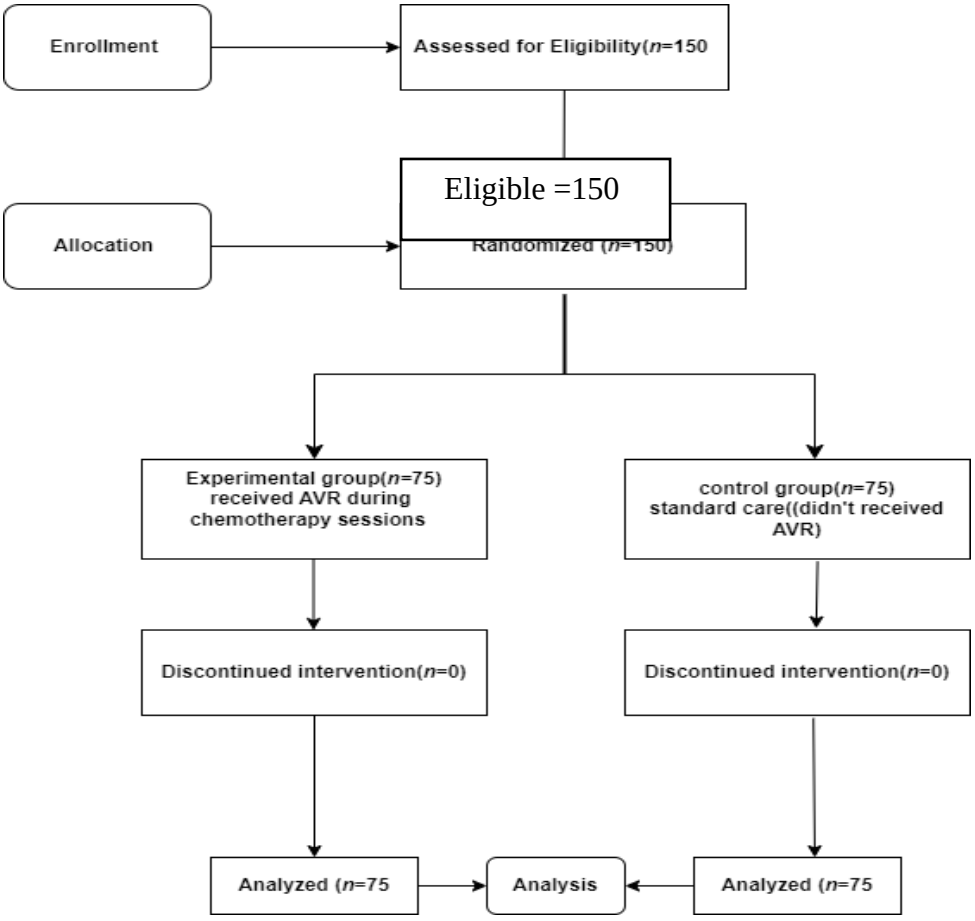


Figure 3.1: This graph shows the process of randomized allocation of the sample

3.5 Eligibility Criteria

3.5.1 Inclusion criteria

Participants eligible for this study were adult patients aged 18 to 60 years undergoing chemotherapy treatment for breast or colon cancer. To ensure a homogeneous sample, only patients with stage one or two of the disease, as defined by the study protocol, were included. Additionally, participants were required to have manageable levels of pain, anxiety, and stress. Patients with more severe conditions may require specialized care beyond the scope of this study. These criteria were designed to select a representative sample of cancer patients for whom the intervention could be appropriately evaluated.

3.5.2 Exclusion criteria

Participants were excluded from the study if they were over 60 years of age, as the study focused on adult patients within a younger demographic. Patients with types of cancer other than breast or colon cancer were also excluded to maintain a specific focus on these two types of cancer. Additionally, individuals experiencing severe pain, anxiety, or stress, which might necessitate more intensive intervention or could interfere with the study's outcomes, were not included. These criteria ensured that the study population was both appropriate for the intervention and able to participate fully in the research process.

3.6 Research Instruments

Questionnaires were used to gather the data. It consists of five sections: 1) Socio demographic data; 2) Numeric Pain Rating Scale (NPRS); 3); Perceived Stress Scale; and 5) Generalized Anxiety Assessment (GAD-7); 4) General Self-Efficacy Scale (GSE).

3.6.1 Socio demographic data: composed of age gender, resident area, marital status, type of cancer, number of chemotherapy sessions and medical data.

3.6.2 Numeric Pain Rating Scale (NPRS)

This scale was developed by Mccaffery and Beebe, (1989) for assessing the pain scale. It is a numeric pain rating scale that indicates the intensity of the current, best, and worst pain levels on a scale of 0 (no pain) to 10 (worst pain imaginable). (see Appendix C). This scale has a high feasibility (quick and easy to use). The English version of the NPRS was translated into Arabic as per the translation process guidelines for patient-rated outcome scales (Alghadir, Anwer & Iqbal, 2016). (See Appendix D). In a study that support using NPRS, they examined the relationship between pain and the time used on computer and depression, the study used NPRS as a tool to examine the pain intensity and the confidence interval was 0.90 that's mean it has a high level of sensitivity as easy and can be used for wide range to examine the pain severity (Hong & Shin, 2020). In another study utilizing augmented reality as a non-pharmacological distraction method for cancer patients, researchers used the NPRS as a tool to measure pain levels. They found the scale to be valid and reliable for assessing pain, demonstrating high sensitivity for the pain levels experienced by cancer patients (Gautama et al., 2023). Moreover, a study exploring the classification of pain severity with using NPRS by its impact on functionality identified optimal thresholds that create three distinct levels of pain severity on a 0-10 numerical scale.

The findings indicated that, based on the level of functional interference in cancer patients, scores of 1-4 represent mild pain, 5-6 represent moderate pain, and 7-10 represent severe pain as a cut point (Serlin et al., 1995). Moreover, in a study examining pain intensity in patients undergoing bone marrow aspiration, the Numerical Pain Rating Scale (NPRS) was employed to assess pain levels in patients undergoing cannula puncture procedures. The study utilized a Virtual Reality device as a distraction method and found that the NPRS was well-suited for achieving the study's objectives (Soret et al., 2022).

3.6.3 Perceived Stress Scale (PSS-10)

The Perceived Stress Scale (PSS-10) is a 10-item questionnaire originally developed by Cohen et al. (1983) widely used to assess stress levels in young people and adults aged 12 and above. It evaluates the degree to which an individual has perceived life as unpredictable, uncontrollable and overloading over the previous month. The responses include- never, never almost, sometimes, fairly often, and very often. (See Appendix C). The PSS-10 has been shown to have a good internal consistency in both adults and university student populations, and good concurrent validity It was positively correlated with measures of anxiety and depression in adults and university students as reviewed by Lee (2012). A wide range of translated versions of the PSS are available, including Swedish, Hebrew, Italian, German, and Arabic (Cohen et al., 1991). Arabic translation of the 10 item Perceived Stress Scale was used (Ali et al., 2021). (see Appendix D). With a study on breast cancer patients, they used the (PSS-10) and the reliability was estimated by McDonald's omega coefficient, the study showed that the scale reliability score was 0.87(Soria-Reyes et al., 2023). The PSS-10 does not have universally agreed-upon clinical cut-off points, scores are generally interpreted as Low stress: 0–13, Moderate stress: 14–26, High stress: 27–40; These ranges provide a general guideline for interpreting the scores, helping to categorize participants based on their perceived stress levels. However, the exact cut-off points can vary depending on the population studied and the specific context of the research.

3.6.4 Generalized Anxiety Assessment (GAD-7)

The GAD-7 originates from Spitzer et al., 2006). used with permission. The GAD-7 score is calculated by assigning scores of 0, 1, 2, and 3, to the response categories of 'not at all', 'several days', 'more than half the days', and 'nearly every day', respectively, and adding together the scores for the seven questions. Scores of 5, 10, and 15 are taken as the cut-off points for mild, moderate and severe anxiety, respectively. (see Appendix C). In a study

used GAD-7 and was done to examine the effect of anxiety on caregivers who support the cancer patients, the GAD-7 reliability and validity was examined the Cronbach's alpha result 0.085 (Akkuş et al., 2022). The Arabic version of the GAD7 scale in this study also demonstrated in Jordan a high internal consistency reliability, with a Cronbach's alpha of 0.895(Yousuf et al., 2022). (see Appendix D).

3.6.5 General Self-Efficacy Scale (GSE)

The scale is designed to assess a person's optimistic self-beliefs used to cope with life's demands; it does not assess coping and adaptation for specific behaviors. Self-efficacy is typically referenced in relation to specific tasks, but high self-efficacy on one task is thought to generalize to other tasks. It is a 10-item measure that assesses how much people believe they can achieve their goals, despite difficulties. It was developed by Ralf Schwarzer & Matthias Jerusalem in 1995. The study employed the Arabic adaptation of the General Self-Efficacy Scale, previously validated by Crandall et al. (2015), to measure participants' perceived self-efficacy.", to measure participants' perceived self-efficacy." Using a 5-point rating scale (1= Not at all true; 2 = Hardly true; 3 = Moderately true, 4= Exactly true). There is no fix cut-off score. One could, however, establish groups on the basis of the empirical distributions of a particular reference population. One could do a median split, which is to dichotomize the sample, for example, at the cut-off point of 30 (if this is near the median in sample) (see Appendix C).

In a study support using GSE in 2020, they evaluate the psychometric characteristics and features of the GSE in china. The GSE showed high internal consistency at a = 0.91 (Zeng et al., 2020).

3.7 Data Collection Process

The data was collected from April 2023 to August 2023. Ethical approval and permission to conduct the study were obtained from The Arab American University and the Palestinian Ministry of Health. The data were collected as follows:

The data collection process began with a meeting with the head nurse of the chemotherapy unit. The purpose of this meeting was to jointly compile a patient list and secure access to their records. Patients who met the eligibility criteria for the study were then selected for randomized allocation, ensuring that each eligible patient had an equal chance of participating in the study. The list was prepared and organized by hospital number in collaboration with the head nurse. Randomized allocation was done by assigning the first patient to the intervention group, the second

to the control group, and so on until the required number of participants was reached. To prevent contamination, the researcher first administered the questionnaire with routine care to the control group, followed by the implementation of AVR for the intervention group. Participants were informed about the study's purpose, activities, and duration. They were also told that the study was part of the researcher's academic requirements for obtaining a doctoral degree in nursing. Patients who were interested in participating signed informed consent forms. The study was conducted in two phases to prevent cross-contamination between the two groups:

Phase one: the control group participated in routine sessions without AVR. Patients were admitted to the daycare unit, where a cannula was applied. The nurse then followed the doctor's order for the type of medication that would be given to the patient. Subsequently, the patients filled out the questionnaire at the posttest.

Phase two: the intervention group received AVR before they started treatment and during the session. The researcher administered the posttest questionnaire in the same way in pre-test. To control the extraneous variables, the researcher ensured the following:

The questionnaire assessed immediately after finishing AVR. Participants informed not to discuss AVR with each other's, as the researcher explained to the participants the purpose of the study and their participation will not affect their care or treatment.

Both groups completed the questionnaires during their regular visits to the chemotherapy units in these hospitals. For the post-intervention assessment, patients in the intervention group completed the questionnaires at the end of the AVR sessions, whereas those in the control group received the standard treatment, then the questionnaires were used to measure their levels of pain, stress, tension, and SE.

3.8 Intervention of the procedure

Once the participants were prepared for chemotherapy infusion, we provided them with the AVR headset and gave a brief overview of how the hardware worked. This included instructions on navigating the interface and information about the available apps for use during the intervention. For participants who were unable to operate the headset themselves, we managed the device and simply allowed them to watch the videos. Participants then completed a brief self-administered questionnaire to assess their levels of pain, stress, anxiety, and self-efficacy. They could choose which video they wanted to watch, with options including mountains, rivers, the sea, and waterfalls.

The AVR system used in this study was Meta Quest 2 headset KW49CM, equipped with high storage GB and pairing with phone app on meta-Quest iOS app version 192.0. This device with high resolution and high quality features, this device allows users to engage in the views selected through small screen in front of the eyes (Raymer et al., 2023). The researcher used scenarios included mountain fall, deep sea diving "Ocean Rift," or sitting on the beach with the "Happy Place" track (Chirico et al., 2016). The scenarios were assessed in a pilot study to determine if they were comfortable and clear. The scenarios downloaded from Air Pano web site for 360° videos.

All patients were shown calming scenes, such as beaches, mountain waterfalls, and other serene or imaginary places designed to inspire tranquility. To help them relax, we also provided inspirational videos. After the intervention, participants were interviewed to assess whether there was a decrease in pain, stress, and anxiety symptoms, as well as an improvement in self-efficacy.

3.9 Ethical Considerations

Ethical approval was obtained from the IRB committee from Arab American University under the number (2023 /A /99/N), as well as from the Ministry of Health and the recruited hospitals. Written permission (informed consent) for participation was obtained from each participant. A detailed explanation about the purpose of the study and the outcome that may be experienced as relaxation and distraction benefits. All ethical issues of research were continued and participation was voluntary also participants were informed that withdrawal would be free time during the study. The procedure was anonymous by giving participants a unique number to utilize for all of their responses in the statistical strand of the research, and participant confidentiality was ensured. Secrecy and avoiding dishonesty are two aspects of ethical values. Throughout the study phases (data collection, analysis, and presentation of study results), participant identification was not disclosed. Additionally, all data were safely saved so that only the research group had permission to view it.

3.10 Data analysis

Data analysis was executed by using the Statistical Package for Social Sciences (SPSS) version 23. Significance was set at $p \leq 0.\ 05$. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to describe the characteristics of the participants. An independent sample t-test was used to compare both groups at pre- and

post-test. Also, a paired samples t-test was used for comparison between pre and post for each group. furthermore, a chi-square test was performed to compare the level of anxiety between the interventional and control groups.

Table 3.2: Data analysis plan

Research question	test	Assumption
What is the effect of AVR therapy on the mean pain score compared with routine care during chemotherapy sessions among cancer patient?	T test, paired t-test	The normal distribution of the variables 2. Homogeneity of variances between the two groups 3. The existence of two mutually exclusive groups, the interventional and the control groups
What is the effect of AVR therapy on the general self-efficacy compared with routine care during chemotherapy sessions among cancer patients?	T-test, paired t-test	1.The normal distribution of the variables scores test conducted to test the 2. Homogeneity of variances between the two groups 3.The existence of two mutually exclusive groups, the interventional and the control groups
What is the effect of AVR therapy on stress compared with routine care during chemotherapy sessions among cancer patients?	T-test, paired t-test	1.The normal distribution of the variables scores test conducted to test the 2. Homogeneity of variances between the two groups 3.The existence of two mutually exclusive groups, the interventional and the control groups
4. What is the effect of AVR therapy on the anxiety compared with routine care during chemotherapy session among cancer patient?	Chi-square	1.the data in the cells should be frequencies, or counts of cases rather than percentages or some other transformation of the data. 2.The levels (or categories) of the variables are mutually exclusive. 3.Each subject may contribute data to one and only one cell in the $\chi 2$

Summary:

The methodology chapter delineates the research design, setting, population, sampling techniques, research instruments, data collection procedures, ethical considerations, and data analysis plan for investigating the impact of augmented reality (AVR) on pain, stress, anxiety, and self-efficacy among adult cancer patients undergoing chemotherapy in the West Bank. Utilizing a randomized control trial (RCT) design, the study involved participants from three major hospitals specializing in cancer care. Through meticulous selection criteria and a calculated sample size, 150 participants were assigned to either the intervention (AVR) or control group. Data collection encompassed pretest and posttest assessments using various validated instruments. Ethical approval was secured, and

informed consent was obtained from all participants. Following data collection, statistical analyses were conducted to explore the effects of AVR therapy on the study variables. The rigorous methodology ensures the validity and reliability of the study's findings, contributing valuable insights to the field of oncology and nursing.

Chapter Four: Results

4.1 Introduction

In this chapter, the results of the study are presented. The purpose of this study was to examine the effect of AVR on pain, stress, anxiety, and self-efficacy among adult cancer patients undergoing chemotherapy sessions in the West Bank hospitals in Palestine. The statistical package for social science (SPSS, version 23) was used to analyze the data. Descriptive and inferential statistics were used to test the research questions. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to describe the characteristics of the participants. The inferential statistics (independent t-test, paired t-test and X^2) were utilized to test the research questions.

4.2 Description of the participants' characteristics

The analysis revealed that 99 (66.0%) of the patients age were between 40-60 years. The majority of them 111(74.0%) were females, and 92 (61.3%) had a high school or less. Approximately two thirds of them, 100 (66.7%), were married, and 61(40.7%) from the villages. Also, majority of them 107 (71.3%) are none-employee, as seen in Table 4.1.

Table 4.1 Description of Participants socio-demographics (N =150)

Variables		N	(%)
Gender	Less than 40 years	39	26.0
	40-60 years	111	74.0
Age	More than 60 years	29	19.3
	High school or less	99	66.0
	Diploma or bachelor	22	14.7
Level of education	Postgraduate	92	61.3
	Married	47	31.3
	Single	11	7.3
Marital status	Divorced	100	66.7
	Widowed	35	23.3
	City	6	4.0
	Village	9	6.0
Residence	Camp	43	28.7
	Town	61	40.7
	Employee	23	15.3

	Not-employee	23	15.3
Occupation	Less than 40 years	43	28.7
	40-60 years	107	71.3

4.3 Description of the participants medical and health history

The analysis revealed that the majority of the participants 110 (73.3%) have breast cancer. More than half of them 79 (52.7%) have two chemotherapy sessions and 44 (29.3%) received Adriamycin drug. Also, 74(49.3) were in first cancer stage. However, 93(62.0%) haven't chronic diseases, as seen in Table (4.2).

Table 4.2 Description of the participants' health history (N =150)

Variables		n	%
Medication	Adriamycin	44	29.3
	Cyclophosphamide	25	16.7
	Docetaxel	41	27.3
	Irinotecan	19	12.7
	Oxaliplan	21	14.0
Cancer type	Colon	40	26.7
	Breast	110	73.3
Session of chemotherapy	Session 1	64	42.7
	Session 2	79	52.7
	Session 3	7	4.7
Chronic disease	Yes	57	38.0
	No	93	62.0
Cancer stage	First stage	74	49.3
	Second stage	73	48.7

4.4 Comparison of the participants' characteristics between the two groups

A chi-square test was performed to assess if there were significant differences between the interventional and control groups regarding socio-demographic data. The results revealed no significant differences between the two groups, as displayed in Table 4.3.

Table 4.3 Description of Participants socio-demographics between both groups (N =150)

Variables		Control n(%)	Experiment n(%)	X^2 test	*P*-value
Gender	Male	18((24.0)	21(28.0)	0.312	.577
	Female	57(76.0)	54(72.0)		
Age	Less than 40 years	14(18.7)	15 (20.0)	0.307	.858
	40-60 years	51(68.0)	48(64.0)		
	More than 60 years	10(13.3)	12(16.0)		
Level of education	Married	41(54.7)	51(68.0)	2.948	.229
	Single	27(36.0)	20(26.7)		
	Divorced	7(9.3)	4(5.3)		
Marital status	Widowed	42(56.0)	56 (74.7)	7.492	0.058
	City	20 (26.7)	15(20.0)		
	Village	6(8.0)	2(2.7)		
	widowed	7(9.3)	2(2.7)		
Residence	city	21(28.0)	22(29.3)	7.596	0.055
	village	32(42.7)	36(48.0)		
	camp	13(17.3)	3(4.0)		
	Town	9(12.0)	14(18.7)		
Occupation	Employee	21(28.0)	22(29.3)	0.033	.857
	None-employee	54(72.0)	53(70.7)		

P. value significant at the 0.05 level

4.5 Comparison of the participants' medical and health history between the two groups

A chi-square test was performed to assess if there were significant differences between the interventional and control groups regarding medical and health history. The results revealed no significant differences between the two groups, as displayed in Table 4.4

Table 4.4 Description of participants' Medical and health history between both groups (N =150)

Variables		Control n(%)	Experiment n(%)	Test statistics	*P*-value
Medication	Adriamyc	27(36.0)	17(22.7)	X^2=3.989	0.407
	Cyclopho	13(17.3)	12(16.0)		
	Docetaxe	17(22.7)	24(32.0)		
	Irinotec	9(12.0)	10(13.3)		
	Oxalipla	9(12.0)	12(16.0)		
Cancer type	Colon	18(24.0)	22(29.3)	X^2=.545	.460
	Breast	57(76.0)	53(70.7)		
Session of	Session 1	32(42.7)	32(42.7)	X^2=.156	.925

chemotherapy	Session 2	39(52.0)	40(53.3)		
	Session 3	4(5.3)	3(4.0)		
Chronic disease	Yes	24(32.0)	33(44.0)	X^2=2.292	.130
	No	51(68.0)	42(56.0)		
Cancer stage	First stage	42(56.0)	32(42.7)	X^2=2.794	0.247
	Second stage	32(42.7)	41(54.7)		

P. value significant at the 0.05 level

4.6 Comparison of the main variables of the study in the two groups

To compare the main variables of the two groups at the post-test, the homogeneity of the two groups at the pre-test must be assessed. Therefore, an independent sample t-test was performed to compare the means of the variables (Pain, general Self-efficacy, stress) between the interventional and control groups, as seen in Table 4-5.

The first assumption of the t test was the normal distribution of the variables scores, which were assessed by kurtosis, and skewness, hat indicated the outcomes variables scores were approximately normally distributed within the two groups (P> 0.05). The second assumption was Levene's test conducted to test the homogeneity of variances between the two groups (p > 0.05). This indicated no significant violation of the equal variance assumption. The third assumption is the existence of two mutually exclusive groups, the interventional and the control groups.

Also, chi-square test was performed to compare the level of anxiety between the interventional and control groups. There are no significant differences between the two groups (p > 0.05), as seen in Table 4.5

Table 4.5 Comparisons of the means of the variables scores between the control and Interventional groups at pretest (N= 150**)**

Outcomes		Control	interventional	Levene's test	p. value	t test	p. value
		M(SD)	M(SD)				
Pain		5.1(2.5)	5.2(2.5)	.066	.797	.26	.793
Self-efficacy		23.3(3.8	23.5(3.7)	.026	.872	.43	.663
Perceived stress scale (PSS)		(4.2)	19.6(3.9)	.158	.692	-.4	.659
		N(%)	N(%)			X^2	
General anxiety disorder	Minimal anxiety	14(18.7)	14 (18.7)			.04	0.998
	Mild	24(32.0)	25(33.3%)				

(GAD)	anxiety						
	Moderate anxiety	26(34.7)	25(33.3)				
	Severe anxiety	11(14.7)	11(14.7)				

P. value significant at the 0.05 level

4.7 Testing research hypothesis

Research Hypothesis One: AVR therapy significantly reduces pain levels compared with routine care during chemotherapy sessions among patients with cancer.

The differences in pain scores between the interventional and control groups at the post-test and between the groups themselves pre- and post-test were examined. These differences were examined by an independent t-test and paired t-test.

The analysis revealed that there was a significant difference in pain score mean between the interventional and control groups (P< 0.05). The mean pain scores of the interventional group (M = 2.6±SD 1.7) were lower than those of the control group (M = 4.6±SD 2.8), as seen in Table 4.6

Table 4.6 Differences of the of the pain scores mean between the control and Interventional groups at post-test (N= 150)

Variable	Control	Interventional	t test	p. value
Pain	M(SD)	M(SD)		
	4.6(2.8)	2.6(1.7)	5.271	0.001*

**P. value significant at the 0.05 level*

Also, the analysis revealed that there was a significant difference in the mean pain scores between the pre- and post-tests in the interventional group (P< 0.05). The mean pain scores of the interventional group at the post-test (M = 2.6±SD 1.7) was lower than the pre-test (M = 5.2±SD 2.5), as seen in Table 4.7

Table 4.7 Differences of the pain scores mean of the interventional group at pre and post-test (N= 75)

Variable	Pretest	Post-test	t test	p. value
Pain	M(SD)	M(SD)		
	5.2(2.5)	2.6(1.7)	9.525	0.001*

**P. value significant at the 0.05 level*

The analysis revealed that the mean pain scores of the control group at the post-test (M = 4.6±SD 2.8) was lower than the pre-test (M = 5.1±SD 2.5) but there was no a significant difference in the mean pain scores between the pre- and post-tests in the control group (P> 0.05), as seen in Table 4.8

Table 4.8 Differences of the pain scores mean of the control group at pre and post-test (N= 75)

Variable	Pretest	Post-test	t test	p. value
Pain	M(SD)	M(SD)		
	5.1(2.5)	4.6(2.8)	1.223	0.225

P. value significant at the 0.05 level

Research Hypothesis Two: AVR therapy significantly improves general SE compared with routine care during chemotherapy sessions among patients with cancer.

The differences in the general self-efficacy scores between the interventional and control groups at the post-test and between the groups themselves pre- and post-test were examined. These differences were examined by a paired t-test and an independent t-test.

The analysis revealed that there was a significant difference in general self-efficacy scores mean between the interventional and control groups (P< 0.05). The mean of the general self-efficacy scores in the interventional group (M = 31.0±SD 6.7) was higher than that in the control group (M = 28.8±SD 6.8), as seen in Table 4.9

Table 4.9 Differences of the means of the general self-efficacy scores between the control and Interventional groups at post-test (N= 150)

Variable	Control	Interventional	t test	p. valu
	M(SD)	M(SD)		
1. "I can always manage to solve difficult problems if I try hard enough"	2.8(0.9)	2.(0.9)		
2. "If someone opposes me, I can find the means and ways to get what I want".	2.8(0.9)	3.1(0.8)		
3. "It is easy for me to stick to my aims and accomplish my goals".	2.9(0.9)	3.0(0.9)		
4. "I am confident that I could deal efficiently with unexpected events".	2.9(0.9)	3.2(0.7)		
5. "Thanks to my resourcefulness, I know how to handle unforeseen situations".	2.9(1.0)	3.2(0.8)		
6. "I can solve most problems if I invest the necessary effort".	2.8(0.9)	3.1(0.8)		
7. "I can remain calm when facing difficulties because I can rely on my coping abilities".	2.9(0.9)	3.1(0.8)		
8. "When I am confronted with a problem, I can usually find several solutions".	2.9(0.8)	3.2(0.8)		
9. "If I am in trouble, I can usually think of a solution"	2.8(0.8)	3.1(0.8)		
10. "I can usually handle whatever comes my way".	2.9(0.9)	3.1(0.9)		
Self-efficacy	28.8(6.8)	31.0(6.7)	2.006	0.047*

**P. value significant at the 0.05 level*

The analysis revealed that there was a significant difference in general self-efficacy scores mean between pre- and post-test of the interventional group (P< 0.05). The mean general self-efficacy scores of the interventional group at the post-test (M = 31.0±SD 6.7) was higher than the pre-test (M = 23.5±SD 3.7), as seen in Table 4.10

Table 4.10 Differences of the mean of the general self-efficacy scores of the interventional group at pre and post-test (N= 75)

	Pretest	Posttest	t test	p. value
	M(SD)	M(SD)		
1. "I can always manage to solve difficult problems if I try hard enough"	2.5(0.9)	2.9(0.9)		
2. "If someone opposes me, I can find the means and ways to get what I want".	2.4(0.8)	3.1(0.8)		
3. "It is easy for me to stick to my aims and accomplish my goals".	2.3(0.8)	3.0(0.9)		
4. "I am confident that I could deal efficiently with unexpected events".	2.5(0.8)	3.2(0.7)		
5. "Thanks to my resourcefulness, I know how to handle unforeseen situations".	2.3(0.8)	3.2(0.8)		
6. "I can solve most problems if I invest the necessary effort".	2.3(0.8)	3.1(0.8)		
7. "I can remain calm when facing difficulties because I can rely on my coping abilities".	2.2(0.8)	3.1(0.8)		
8. "When I am confronted with a problem, I can usually find several solutions".	2.4(0.7)	3.2(0.8)		
9. "If I am in trouble, I can usually think of a solution"	2.5(0.9)	3.1(0.8)		
10. "I can usually handle whatever comes my way".	2.2(0.8)	3.1(0.9)		
General Self-efficacy	23.5(3.7)	31.0(6.7)	9.404	0.001*

**P. value significant at the 0.05 level*

The analysis revealed that there was a significant difference in general self-efficacy scores mean between pre- and post-test of the control group ($P< 0.05$). The mean general self-efficacy scores in the control group at the post-test (M = 28.8±SD 6.8) was higher than the pre-test (M = 23.3±SD 3.8), as seen in Table 4.11

Table 4.11 Differences of the general self-efficacy of the control group at pre and post-test (N= 75)

	Pretest	Posttest	t test	p. value
	M(SD)	M(SD)		
1. "I can always manage to solve difficult problems if I try hard enough"	2.4(0.8)	2.8(0.9)		
2. "If someone opposes me, I can find the means and ways to get what I want".	2.3(0.8)	2.8(0.9)		
3. "It is easy for me to stick to my aims and accomplish my goals".	2.3(0.8)	2.9(0.9)		
4. "I am confident that I could deal efficiently with unexpected events".	2.4(0.9)	2.9(0.9)		
5. "Thanks to my resourcefulness, I know how to handle unforeseen situations".	2.3(0.8)	2.9(1.0)		
6. "I can solve most problems if I invest the necessary effort".	2.3(0.8)	2.8(0.9)		
7. "I can remain calm when facing difficulties because I can rely on my coping abilities".	2.2(0.8)	2.9(0.9)		
8. "When I am confronted with a problem, I can usually find several solutions".	2.4(0.7)	2.9(0.8)		
9. "If I am in trouble, I can usually think of a solution"	2.4(0.9)	2.8(0.8)		
10. "I can usually handle whatever comes my way".	2.2(0.8)	2.9(0.9)		
General Self-efficacy	23.3(3.8)	28.8(6.8)	5.967	0.001*

t= paired t test

**P. value significant at the 0.05 level*

Research Hypothesis Three: AVR therapy significantly reduces stress levels compared with routine care during chemotherapy sessions among patients with cancer.

The differences in stress mean scores between the interventional and control groups at the post-test and between the groups themselves pre- and post-test were examined. These differences were examined by a paired t-test and an independent t-test.

The analysis revealed that there was a significant difference in the stress mean scores between the interventional and control groups (P< 0.05). The mean stress scores in the interventional group (M = 17.7±SD 2.8) were lower than that in the control group (M = 19.2±SD 2.5), as seen in Table 4.12

Table 4.12 Differences of the mean of the stress scores between the control and Interventional groups at post-test (N= 150)

Stress	Control	Interventional	t test	p. value
	M(SD)	M(SD)		
"Been upset because of something that happened unexpectedly"?	1.7(0.9)	1.0(0.8)		
"Felt that you were unable to control the important things in your life"?	1.6(1.0)	1.0(0.8)		
"Felt nervous and "stressed"?	1.5(1.0)	1.1(1.1)		
"Felt confident about your ability to handle your personal problems"?	2.4(1.1)	3.1(1.1)		
"Felt that things were going your way"?	2.3(1.1)	2.9(1.0)		
"Found that you could not cope with all the things that you had to do"?	1.7(1.1)	0.9(1.1)		
"Been able to control irritations in your life"?	2.3(1.1)	2.9(1.0)		
"Felt that you were on top of things"?	2.4(1.0)	2.9(1.1)		
"Been angered because of things that were outside of your control"?	1.7(1.0)	1.0(1.0)		
"Felt difficulties were piling up so high that you could not overcome them"?	1.6(1.0)	1.0(1.1)		
PSS total	19.2(2.5)	17.7(2.8)	3.371	0.001*

t= an independent t test

P. value significant at the 0.05 level

The analysis revealed that there was a significant difference in the stress scores mean between pre- and post-test of the interventional group (P< 0.05). The mean stress scores of the interventional group at the post-test (M = 17.7±SD 2.8) was lower than the pre-test (M = 19.6±SD 3.9), as seen in Table 4.13

Table 4.13 Differences of the mean of the stress of the interventional group at pre and post-test (N= 75)

Stress	Pre test	Post test	t test	p. value
	M(SD)	M(SD)		
"Been upset because of something that happened unexpectedly"?	1.8000 1.02667	.9867 .84619		
"Felt that you were unable to control the important things in your life"?	2.0000 1.15079	.9733 .83784		
"Felt nervous and "stressed"?	2.1333 1.10690	1.0800 .99675		
"Felt confident about your ability to handle your personal problems"?	1.9600 1.15595	2.9600 1.14420		
"Felt that things were going your	1.8667 .97722	2.9200 1.04958		

way"?				
"Found that you could not cope with all the things that you had to do"?	2.0133 1.12097	.9200 .99675		
"Been able to control irritations in your life"?	1.8667 1.06965	2.9333 1.01786		
"Felt that you were on top of things"?	1.7867 1.11856	2.9333 1.14294		
"Been angered because of things that were outside of your control"?	2.1467 1.06153	1.0133 1.00664		
"Felt difficulties were piling up so high that you could not overcome them"?	2.0000 1.15079	1.0267 1.10250		
PSS	19.6(3.9)	17.7(2.8)	3.394	0.001*

t= paired t test

P. value significant at the 0.05 level

The analysis revealed that there was no a significant difference in stress scores mean between pre- and post-test of the control group (P> 0.05), as seen in Table 4.14

Table 4.14 Differences of the stress of the control group at pre and post-test (N= 75)

Stress	Pre test	Post test	t test	p. value
	M(SD)	M(SD)		
"Been upset because of something that happened unexpectedly"?	1.9(1.1)	1.7(0.9)		
"Felt that you were unable to control the important things in your life"?	2.1(1.1)	1.6(1.1)		
"Felt nervous and "stressed"?	2.1(1.0)	1.5(1.0)		
"Felt confident about your ability to handle your personal problems"?	1.9(1.2)	2.4(1.2)		
"Felt that things were going your way?	1.8(1.0)	2.3(1.1)		
"Found that you could not cope with all the things that you had to do"?	2.2(1.1)	1.7(1.1)		
"Been able to control irritations in your life"?	1.9(1.1)	2.3(1.1)		
"Felt that you were on top of things "?	1.7(1.1)	2.4(0.9)		
"Been angered because of things that were outside of your control"?	2.2(1.1)	1.7(1.0)		
"Felt difficulties were piling up so high that you could not overcome them"?	2.0(1.2)	1.6(1.0)		
Total stress	19.9(4.2)	19.2(2.5)	1.114	0.269

t= paired t test

P. value significant at the 0.05 level

Research Hypothesis Four: AVR therapy significantly reduces anxiety levels compared with routine care during chemotherapy sessions among patients with cancer.

The differences in anxiety level between the interventional and control groups at the post-test was examined. These differences were examined by X^2 test.

The analysis revealed that there was a significant difference in the anxiety levels between the interventional and control groups ($P< 0.05$). Also, the analysis revealed that 41(54.7%) of the interventional group have minimal anxiety while only 20 (26.7%) of the control group have similar results.

4.8 Summary

This chapter of the result and interpretation dealt with the data collected regards demographic data and the levels of study variables. And Comparisons of the means of the variables scores between the control and interventional groups at pretest and posttest also Comparisons of the variables scores between the control and interventional groups at pretest. The result of the study revealed that there was a significant difference in pain, self-efficacy, stress mean, and anxiety levels scores mean between the interventional and control groups ($P< 0.05$). finally, the result showed that using AVR has positive outcome on the levels pf pain, self-efficacy, stress and anxiety.

Chapter Five: Discussion

5.1 Comparison of the participants' characteristics between the two groups

The analysis of participant characteristics in this study reveals a predominance of female participants, with the majority in both the interventional and control groups being female. This finding is consistent with previous research on AVR interventions for patients with cancer. For instance, Schneider and Hood (2007) observed a higher representation of female participants (195 females compared to 128 males) in their study on AVR's effectiveness in reducing stress during chemotherapy. Similarly, Birkhoff (2021) reported a majority of female participants (n=27) in their study evaluating AVR's impact on anxiety and self-efficacy, compared to males (n=8). This gender disparity is further supported by Scates (2020), who noted that the majority of VR users in their study were female (35 females vs. 15 males). Ashley et al. (2021) also found a predominance of female participants (n=25) over males (n=8) using AVR during chemotherapy sessions.

The consistent overrepresentation of females in these studies, including ours, suggests that female patients with cancer may be more likely to engage with and benefit from AVR interventions. This could be influenced by various factors, such as differences in psychological and emotional coping strategies between genders. It also underscores the need for targeted approaches in AVR development and implementation to address the specific needs of female patients.

In terms of age, most of participants were between 40 and 60 years old. This age group is significant as it represents individuals who are likely to be managing multiple life responsibilities, including family and career, alongside their health challenges. The presence of AVR as a supportive intervention could be particularly beneficial for this demographic, addressing their stress and anxiety associated with cancer treatment.

The high proportion of married participants suggests that the presence of a supportive partner may play a crucial role in the efficacy of AVR interventions. The support from a spouse or partner could potentially enhance the positive effects of AVR, offering additional emotional reinforcement during treatment. This finding aligns with the broader understanding that social support is a key factor in patient well-being.

Participants from rural areas and those who are unemployed also comprised a significant portion of the study. This demographic detail is important as it highlights potential socio-economic and geographical factors that might affect access to and utilization

of innovative therapies. Rural patients might face barriers in accessing specialized care, making AVR a valuable tool for them. Similarly, unemployed individuals may experience greater financial and lifestyle impacts due to their condition, further emphasizing the importance of accessible supportive interventions like AVR.

In conclusion, the demographic characteristics observed in this study—primarily female participants, individuals aged 40-60, married, and from rural or unemployed backgrounds—align with trends reported in existing literature. The consistency of these findings with previous studies (Schneider & Hood, 2007; Birkhoff, 2021; Scates, 2020; Ashley et al., 2021) reinforces the relevance of AVR as a beneficial tool for patients with cancer and highlights the need for continued research and tailored interventions to meet the diverse needs of this population.

5.2 Differences of the of the pain scores mean between the control and Interventional groups at post-test

The significant improvement in pain levels observed in the interventional group compared to the control group highlights the efficacy of AVR as a tool for pain management. This finding aligns with previous research indicating that VR can effectively reduce pain. For instance, Mohammad and Ahmad (2019) found a statistically significant difference in pain scores between groups receiving AVR interventions and those who did not, affirming the potential of VR techniques in pain management.

This outcome is supported by a broader body of research demonstrating the effectiveness of AVR in alleviating pain. Scates et al. (2020) and Kipping et al. (2012) both observed significant reductions in pain levels following AVR interventions, reinforcing the notion that AVR can serve as a potent adjunct to traditional pain management strategies. Similarly, Mohammad and Ahmad (2018) and Tanja-Dijkstra et al. (2018) reported substantial decreases in pain levels due to AVR applications, highlighting its role in enhancing patient comfort.

The study's findings are also consistent with Tashjian et al. (2017), who noted significant reductions in pain following AVR interventions. This consistency across various studies suggests that AVR not only provides temporary distraction but may also influence the neurological and psychological mechanisms underlying pain perception.

Furthermore, the literature review by Buche (2022) emphasizes that AVR can be an effective tool in reducing unpleasant stimuli and mitigating the anxiety and pain associated

with cancer. By immersing patients in engaging virtual environments, AVR can distract from pain and discomfort, offering a multi-faceted approach to pain management.

The significant reduction in pain scores observed in the interventional group highlights the potential of AVR to serve as an effective complementary therapy for pain management. This is particularly relevant in clinical settings where traditional pain relief methods might be insufficient or accompanied by adverse effects. AVR's ability to provide a non-pharmacological means of pain relief aligns with the growing interest in integrative approaches that enhance patient care while minimizing reliance on medication.

In summary, the significant differences in pain scores between the interventional and control groups underscore the potential of AVR as an effective pain management tool. The alignment of these findings with previous research (Scates et al., 2020; Kipping et al., 2012; Mohammad & Ahmad, 2018; Tanja-Dijkstra et al., 2018; Tashjian et al., 2017; Buche, 2022) supports the continued exploration and integration of VR technologies in clinical practice to improve patient outcomes and comfort.

5.3 Differences of the means of the general self-efficacy scores between the control and Interventional groups at post-test

The analysis of self-efficacy scores between the control and interventional groups reveals a significant improvement in the group utilizing AVR. This finding underscores the potential of AVR to enhance patients' self-efficacy, which is crucial for managing cancer treatment and overall well-being.

The observed increase in self-efficacy among AVR users aligns with existing research highlighting the positive impact of AVR on patients' confidence and perceived control. For instance, Birkhoff (2021) demonstrated that AVR use in a cancer center led to enhanced self-efficacy, as measured by the Cancer Behavior Inventory (CBI). This study supports the notion that AVR can empower patients by improving their confidence in managing their condition.

Similarly, a randomized crossover study conducted by Austin (2022) in Austria found that AVR not only reduced anxiety but also improved self-efficacy among patients with cancer. This suggests that AVR can play a dual role in both emotional and psychological support, enhancing patients' ability to cope with their illness and treatment.

In Iran, Sharifpour et al. (2021) observed that AVR interventions led to increased self-efficacy and reduced pain among patients with cancer. Their findings highlight the relationship between self-efficacy and pain control, suggesting that improved self-efficacy can contribute to better pain management and, consequently, a higher quality of life.

These results collectively indicate that AVR can significantly boost patients' self-efficacy by providing immersive, engaging experiences that may enhance their coping skills and sense of control. This improvement in self-efficacy is particularly important as it empowers patients to manage their treatment and navigate their health challenges more effectively.

The alignment of these findings with previous research underscores the effectiveness of VR in enhancing self-efficacy and highlights the broader potential of AVR as a supportive tool in oncology. By fostering a greater sense of control and confidence, AVR can contribute to improved patient outcomes and well-being.

In summary, the significant improvement in self-efficacy observed in the interventional group supports the growing body of evidence that AVR can be an effective tool in enhancing patients' confidence and coping abilities. The consistency of these findings with studies by Birkhoff (2021), Austin (2022), and Sharifpour et al. (2021) reinforces the value of integrating AVR into patient care to improve self-efficacy and overall treatment experience.

5.4 Differences of the mean of the stress scores between the control and Interventional groups at post-test

The significant reduction in stress observed in the interventional group underscores the effectiveness of AVR in alleviating stress among patients with cancer. This finding aligns with a growing body of evidence supporting AVR as a valuable tool for stress management in oncology settings.

Birnie et al. (2018) conducted a study at a cancer clinic in Toronto, which demonstrated that AVR significantly decreased stress associated with the insertion of a cannula for cancer medication. This study highlights AVR’s potential in addressing acute

stress responses during medical procedures, suggesting that AVR can provide a valuable distraction and psychological relief during such stressful moments.

Similarly, Torres et al. (2023) found that AVR interventions for women undergoing chemotherapy for breast cancer led to a significant reduction in emotional distress. This aligns with our findings and emphasizes AVR's role in mitigating the psychological impact of cancer treatments, particularly by reducing emotional strain during chemotherapy.

The study by Scates et al. (2020) further corroborates these findings, reporting that AVR significantly reduced stress and enhanced relaxation. This study reinforces the notion that immersive VR experiences can contribute to a state of relaxation, thereby reducing overall stress levels.

A comprehensive literature review by Roche and Siegel (2019) also supports our results, indicating that AVR is effective in decreasing stress. This review consolidates evidence from multiple studies, providing robust support for the use of AVR in enhancing mental wellness and reducing stress among patients.

Kim (2021) found that AVR use led to a significant decrease in stress levels among participants with high-stress conditions. This study highlights AVR’s effectiveness in managing severe stress, further validating its utility as an intervention for stress relief.

Buche (2022, as cited in Li et al., 2016) also underscores the benefits of AVR in reducing distress associated with cancer, reinforcing the idea that AVR can be an effective tool for improving psychological well-being in oncology patients. Additionally, Tennant et al. (2020) observed that AVR techniques positively impacted mood and reduced distress among pediatric patients with cancer, highlighting AVR’s applicability across different age groups.

These findings collectively indicate that AVR can significantly reduce stress by providing immersive, engaging experiences that offer psychological relief and distraction from distressing treatment procedures. The evidence suggests that AVR not only helps in managing immediate stress but also contributes to overall mental wellness, making it a valuable addition to supportive care strategies in oncology.

In conclusion, the significant reduction in stress observed in our study aligns with previous research (Birnie et al., 2018; Torres et al., 2023; Scates et al., 2020; Roche & Siegel, 2019; Kim, 2021; Buche, 2022; Tennant et al., 2020) and underscores the efficacy of AVR in enhancing patient comfort and psychological well-being. Integrating VR into routine cancer care could provide a meaningful improvement in managing stress and improving the overall patient experience.

5.5 Comparisons of the anxiety levels between the control and Interventional groups at post-test:

The significant reduction in anxiety observed in the interventional group using AVR or underscores the effectiveness of these technologies in managing anxiety among patients with cancer. This aligns with several studies that highlight the positive impact of AVR on reducing anxiety levels.

Menekli et al. (2022) demonstrated that AVR effectively reduced anxiety among oncology patients, supporting the notion that AVR can serve as a powerful tool in anxiety management. This is reinforced by Glennon (2018), who found that AVR significantly decreased anxiety levels in patients with cancer, further validating AVR's role in improving psychological outcomes in clinical settings.

The study by Shin et al. (2023) revealed that AVR not only provided immediate anxiety relief but also increased patient interest in the procedure, highlighting the dual benefit of AVR in both reducing anxiety and engaging patients in their care. This reflects the immersive nature of AVR, which can effectively distract patients from their anxieties and offer a temporary escape from the stresses associated with cancer treatment.

Similarly, Mohammad and Ahmad (2019) observed a decrease in anxiety among breast patients with cancer using AVR at the King Hussein Cancer Center. This finding aligns with our results and demonstrates that VR can be effective across different settings and populations. Tennant et al. (2020) also found improvements in comfort and mood, leading to reduced anxiety levels among pediatric patients with cancer, further supporting the efficacy of AVR in diverse patient groups.

A systematic review by Zasadzka et al. (2021) reinforced these findings, showing that AVR effectively alleviated anxiety related to medical procedures and environments. This review emphasizes the broad applicability of AVR in oncology, demonstrating its potential to enhance patient care by reducing anxiety.

The study by Khan et al. (2022) further supports the effectiveness of AVR in improving anxiety levels among breast patients with cancer, aligning with the current study's results. Similarly, Yazdipour et al. (2023) conducted a systematic review that included a large number of studies, confirming that AVR can significantly reduce anxiety, pain, and stress, thus providing comprehensive support for its use in oncology.

However, it is important to acknowledge studies with contrasting findings, such as those by Mohammad (2019), Chirico et al. (2016), and Morris et al. (2009), which reported no effect of AVR on anxiety levels. These discrepancies may be attributed to factors such as sample size limitations or variations in AVR implementation. For instance, smaller sample sizes may reduce the statistical power to detect significant effects, as suggested by Mohammad and Ahmad (2019).

In conclusion, the substantial reduction in anxiety observed in the AVR group aligns with a significant body of research (Menekli et al., 2022; Glennon, 2018; Shin et al., 2023; Mohammad & Ahmad, 2019; Tennant et al., 2020; Zasadzka et al., 2021; Khan et al., 2022; Yazdipour et al., 2023) supporting AVR’s effectiveness in managing anxiety. While some studies report mixed results, the overall evidence suggests that AVR can be a valuable tool in alleviating anxiety and improving the patient experience in oncology settings.

5.6 conclusion

This study examined the impact of AVR on pain, stress, anxiety, and SE in patients with cancer undergoing chemotherapy. Our findings indicate that AVR use during chemotherapy sessions significantly reduced patient-reported pain, stress, and anxiety while enhancing their SE compared to a control group. Patients generally expressed positive experiences with AVR, finding it to be a beneficial distraction during treatment. Further research is warranted to investigate the long-term effects of AVR interventions and to compare the effectiveness of different AVR experiences in managing psychological distress among patients with cancer.

5.7 Strengths and limitations of the study

The strength of the current research was in using four major variables pain, self-efficacy, stress, and anxiety as most of the studies made one or two variables, this study was a randomized control trial and done in three major hospitals that have major cancer units that totally separated from the other hospital departments which give the chance to implant the intervention in a non-stressful manner. Also, this study used the most advanced virtual reality goggles with advanced settings. Finally, this is the first study done in Palestine using AVR with cancer patients.

However, some limitations must be mentioned in this study first of all the major challenge faced by the study is the need for high advanced internet package (5G) to operate the video it is available just from the website and the internet was not available in the three settings. Also, the place is very narrow, and patients are sometimes in the corridors which violating privacy and difficulty in communication with the participants.

5.8 Implications of the study

Implications for Nursing Education

Curriculum Integration: Incorporate virtual reality techniques into nursing school curricula across various courses, such as oncology nursing, pain management, and mental health.

Simulation Lab Training: Develop comprehensive simulation scenarios that allow students to practice using virtual reality techniques in a variety of cancer care settings, including inpatient units, outpatient clinics, and home care environments.

Evidence-Based Practice: Teach students how to critically evaluate research evidence on the effectiveness of AVR techniques for patients with cancer and apply this knowledge to their practice.

Interdisciplinary Collaboration: Foster interdisciplinary collaboration between nursing faculty, oncology specialists, and technology experts to develop and implement effective AVR curricula.

Implications for Nursing Practice

Pain, Stress, and Anxiety Management: Utilize AVR techniques to address a wide range of cancer-related symptoms, such as pain, fatigue, nausea, and anxiety.

Oncology Nursing Specialization: Create specialized training programs for oncology nurses that focus on the effective use of AVR techniques for patients with cancer.

Practical Care Program: Integrate AVR techniques into practical care programs for nurses working in cancer clinics and departments, providing hands-on training and mentorship.

Patient-Centered Care: Emphasize the importance of patient-centered care when using AVR techniques, ensuring that patients' individual needs and preferences are taken into account.

Implications for Policy

Stakeholder Support: Engage with key stakeholders, such as healthcare administrators, policymakers, and patient advocacy groups, to gain their support for the implementation and use of AVR techniques in cancer care.

Resource Allocation: Advocate for the allocation of adequate resources, including funding, technology, and training, to support the integration of AVR techniques into healthcare settings.

Policy Development: Develop clear policies and guidelines for the use of AVR techniques in cancer care, addressing issues such as patient privacy, data security, and quality assurance.

Implications for Future Research

Evidence-Based Practice: Conduct rigorous research studies to further investigate the effectiveness of AVR techniques for patients with cancer, focusing on outcomes such as pain reduction, improved quality of life, and reduced anxiety.

Psychological Effects: Explore the psychological effects of AVR on patients with cancer, including its impact on mood, coping mechanisms, and overall well-being.

Comparative Studies: Compare the effectiveness of AVR techniques to traditional interventions for managing cancer-related symptoms, such as medications and psychotherapy.

Long-Term Outcomes: Evaluate the long-term outcomes of using AVR techniques for patients with cancer, including their impact on survival rates and quality of life after treatment.

International Collaboration: Foster international collaboration among researchers, clinicians, and policymakers to share knowledge, expertise, and best practices in the field of AVR and cancer care.

Publication and Dissemination: Disseminate research findings through high-quality publications in peer-reviewed journals and through accessible online platforms, ensuring that the information is widely available to healthcare professionals and the public.

By addressing these implications, we can harness the full potential of AVR techniques to improve the lives of patients with cancer and advance the field of cancer care.

5.9 Recommendations:

The potential of AVR technology in enhancing the lives of patients with cancer is significant. To fully realize this potential, a multi-faceted approach involving policymakers, healthcare providers, patients, and technology developers is essential.

Policymakers can play a crucial role by funding research initiatives, establishing guidelines for AVR use in healthcare settings, and incentivizing hospitals and clinics to adopt AVR technology. Hospitals and clinics can contribute by conducting pilot studies, investing in AVR infrastructure, and training healthcare professionals in the effective use of AVR. Stakeholders, such as patient advocacy groups and AVR developers, can collaborate on research projects, raise public awareness, and develop AVR content tailored to specific patient needs.

Specific research areas to explore include pain management, anxiety and depression reduction, rehabilitation and physical therapy, and patient education and support. Additional

considerations such as data privacy and security, accessibility and equity, and long-term impact should also be carefully addressed.

By implementing these recommendations, stakeholders can harness the power of AVR to make a positive impact on the lives of patients with cancer, improving their physical and mental well-being throughout their treatment journey.

References

Abdullatif, Q. A. (2004). Adaptation of the state trait anxiety inventory in Arabic: A comparison with the American STAI.

Abrahams, H.J.G. (2016). Risk factors, prevalence, and course of severe fatigue after breast cancer treatment: a meta-analysis involving 12 327 breast cancer survivors. Annals of Oncology, 27(6): p. 965-974.

Abu-Rmeileh, N. M., Gianicolo, E. A. L., Bruni, A., Mitwali, S., Portaluri, M., Bitar, J., ... & Vigotti, M. A. (2016). Cancer mortality in the West Bank, occupied Palestinian territory. BMC public health, 16(1), 1-10.

Ahmadpour N, Randall H, Choksi H, Gao A, Vaughan C, Poronnik P. (2019). Virtual Reality interventions for acute and chronic pain management. Int J Biochem Cell Biol. Sep; 114:105568. doi: 10.1016/j.biocel.2019. 105568.S1357-2725(19)30145-1.

Ahmadpour N, Keep M, Janssen A, Rouf AS, Marthick M. (2020). Design strategies for virtual reality interventions for managing pain and anxiety in children and adolescents: scoping review. JMIR Serious Games; 8(1):e14565.

Alghadir, A. H., Anwer, S., & Iqbal, Z. A. (2016). The psychometric properties of an Arabic numeric pain rating scale for measuring osteoarthritis knee pain. Disability and rehabilitation, 38(24), 2392-2397.

Al-Shamsi, H.O., Iqbal, F., Abu-Gheida, I.H. (2022). Introduction. In: Al-Shamsi, H.O., Abu-Gheida, I.H., Iqbal, F., Al-Awadhi, A. (eds) Cancer in the Arab World. Springer, Singapore. https://doi.org/10.1007/978-981-16-7945-2_1

Akkuş, Y., Karacan, Y., Ünlü, K., Deniz, M., & Parlak, A. (2022). The effect of anxiety and spiritual well-being on the care burden of caregivers of cancer patients during the COVID-19 pandemic. Supportive Care in Cancer, 1-10.

Amjad, M. T., Chidharla, A., & Kasi, A. (2020). Cancer chemotherapy.

Antoni, M. H., Moreno, P. I., & Penedo, F. J. (2023). Stress management interventions to facilitate psychological and physiological adaptation and optimal health outcomes in cancer patients and survivors. Annual review of psychology, 74(1), 423-455.

Arnstein, P. (2018). Adult cancer pain: an evidence-based update. Journal of Radiology Nursing, 37(1), 15-20.

Ashley Verzwyvelt, L., McNamara, A., Xu, X., & Stubbins, R. (2021). Effects of virtual reality v. biophilic environments on pain and distress in oncology patients: a case-crossover pilot study. Scientific Reports, 11(1), 20196.

Attar RH, Baghdadi ZD. Comparative efficacy of active and passive distraction during restorative treatment in children using an iPad versus audiovisual eyeglasses: a randomised controlled trial. Eur Arch Paediatr Dent. 2015 Feb 22;16(1):1–8. doi: 10.1007/s40368-014-0136.

Babbie, E. (2021). The Practice of Social Research (15th ed.). Belmont, CA: Cengage Learning.

Bandara, W., Furtmueller, E., Gorbacheva, E., Miskon, S., & Beekhuyzen, J. (2015). Achieving rigor in literature reviews: Insights from qualitative data analysis and tool-support. Communications of the Association for Information systems, 37(1), 8.

Bandura, A. (1997). Self-efficacy the exercise of control. New York: H. Freeman & Co. Student Success, 333, 48461.

Barrera, I. and D. Spiegel, Review of psychotherapeutic interventions on depression in cancer patients and their impact on disease progression. International Review of Psychiatry, 2014. 26(1): p. 31-43.

Behranvand, N., Nasri, F., Zolfaghari Emameh, R., Khani, P., Hosseini, A., Garssen, J., & Falak, R. (2022). Chemotherapy: A double-edged sword in cancer treatment. Cancer immunology, immunotherapy, 71(3), 507-526.

Bernaerts, S., Bonroy, B., Daems, J., Sels, R., Struyf, D., Gies, I., & van de Veerdonk, W. (2022). Virtual Reality for Distraction and Relaxation in a Pediatric Hospital Setting: An Interventional Study with a Mixed-Methods Design. Frontiers in digital health, 4, 866119.

Beyer-Berjot, L. (2016). A Virtual Reality Training Curriculum for Laparoscopic Colorectal Surgery. Journal of Surgical Education, 73(6): p. 932-941.

Billinghurst, M., Clark, A., & Lee, G. (2015). A survey of augmented reality. Foundations and Trends® in Human–Computer Interaction, 8(2-3), 73-272.

Birkhoff, S. D. (2021). The Effects of Virtual Reality on Anxiety and Self-Efficacy Among Patients with Cancer: A Pilot Study. Number 4/July 2021, 48(4), 431-439.

Birnie, K. A., Kulandaivelu, Y., Jibb, L., Hroch, P., Positano, K., Robertson, S., ... & Stinson, J. (2018). Usability testing of an interactive virtual reality distraction intervention to reduce procedural pain in children and adolescents with cancer. Journal of Pediatric Oncology Nursing, 35(6), 406-416.

Brassel S, Power E, Campbell A, Brunner M, Togher L. (2021). Recommendations for the design and implementation of virtual reality for acquired brain injury rehabilitation: systematic review. J Med Internet Res. (7): e26344.

Bray, F., Laversanne, M., Weiderpass, E., & Soerjomataram, I. (2021). The ever-increasing importance of cancer as a leading cause of premature death worldwide. Cancer, 127(16), 3029-3030.

Bredal, I. S., Smeby, N. A., Ottesen, S., Warncke, T., & Schlichting, E. (2014). Chronic pain in breast cancer survivors: comparison of psychosocial, surgical, and medical characteristics between survivors with and without pain. Journal of pain and symptom management, 48(5), 852-862.

Bryant L, Brunner M, Hemsley B. (2020). A review of virtual reality technologies in the field of communication disability: implications for practice and research. Disabil Rehabil Assist Technol. (4):365–372. doi: 10.1080/17483107.2018.1549276 .

Bryman, A. (2016). Social Research Methods (5th ed.). Oxford, UK: Oxford University Press.

Buche H, Michel A and Blanc N (2022), Use of virtual reality in oncology: From the state of the art to an integrative model. Front. Virtual Real. 3:894162. doi: 10.3389/frvir.2022.894162.

Burrai, F., Ortu, S., Marinucci, M., De Marinis, M. G., & Piredda, M. (2023). Effectiveness of Immersive Virtual Reality in People with Cancer Undergoing Antiblastic Therapy: A Randomized Controlled Trial. In Seminars in Oncology Nursing (Vol. 39, No. 4, p. 151470). WB.

Dictionary, C. (2022). Cambridge dictionary. Retrieved May, 23, 2022.

Carmigniani, J., & Furht, B. (2011). Augmented reality: an overview. Handbook of augmented reality, 3-46.

Chhikara, B. S., & Parang, K. (2023). Global Cancer Statistics 2022: the trends projection analysis. *Chemical Biology Letters*, *10*(1), 451-451.

Chin, C. H., Tseng, L. M., Chao, T. C., Wang, T. J., Wu, S. F., & Liang, S. Y. (2021). Self-care as a mediator between symptom-management self-efficacy and quality of life in women with breast cancer. PloS one, 16(2), e0246430.

Chirico A, D'Aiuto M, Pinto M, Milanese C, Napoli A, Avino F, Iodice G, Russo G, De Laurentiis M, Ciliberto G, Giordano A, Lucidi F. (2016). The elapsed time during a virtual reality treatment for stressful procedures. A pool analysis on breast cancer patients during chemotherapy. Smart Innovation, Systems and Technologies, Vol 55.

Chirico, A. (2020). Virtual reality and music therapy as distraction interventions to alleviate anxiety and improve mood states in breast cancer patients during chemotherapy. Journal of Cellular Physiology. 235(6): p. 5353-5362.

Chirico, A. (2016). Virtual Reality in Health System: Beyond Entertainment. A Mini-Review on the Efficacy of VR During Cancer Treatment. Journal of Cellular Physiology, 231(2): p. 275-287.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. Journal of health and social behavior, 385-396.

Cohen, S., Tyrrell, D. A. J., & Smith, A. P. (1991). Psychological stress and susceptibility to the common cold. New England Journal of Medicine, 325, 606-612.

https://www.cmu.edu/dietrich/psychology/stress-immunity-disease-lab/scales/index.html.

Collett, B. J. (1995). Classification of Chronic Pain. Descriptions of Chronic Pain Syndromes and Definitions of Pain Terms, 2nd Edn. H. MERSKY AND N. BOGDUK (editors). Published by IASP Press, Seattle, WA, USA. Pp. 222; indexed. Price US $20 (US $14 for IASP members). British Journal of Anaesthesia, 75, 254-255.

Crandall, A., Rahim, H. A., & Yount, K. M. (2015). Validation of the general self-efficacy scale among Qatari young women. Eastern Mediterranean Health Journal, 21(12), 891-896.

Creswell, J. W., & Creswell, J. D. (2018). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (5th ed.). Thousand Oaks, CA: Sage.

da Costa, A. A. B., Chowdhury, D., Shapiro, G.I., D'Andrea, A.D., & Konstantinopoulos, P.A. (2023). Targeting replication stress in cancer therapy. Nature Reviews Drug Discovery, 22(1), 38-58.

Danaei, G., Vander Hoorn, S., Lopez, A. D., Murray, C. J., & Ezzati, M. (2005). Causes of cancer in the world: comparative risk assessment of nine behavioural and environmental risk factors. *The Lancet*, *366*(9499), 1784-1793.

Dascal J, Reid M, IsHak W, Spiegel B, Recacho J, Rosen B, Danovitch I. (2017). Virtual reality and medical inpatients: a systematic review of randomized, controlled trials. Innov Clin Neurosci.14(1-2):14–21.

Debika, D. (2017). Effectiveness of Virtual Reality Therapy upon Symptomatic Distress among Cancer Patients (Doctoral dissertation, Apollo College of Nursing, Chennai).

Deng, G. (2019). Integrative medicine therapies for pain management in cancer patients. Cancer Journal (Sudbury, Mass.), 25(5), 343.

Dewi, R., Panduragan, S. L., & Umar, N. S. (2023). The relationship between self-efficacy and coping mechanisms with quality of life in Breast Cancer patients. KnE Social Sciences, 278-289.

D'Souza C, Antony S, Thomas B, Murthy SG. (2016). Coping strategies used by cancer patients to deal with the physical and psychological problems of chemotherapy. Int J Innov Res Dev.5(3):36–41.

Duarte, J., Björkstrand, F. K., McCracken, L., & Perrin, S. (2023). The contribution of psychological flexibility to functioning in people living with cancer-related pain. European Journal of Pain, 27(3), 413-423.

Feliu, J. (2021). Prediction of Unplanned Hospitalizations in Older Patients Treated with Chemotherapy. Cancers. 13(6).

Gautama, M. S. N., Haryani, H., & Huang, T. W. (2023). Efficacy of smartphone-based virtual reality relaxation in providing comfort to patients with cancer undergoing chemotherapy in oncology outpatient setting in Indonesia: protocol for a randomized controlled trial. BMJ open, 13(7), e074506.

Gershon, J., Zimand, E., Pickering, M., Rothbaum, B. O., & Hodges, L. (2004). A pilot study and feasibility study of virtual reality as a distraction for children with cancer. Journal of the American Academy of Child and Adolescent Psychiatry, 43(10), 1243–1249.

Gigante, M. A. (1993). Virtual reality: definitions, history and applications. In Virtual reality systems (pp. 3-14): Elsevier.

Glennon, C. (2018). Use of virtual reality to distract from pain and anxiety. Number 4/July 2018, 45(4), 545-552 .

Gold, J., Reger, G., Rizzo, A., Buckwalter, G., Kim, S., & Joseph, M. (2005). Virtual reality in outpatient phlebotomy: Evaluating pediatric pain distraction during blood draw. Journal of Pain, 6(3), Article S57.

Gold, J. I., Belmont, K. A., and Thomas, D. A. (2007). The neurobiology of virtual reality pain attenuation. CyberPsychol. Behav. 10, 536–544. doi:10.1089/cpb.2007. 9993.

Gorini, A. (2011). The role of immersion and narrative in mediated presence: the virtual hospital experience. Cyberpsychol Behav Soc Netw,. 14(3): p. 99-105.

Gustafson, A. (2017). Reducing patient uncertainty: implementation of a shared decision-making process enhances treatment quality and provider communication. Number 1/February 2017, 21(1), 113-115.

Halahleh, K., Abu-Rmeileh, N. M., & Abusrour, M. M. (2022). General oncology care in Palestine. In Cancer in the Arab World (pp. 195-213).

Hong, S., & Shin, D. (2020). Relationship between pain intensity, disability, exercise time and computer usage time and depression in office workers with non-specific chronic low back pain. Medical Hypotheses, 137, 109562.

Ijaz K, Ahmadpour N, Wang Y, Calvo RA. (2020). Player Experience of Needs Satisfaction (PENS) in an immersive virtual reality exercise platform describes motivation and enjoyment. Int J Hum-Comput Interact.eb 11;36(13):1195–1204. doi: 10.1080/10447318.2020.1726107 .

Indovina, P., Barone, D., Gallo, L., Chirico, A., De Pietro, G., & Giordano, A. (2018). Virtual reality as a distraction intervention to relieve pain and distress during medical procedures. *The Clinical journal of pain*, *34*(9), 858-877.

Jassim, G.A. (2015). Psychological interventions for women with non-metastatic breast cancer. Cochrane Database of Systematic Reviews. (5).

International Agency for Research on Cancer. (2023). Global Cancer Observatory: Cancer Today. Retrieved from https://gco.iarc.fr/today.

International Agency for Research on Cancer. (2023). Global Cancer Observatory: Cancer Tomorrow. Retrieved from https://gco.iarc.fr/tomorrow.

Ioannou, A., Papastavrou, E., Avraamides, M. N., & Charalambous, A. (2020). Virtual reality and symptoms management of anxiety, depression, fatigue, and pain: a systematic review. SAGE open nursing, 6, 2377960820936163.

Javornik, A. (2016). Augmented reality: Research agenda for studying the impact of its media characteristics on consumer behaviour. Journal of Retailing and Consumer Services, 30, 252-261.

Jennings, K. M. (2017). The Roy adaptation model: a theoretical framework for nurses providing care to individuals with anorexia nervosa. *ANS. Advances in nursing science*, *40*(4), 370.

Kabisch, M., Ruckes, C., Seibert-Grafe, M., & Blettner, M. (2011). Randomized controlled trials: part 17 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International*, *108*(39), 663.

Kelleher, S. A., Fisher, H. M., Winger, J. G., Miller, S. N., Amaden, G. H., Somers, T. J., ... & Keefe, F. J. (2022). Virtual reality for improving pain and pain-related symptoms in patients with advanced stage colorectal cancer: A pilot trial to test feasibility and acceptability. *Palliative & supportive care*, *20*(4), 471-481.

Khan, M. U. S., Hussain, H. G., Farooq, M., Shahnoor, S., Humayun, M., Baig, E., & Cheema, H. A. (2022). The potential of virtual reality for rehabilitation intervention in females with breast cancer. International Journal of Surgery, 106, 106940.

Kim, H. J., Kim, S. M., Shin, H., Jang, J. S., Kim, Y. I., & Han, D. H. (2018). A mobile game for patients with breast cancer for chemotherapy self-management and quality-of-life improvement: randomized controlled trial. *Journal of medical Internet research*, *20*(10), e273.

Kim, H., Lee, J.-H., & Na, S.-H. (2017). Predictor-estimator using multilevel task learning with stack propagation for neural quality estimation. Paper presented at the Proceedings of the Second Conference on Machine Translation.

Kim, S., & Kim, E. (2020). The use of virtual reality in psychiatry: a review. *Journal of the Korean Academy of Child and Adolescent Psychiatry*, *31*(1), 26.

Kim, H., Kim, D. J., Kim, S., Chung, W. H., Park, K. A., Kim, J. D., ... & Jeon, H. J. (2021). Effect of virtual reality on stress reduction and change of physiological parameters including heart rate variability in people with high stress: an open randomized crossover trial. Frontiers in psychiatry, 12, 614539.

Kipping, B., Rodger, S., Miller, K., & Kimble, R. M. (2012). Virtual reality for acute pain reduction in adolescents undergoing burn wound care: A prospective randomized controlled trial. Burns, 38(5), 650–657. https://doi.org/10.1016/j. burns.2011.11.010.

Kleiber, C., and McCarthy, A. M. (2006). Evaluating instruments for a study on children's responses to a painful procedure when parents are distraction coaches. J. Pediatr. Nurs. 21, 99–107. doi: 10.1016/j.pedn.2005.06.008.

Kurt, S., & Altan Sarikaya, N. (2022). Correlation of self-efficacy and symptom control in cancer patients. Supportive Care in Cancer, 30(7), 5849-5857.

Kusiak, A., Jereczek-Fossa, B. A., Cichońska, D., & Alterio, D. (2020). Oncological-therapy related oral mucositis as an interdisciplinary problem—literature review. International journal of environmental research and public health, 17(7), 2464.

Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. Springer publishing company.

Lee, C., & Wong, G. K. C. (2019). Virtual reality and augmented reality in the management of intracranial tumors: a review. *Journal of Clinical Neuroscience*, *62*, 14-20.

Lee, E. H. (2012). Review of the psychometric evidence of the perceived stress scale. Asian nursing research, 6(4), 121-127.

Lee, M. J., Huang, C. W., Lee, C. P., Kuo, T. Y., Fang, Y. H., Chin-Hung Chen, V., & Yang, Y. H. (2021). Investigation of anxiety and depressive disorders and psychiatric medication use before and after cancer diagnosis. Psycho-Oncology, 30(6), 919-927.

Lewandowska, A., Rudzki, G., Lewandowski, T., Próchnicki, M., Rudzki, S., Laskowska, B., & Brudniak, J. (2020). Quality of life of cancer patients treated with chemotherapy. International journal of environmental research and public health, 17(19), 6938.

Linden, W. (2012). Anxiety and depression after cancer diagnosis: Prevalence rates by cancer type, gender, and age. Journal of Affective Disorders. 141(2-3): p. 343-351.

Liu, M. T., Liang, S. Y., Chao, T. C., Tseng, L. M., & Rosenberg, J. (2023). The Behavioral Adaptations and Barriers of Patients Employing Non-Pharmacological Strategies for Cancer Pain Management-A Qualitative Study. Healthcare (Basel, Switzerland), 11(22), 2911. https://doi.org/10.3390/healthcare11222911

Loreto-Quijada D, Gutiérrez-Maldonado J, Nieto R, Gutiérrez-Martínez O, Ferrer-García M, Saldaña C, et al. (2014). Differential effects of two virtual reality interventions: distraction versus pain control. Cyberpsychol Behav Soc Netw.17(6):353–358. doi: 10.1089/cyber.2014.0057.

Li W, Chung J, Ho EK. (2011). The effectiveness of therapeutic play, using virtual reality computer games, in promoting the psychological well-being of children hospitalized with cancer. J Clin Nurs. (15-16):2135–2143. doi: 10.1111/j.1365-2702.2011.03733.

Li, Z., Han, X. G., Sheng, J., and Ma, S. J. (2016). Virtual reality for improving balance in patients after stroke: A systematic review and metaanalysis. Clin. Rehabil. 30, 432–440. doi:10.1177/0269215515593611

Majid ESA, Garcia JA, Nordin AI, Raffe WL. (2020). Staying motivated during difficult times: a snapshot of serious games for paediatric cancer patients. IEEE Trans Games. 12(4):367–375. doi: 10.1109/tg.2020.3039974.

Manzini CSS, Damasceno VAM, Elias ACA, de Souza Orlandi F. (2020). The brief psychotherapeutic intervention “relaxation, mental images and spirituality”: a systematic review. Sao Paulo Medical Journal.138(3):176-183.

Maples-Keller, J. L., Bunnell, B. E., Kim, S.-J., & Rothbaum, B. O. (2017). The use of virtual reality technology in the treatment of anxiety and other psychiatric disorders. Harvard Review of Psychiatry, 25(3), 103-113. doi:10.1097/HRP.0000000000000138.

Markovitz, L.C., N.J. Drysdale, and B.A. Bettencourt. (2017). The relationship between risk factors and medication adherence among breast cancer survivors: What explanatory role might depression play? Psycho-Oncology. 26(12): p. 2294-2299. 24.

Matejek, E. T. (2020). Patients’ acceptance regarding the implementation of virtual.

Mausbach, B. T., Decastro, G., Schwab, R. B., Tiamson-Kassab, M., & Irwin, S. A. (2020). Healthcare use and costs in adult cancer patients with anxiety and depression. Depression and anxiety, 37(9), 908-915.

Mazur, T. (2018). Virtual Reality-Based Simulators for Cranial Tumor Surgery: A Systematic Review. World Neurosurgery. 110: p. 414-422.

Mccaffery, M., & Beebe, A. (1989). Pain numeric rating scale instructions. Clinical manual for nursing practice, 1.

Menekli, T., Yaprak, B., & Doğan, R. (2022). The effect of virtual reality distraction intervention on pain, anxiety, and vital signs of oncology patients undergoing port catheter implantation: a randomized controlled study. Pain Management Nursing, 23(5), 585-590.

Merluzzi, T. V., Pustejovsky, J. E., Philip, E. J., Sohl, S. J., Berendsen, M., & Salsman, J. M. (2019). Interventions to enhance self-efficacy in cancer patients: A meta-analysis of randomized controlled trials. Psycho-oncology, 28(9), 1781-1790.

Mishra, S. B., & Alok, S. (2022). Handbook of research methodology.

Mohammad, E. B., & Ahmad, M. (2019). Virtual reality as a distraction technique for pain and anxiety among patients with breast cancer: A randomized control trial. Palliative & supportive care, 17(1), 29-34.

Nagai, H., & Kim, Y. H. (2017). Cancer prevention from the perspective of global cancer burden patterns. Journal of thoracic disease, 9(3), 448.

Nishiyama, H., Ito, M., & Kato, N. (2014). Relay-by-smartphone: realizing multihop device-to-device communications. IEEE Communications Magazine, 52(4), 56-65.

Nunnally, J. C. & Berstein, I. (1994). Psychometric Theory (3rd ed). New York: McGraw-Hill Book Company.

Oldenmenger, W. H., Geerling, J. I., Mostovaya, I., Vissers, K. C., de Graeff, A., Reyners, A. K., & van der Linden, Y. M. (2018). A systematic review of the effectiveness of patient-based educational interventions to improve cancer-related pain. Cancer treatment reviews, 63, 96-103.

Ozkaraman, A., Uzgor, F., Dugum, O., & Peker, S. (2019). The effect of health literacy on self-efficacy and quality of life among Turkish cancer patients. JPMA, 69(7), 995-999.

Pensieri, C. and M. Pennacchini, Virtual Reality in Medicine. Handbook on 3d3c Platforms. (2016). Applications and Tools for Three Dimensional Systems for Community, Creation and Commerce. p. 353-401.

Pham, H., H. Torres, and P. Sharma. (2019). Mental health implications in bladder cancer patients: A review. Urologic Oncology-Seminars and Original Investigations. 37(2): p. 97-107.

Pimentel, K., & Teixeira, K. (1993). Virtual Reality: Through the New Looking Glass. McGraw-Hill.

Pittara, M., Matsangidou, M., Stylianides, K., Petkov, N., & Pattichis, C. S. (2020). Virtual reality for pain management in cancer: a comprehensive review. IEEE Access, 8, 225475-225489.

Polit, D.F., and Beck, C.T, (2012). Nursing Research, Generating and Assessing Evidence for Nursing Practice. (8th Ed). New Delhi: Lippincott Williams and Wilkins, 506-25.

Portman, M. E., Natapov, A., & Fisher-Gewirtzman, D. (2015). To go where no man has gone before: Virtual reality in architecture, landscape architecture and environmental planning. Computers, Environment and Urban Systems, 54, 376-384. doi: 10.1016/j.compenvurbsys.2015.05.001.

Pulijala Y, Ma M, Pears M, Peebles D, Ayoub. (2018). A. Effectiveness of immersive virtual reality in surgical training-a randomized control trial. J Oral Maxillofac Surg. 76(5):1065–1072. doi: 10.1016/j.joms.2017.10. 002.S0278-2391(17)31250-8.

http://globocan.iarc.fr, International Agency for Research on Cancer; 2014.

https://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/chemotherapy.html

Quero, G. (2019). Virtual and Augmented Reality in Oncologic Liver Surgery. Surgical Oncology Clinics of North America. 28(1): p. 31-+.

Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. Computers & Education, 147, 103778. doi: 10.1016/j.compedu.2019.103778

Raymer, E., MacDermott, Á., & Akinbi, A. (2023). Virtual reality forensics: Forensic analysis of Meta Quest 2. Forensic Science International: Digital Investigation, 47, 301658.

Reynolds LM, Cavadino A, Chin S, Little Z, Akroyd A, Tennant G, Dobson R, Broom R, Gautier A. (2022). The benefits and acceptability of virtual reality interventions for women with metastatic breast cancer in their homes; a pilot randomised trial. BMC Cancer. 2;22(1):360. doi: 10.1186/s12885-021-09081-z. PMID: 35366823; PMCID: PMC8976512.

Rhoten, B.A., B. Murphy, and S.H. Ridner. (2013). Body image in patients with head and neck cancer: A review of the literature. Oral Oncology. 49(8): p. 753-760.

Rizzo, A. A., & Shilling, R. (2017). Clinical virtual reality tools to advance the prevention, assessment, and treatment of PTSD. European Journal of Psychotraumatology, 8(sup5), 1414560. doi:10.1080/20008198.2017.1414560

Roche, K., Liu, S., & Siegel, S. (2019). The effects of virtual reality on mental wellness: A. *Ment Health, 14*, 811-818.

odriguez, C., Ji, M., Wang, H. L., Padhya, T., & McMillan, S. C. (2019). Cancer pain and quality of life. Journal of Hospice & Palliative Nursing, 21(2), 116-123.

Roy, C. (2011). Extending the Roy adaptation model to meet changing global needs. *Nursing science quarterly*, *24*(4), 345-351.

Salem, H. S. (2023). Cancer status in the Occupied Palestinian Territories: types; incidence; mortality; sex, age, and geography distribution; and possible causes. *Journal of Cancer Research and Clinical Oncology*, *149*(8), 5139-5163.

Sari, N. P. W. P. (2020). Stress and fear in women living with cancer: An argumentation towards the adaptation theory. International Journal of Public Health Science, 9(3), 272-280.

Satava, R. M. (2001). Surgical education and surgical simulation. World Journal of Surgery, 27(3), 349-355. doi:10.1007/s00268-002-6662-5

Scates, D., Dickinson, J. I., Sullivan, K., Cline, H., & Balaraman, R. (2020). Using nature-inspired virtual reality as a distraction to reduce stress and pain among cancer patients. Environment and Behavior, 52(8), 895-918.

Schneider, S. M., & Hood, L. E. (2007, January). Virtual reality: a distraction intervention for chemotherapy. In *Oncology nursing forum* (Vol. 34, No. 1, p. 39). NIH Public Access.

Schneider SM, Kisby CK, Flint EP. (2011). Effect of virtual reality on time perception in patients receiving chemotherapy. Support Care Cancer. 26;19(4):555–564.doi:10.1007/s00520-010-0852-7. http://europepmc.org/abstract/MED/20336327

Seiler, A., & Jenewein, J. (2019). Resilience in cancer patients. Frontiers in psychiatry, 10, 208.

Serlin, R. C., Mendoza, T. R., Nakamura, Y., Edwards, K. R., & Cleeland, C. S. (1995). When is cancer pain mild, moderate or severe? Grading pain severity by its interference with function. Pain, 61(2), 277-284.

Sharifpour, S., Manshaee, G. R., & Sajjadian, I. (2021). Effects of virtual reality therapy on perceived pain intensity, anxiety, catastrophising and self-efficacy among adolescents with cancer. Counselling and Psychotherapy Research, 21(1), 218-226.

Shin, J., Chang, J. S., Kim, J. S., An, J. Y., Chung, S. Y., Yoon, S. Y., & Kim, Y. B. (2023). An Investigation of the Effect of Virtual Reality on Alleviating Anxiety in Patients With Breast Cancer Undergoing Radiation Therapy: A Randomized Controlled Trial. *International Journal of Radiation Oncology* Biology* Physics*.

Siegel R, DeSantis C, Virgo K, Stein K, Mariotto A, Smith T, Cooper D, Gansler T, Lerro C, Fedewa S, Lin C, Leach C, Cannady RS, Cho H, Scoppa S, Hachey M, Kirch R, Jemal A, Ward E. (2012). Cancer treatment and survivorship statistics. CA Cancer J Clin. 2012;62(4):220–241. doi: 10.3322/caac.21149 .

Snijders, R. A., Brom, L., Theunissen, M., & van den Beuken-van Everdingen, M. H. (2023). Update on prevalence of pain in patients with cancer 2022: a systematic literature review and meta-analysis. Cancers, 15(3), 591.

Soria-Reyes, L. M., Cerezo, M. V., Alarcón, R., & Blanca, M. J. (2023). Psychometric properties of the perceived stress scale (pss-10) with breast cancer patients. Stress and Health, 39(1), 115-124.

Soret, L., Gendron, N., Rivet, N., Chocron, R., Macraigne, L., Clausse, D., & Darnige, L. (2022). Pain Assessment Using Virtual Reality Facemask During Bone Marrow Aspiration: Prospective Study Including Propensity-Matched Analysis. JMIR Serious Games, 10(4), e33221.

Spielberger, C. D. (1989). State-Trait Anxiety Inventory: Bibliography (2nd ed.). Palo Alto, CA: Consulting Psychologists Press.

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). Manual for the State-Trait Anxiety Inventory. Palo Alto, CA: Consulting Psychologists Press.

Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021). Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a* cancer journal for clinicians, 71(3), 209-249.

Suresh, K. P., & Chandrashekara, S. (2012). Sample size estimation and power analysis for clinical research studies. Journal of human reproductive *sciences*, *5*(1), 7.

Sutherland, I. E. (1965). The ultimate display. Proceedings of the IFIP Congress, 2, 506-508. Retrieved from https://www.springer.com/gp/book/9783540282413.

Suzuki, R., Karim, A., Xia, T., Hedayati, H., & Marquardt, N. (2022, April). Augmented reality and robotics: A survey and taxonomy for ar-enhanced human-robot interaction and robotic interfaces. In Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems (pp. 1-33).

Taghian, N.R., et al. (2014). Lymphedema following breast cancer treatment and impact on quality of life: A review. Critical Reviews in Oncology Hematology. 92(3): p. 227-234.

Tanja-Dijkstra, K., Pahl, S., White, M. P., Auvray, M., Stone, R. J., Andrade, J., &Moles, D. R. (2018). The soothing sea: A virtual coastal walk can reduce experienced and recollected pain. Environment and Behavior, 50(6), 599–625.

Tashjian, V. C., Mosadeghi, S., Howard, A. R., Lopez, M., Dupuy, T., Reid, M., & Spiegel, B. (2017). Virtual reality for management of pain in hospitalized patients: Results of a controlled trial. JMIR Mental Health, 4(1), Article e9. https://doi.org/10.2196/mental.7387.

Tennant, M., Youssef, G. J., McGillivray, J., Clark, T. J., McMillan, L., & McCarthy, M. C. (2020). Exploring the use of Immersive Virtual Reality to enhance Psychological Well-Being in Pediatric Oncology: A pilot randomized controlled trial. *European Journal of Oncology Nursing*, *48*, 101804.

Tian, B., Hua, S., & Liu, J. (2020). Cyclodextrin-based delivery systems for chemotherapeutic anticancer drugs: A review. Carbohydrate polymers, 232, 115805.

Torres García, A., Morcillo Serra, C., Argilés Huguet, M., González Gardó, L., Abad Esteve, A., & Ramos Quiroga, J. A. (2023). Efficacy of a Virtual Reality Intervention for Reducing Anxiety, Depression, and Increasing Disease Coping in Patients with Breast Cancer Before Their First Chemotherapy Dose. Cognitive Therapy and Research, 1-15.

Tzenios, N. (2023). obesity as a risk factor for different types of cancer. EPRA International Journal of Research and Development (IJRD), 8(2), 97-100.

Vakalopoulos, I., et al. (2015). Impact of cancer and cancer treatment on male fertility. Hormones-International Journal of Endocrinology and Metabolism. 14(4): p. 579-589.

Van Den Beuken-Van, M. H., Hochstenbach, L. M., Joosten, E. A., Tjan-Heijnen, V. C., & Janssen, D. J. (2016). Update on prevalence of pain in patients with cancer: systematic review and meta-analysis. Journal of pain and symptom management, 51(6), 1070-1090.

Vonk-Klaassen, S.M., et al. (2016). Ostomy-related problems and their impact on quality of life of colorectal cancer ostomates: a systematic review. Quality of Life Research. 25(1): p. 125-133.

Wang, Y. H., Li, J. Q., Shi, J. F., Que, J. Y., Liu, J. J., Lappin, J. M., ... & Bao, Y. P. (2020). Depression and anxiety in relation to cancer incidence and mortality: a systematic review and meta-analysis of cohort studies. Molecular psychiatry, 25(7), 1487-1499.

White, L. L. (2019). Self-efficacy for management of symptoms and symptom distress in adults with cancer: an integrative review. Number 1/January 2019, 46(1), 113-128.

Wilkinson, J., & Branco, M. (2020). SIP position on the importance of addressing cancer related pain management in the Europe's Beating Cancer Plan and beyond. Retrieved from https://europeanpainfederation.eu/sip/

Wochna Loerzel V, Clochesy J, Geddie PI. (2020). Using serious games to increase prevention and self-management of chemotherapy-induced nausea and vomiting in older adults with cancer. Oncol Nurs Forum. 01;47(5):567–576. doi: 10.1188/20.ONF.567-576. http://europepmc.org/abstract/MED/32830802.

World Health Organization. (2003). Global cancer rates. World Health Organization. https://www.who.int/news/item/03-04-2003-global-cancer-rates-could-increase-by-50-to-15-million-by-2020

Wolitzky, K., Fivush, R., Zimand, E., Hodges, L., & Rothbaum, B. O. (2005). Effectiveness of virtual reality distraction during a painful medical procedure in pediatric oncology patients. Psychology & Health, 20(6), 817–824.

Wu, X., Xu, H., Zhang, X., Han, S., Ge, L., Li, X., & Zhang, X. (2021). Self-efficacy, hope as mediators between positive coping and resilience among patients with gastric cancer before the first chemotherapy. Cancer nursing, 44(1), 79-85.

Xu, A., Wang, Y., & Wu, X. (2019). Effectiveness of e-health based self-management to improve cancer-related fatigue, self-efficacy and quality of life in cancer patients: Systematic review and meta-analysis. Journal of Advanced Nursing, 75(12), 3434-3447.

Yazdipour, A. B., Saeedi, S., Bostan, H., Masoorian, H., Sajjadi, H., & Ghazisaeedi, M. (2023). Opportunities and challenges of virtual reality-based interventions for patients with breast cancer: a systematic review. BMC Medical Informatics and Decision Making, 23(1), 1-16.

Yoo S, Ackad C, Heywood T, Kay J. (2017). Evaluating the actual and perceived exertion provided by virtual reality games. CHI Conference Extended Abstracts on Human Factors in Computing Systems; May 6-11, 2017; Colorado, USA.

Zasadzka E, Pieczyńska A, Trzmiel T, Hojan K. (2021). Virtual Reality as a Promising Tool Supporting Oncological Treatment in Breast Cancer. Int J Environ Res Public Health. 19;18(16):8768. doi: 10.3390/ijerph18168768. PMID: 34444513; PMCID: PMC8393836.

Zeng, G., Fung, S. F., Li, J., Hussain, N., & Yu, P. (2020). Evaluating the psychometric properties and factor structure of the general self-efficacy scale in China. Current Psychology, 1-11.

Zeng, Y., Zeng, L., Cheng, A. S., Wei, X., Wang, B., Jiang, J., & Zhou, J. (2022). The use of immersive virtual reality for cancer-related cognitive impairment assessment and rehabilitation: a clinical feasibility study. *Asia-Pacific Journal of Oncology Nursing*, *9*(12), 100079.

Zhang, H., Xu, H., Zhang, Z. X., & Zhang, Q. (2022). Efficacy of virtual reality-based interventions for patients with breast cancer symptom and rehabilitation management: a systematic review and meta-analysis. BMJ open, 12(3), e051808.

Zhang, M.F., et al. (2015). Effectiveness of Mindfulness-based Therapy for Reducing Anxiety and Depression in Patients with Cancer a Meta-analysis. Medicine. 94(45).

Zheng, R., Wang, S., Zhang, S., Zeng, H., Chen, R., Sun, K., ... & Wei, W. (2023). Global, regional, and national lifetime probabilities of developing cancer in 2020. *Science Bulletin*.

Zhou, F., Duh, H. B., & Billinghurst, M. (2008). Trends in augmented reality tracking, interaction and display: A review of ten years of ISMAR. Proceedings of the IEEE International Symposium on Mixed and Augmented Reality (ISMAR), 193-202.

Appendices

Appendix A

Arab American University- Palestine
Deanship of Scientific Research
IRB committee
Tel: 04-241-8888, ext 1196
E-mail: irb.aaup@aaup.edu

الجامعة العربية الامريكية- فلسطين
عمادة البحث العلمي
لجنة أخلاقيات البحث العلمي
تلفون: 04-241-8888 1196 ext
البريد الالكتروني: irb.aaup@aaup.edu

IRB Approval Letter

Study Title: The Effect of use Augmented Virtual Reality on Pain, Stress, Anxiety, and Self-Efficacy among Adult Cancer Patients undergoing Chemotherapy in the West Bank

Submitted by: Farid Salih Mustafa Abu Liel

Date received: 3rd May 2023

Date reviewed: 4th June 2023

Date approved: 16th June 2023

Your Study titled "**The Effect of use Augmented Virtual Reality on Pain, Stress, Anxiety, and Self-Efficacy among Adult Cancer Patients undergoing Chemotherapy in the West Bank**" With archived number 2023/A/99/N was reviewed by the Arab American University IRB committee and was approved on 16th June 2023

Reham Khalaf-Nazzal, MD, PhD
IRB committee chairman
Arab American University of Palestine

General Conditions:
1. Valid for 4 months from date of approval.
2. It is important to inform the committee with any modification of the approved study protocol.
3. The committee appreciates a copy of the research when accomplished.

Appendix B

State of Palestine
Ministry of Health
Education in Health and Scientific Research Unit

دولة فلسطين
وزارة الصحة
وحدة التعليم الصحي والبحث العلمي

Ref.: ………………
Date:………………

الرقـــم: عحع/١٨٧/٢٠٢١
التـاريخ: ٢٠٢٤/٦/٧

ق. أ. الوكيل المساعد لشؤون المستشفيات والطوارئ المحترم،،،

تحية واحترام...

<u>الموضـــوع: تسهيل مهمة بحث دكتوراه</u>

يرجى تسهيل مهمة الطالب: **فريد ابو ليل – برنامج الدكتوراه في التمريض**– الجامعة العربية الامريكية، بعنوان:

" The Effect of use Augmented Virtual Reality on Pain, Stress, Anxiety, and Self-Efficacy among Adult Cancer Patients undergoing Chemotherapy in the West Bank "

حيث سيقوم الطالب بجمع معلومات عن طريق تعبئة استبانة الدراسة من قبل المرضى (بعد اخذ موافقتهم)، وذلك في:

- **مستشفى الوطني**
- **مستشفى جنين**
- **مستشفى طولكرم**

مع العلم ان مشرفة الدراسة: د. بسمه سلامة.
على ان يتم الالتزام بالمحافظة على اخلاقيات البحث العلمي وسرية المعلومات.
على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر لحين الحصول على موافقة وزارة الصحة.

مع الاحترام...

د. عبد الله القواسمي
رئيس وحدة التعليم الصحي والبحث العلمي

نسخة: عميد كلية الدراسات العليا المحترمة/ الجامعة العربية الامريكية

Telfax.:09-2333901 scientificresearch.dep@gmail.com تلفاكس: 09-2333901

Appendix C

Questionnaire

Questionnaire in English version

Dear participant in this study

After Greetings,

This research aims to identify the effect of using augmented virtual reality on pain, stress, anxiety, and self-efficacy among adult cancer patients undergoing chemotherapy in the West Bank. Please feel free if anything is not clear or if you would like more information.

Take your time to decide whether you want to participate or not. Finally, we would like to note that complete confidentiality regarding the identity of the person who filled out the questionnaire is guaranteed in this research. We would like to inform you that you can withdraw at any time without giving reasons, and that the people who will process the data cannot know the names of the research participants, as the information will be processed generally and not specifically.

Thank you so much for cooperating

#Information from the patient's file:

*Type of medication prescribed……..

*Diagnosis.....

*Session number:☐. 1☐. 2. 3☐

Part one

Participant's information:

*Gender: male ☐ female ☐

*Age…….

* Marital status: 1. Married☐ 2. Single ☐3. Divorced ☐4.Widowed☐.

*occupation: 1.employee☐ 2. Non-employee☐

*Income:……..

*Place of residence: 1. City☐ 2. Village☐ 3. Camp☐ 4. Town.☐

* Hospital name: 1. Al watani Hospital☐ 2. Thabet Thabet Hospital☐ 3. Khalil Suleiman Hospital☐

*Level of education: 1. High school or less☐ 2. Diploma or bachelor's degree☐ 3. Postgraduate studies☐

Part Two

Previous disease information:

*Do you have any chronic diseases: 1. Yes☐ 2. No☐

*Cancer stage: 1. First stage☐ 2. Second stage☐ 3. Third stage☐

* Type of cancer you have: 1. Colon☐ 2. Breast☐.

Pain scale

Please mark the scale below to show how intense your pain is.

A zero (0) means no pain, and ten (10) means extreme pain.

How intense is your pain now?

10	9	8	7	6	5	4	3	2	1

Extreme pain No pain

General Self-Efficacy Scale (GSE)

	Not at all true	Hardly true	Moderately true	Exactly true
1. I can always manage to solve difficult problems if I try hard enough				
2. If someone opposes me, I can find the means and ways to get what I want.				
3. It is easy for me to stick to my aims and accomplish my goals.				
4. I am confident that I could deal efficiently with unexpected events.				
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.				
6. I can solve most problems if I invest the necessary effort.				
7. I can remain calm when facing difficulties because I can rely on my coping abilities.				
8. When I am confronted with a problem, I can usually find several solutions.				
9. If I am in trouble, I can usually think of a solution				
10. I can usually handle whatever comes my way.				

Perceived Stress Scale (PSS-10) Instructions:

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. In the last month, how often have you.

		Never	Almost Never	Sometimes	Fairly Often	Very Often
1.	Been upset because of something that happened unexpectedly?	0	1	2	3	4
2.	Felt that you were unable to control the important things in your life?	0	1	2	3	4
3.	Felt nervous and "stressed"?	0	1	2	3	4
4.	Felt confident about your ability to handle your personal problems?	4	3	2	1	0
5.	Felt that things were going your way?	4	3	2	1	0
6.	Found that you could not cope with all the things that you had to do?	0	1	2	3	4

7.	Been able to control irritations in your life?	4	3	2	1	0
8.	Felt that you were on top of things?	4	3	2	1	0
9.	Been angered because of things that were outside of your control?	0	1	2	3	4
10.	Felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

GAD-7 Anxiety

Over the last two weeks, how often have you been bothered by the following problems?	Not at all	several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3

Column totals _____ + _____ + _____ + _____ = Total score _____

If you checked any problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all □ Somewhat difficult □ Very difficult □ Extremely difficult □

Appendix D

Questionnaire in Arabic version

عزيزي/عزيزتي المشارك في هذه الدراسة
تحية طيبة و بعد،
يهدف هذا البحث الى التعرف على أثر استخدام الواقع الافتراضي المعزز على الألم والتوتر والقلق والفاعلية الذاتية لدى مرضى السرطان البالغين الذين يخضعون للعلاج الكيميائي في الضفة الغربية

ارجوا عدم التردد إذا كان هناك أي شيء غير واضح أو إذا كنت ترغب في مزيد من المعلومات. خذ وقتك لتقرر ما إذا كنت ترغب في المشاركة أم لا.

و اخيرا فاننا نود ان ننوه الى السرية التامة حول هوية الشخص الذي قام بتعبئة الاستبانة مضمونة في هذا البحث. هذا واننا نود اعلامكم بانه يمكنكم الانسحاب في أي وقت دون ابداء الأسباب و أن الأشخاص الذين سيقومون بمعالجة البيانات لا يمكنهم معرفة اسماء المشاركين في البحث، حيث سيتم معالجة المعلومات بشكل عام وليس بشكل خاص .

شكرا جزيلا لتعاونكم

معلومات من ملف المريض:

نوع الدواء الموصوف :.....

التشخيص.....

رقم الجلسة:1. ☐ 2. ☐ 3. ☐

الجزأ الاول
معلومات المشترك:

***الجنس**: ذكر ☐ انثى ☐

***العمر**:.....

* **الحالة الاجتماعية**: 1. متزوج ☐ 2.ب 3. ☐ 3ق 4. ☐ 4.ل 55 . ☐

***الوظيفة**: 1. يعمل ☐ لا يعمل ☐

* **الدخل**: .....

***مكان الاقامة**: 1. مدينة ☐ 2. قرية ☐ 3. مخيم ☐ 4.بلدة.

* **اسم المستشفى**:1.مستشفى الوطني ☐ 2 مستشفى ثابت ثابت ☐ 3. مستشفى خليل سليمان ☐

***مستوى التعليم**: 1. توجيهي او اقل ☐ 2.دبلوم او بكالوريوس ☐ 3. دراسات عليا ☐

الجزأ الثاني

معلومات المرض السابقة

*هل تعاني من اي امراض مزمنة: 1. نعم ☐ 2. لا ☐

*مرحلة السرطان:1. مرحلة اولى ☐ 2. مرحلة ثانية ☐ 3. مرحلة ثالثة ☐

* نوع السرطان الموجود معك 1. قولون ☐ 2. ثدي ☐.

Pain rating scale

يرجى وضع علامة المقياس ادناه لاظهار شدة ألمك

10	9	8	7	6	5	4	3	2	1

الم شديد لا يوجد الم

Arabian Adaptation of the General Self-Efficacy Scale

استبانه توقع الكفاءه الذاتيه العام

	العنصر	لا	نادرا	غالبا	دائما
1	اذا عارضني شخص ما استطيع ايجاد طرق ووسائل لتحقيق ما ابتغيه	1	2	3	4
2	استطيع دائما حل المشاكل الصعبه اذا اجهت نفسي بما فيه الكفايه	1	2	3	4
3	يسهل علي تحقيق اهدافي ونواياي	1	2	3	4
4	اذا فوجئت بمواقف غير متوقعه اعرف دائما كيف اتصرف	1	2	3	4
5	اعتقد بانني قادر على معالجه المشاكل بشكل جيد حتى ولو كانت مفاجئه	1	2	3	4
6	انظر الى المتاعب بنفس هادئه برزانه وذلك لاعتماد الدائم على قدرات الذاتيه	1	2	3	4
7	لا يعيق ما يحدث لي من مشاكل على الاطلاق لانني استطيع التخلص منها بكل بساطه	1	2	3	4
8	اجد حلا لكل مشاكل مشكله تواجهني	1	2	3	4
9	عندما اجابه مشكله جديده اعرف كيف اتعامل معها	1	2	3	4
10	عندما يضعني احدهم امام مشكله ما اعرف كيف اتخلص منها بسهوله لانني املك افكارا عديده تساعدني على حلها	1	2	3	4

Issa Al-Manssour, Ralf Schwarzer & Matthias Jerusalem, Berlin, Germany, 1993

http://userpage.fu-berlin.de/~health/arabic.htm

Arabic translation of the 10 item Perceived Stress Scale

الأسئلة التالية تستفسر عن مشاعرك و أفكارك خلال الشهر الماضي نرجو منك الاجابة عليها

الحالة	اطلاقاً (أبداً)	نادرا	أحياناً	كثيراً	دائما (في أغلب الأحيان)
1. خلال الشهر الماضي، الى أي مدى أحسست بالانزعاج بسبب حدوث أمر غير متوقع ؟	0	1	2	3	4
2. خلال الشهر الماضي، الى أي مدى أحسست بعدم القدرة على التحكم في الأمور الهامة بحياتك ؟	0	1	2	3	4
3. خلال الشهر الماضي، الى أي مدى أحسست بالتوتر و الضغط النفسي ؟	0	1	2	3	4
4. خلال الشهر الماضي، الى أي مدى أحسست بالثقة في قدرتك على التعامل مع مشاكلك الخاصة ؟	4	3	2	1	0
5. خلال الشهر الماضي، الى أي مدى أحسست أن الأمور تسير كما تريد ؟	4	3	2	1	0
6.خلال الشهر الماضي، الى أي مدى وجدت نفسك غير قادر على التأقلم مع كل الأمور الواجب عليك القيام بها ؟	0	1	2	3	4
7.خلال الشهر الماضي، إلى أي مدى تمكنت من التحكم في الأمور التي تزعجك ؟	4	3	2	1	0
8.خلال الشهر الماضي، الى أي مدى أحسست بأنك تملك زمام الأمور (مسيطر على كافة أمورك) ؟	4	3	2	1	0
9.خلال الشهر الماضي، الى أي مدى أحسست بالغضب بسبب أمور خارجة عن تحكمك ؟	0	1	2	3	4
10. خلال الشهر الماضي، إلى أي مدى أحسست بأن الصعاب تتراكم عليك لدرجة أنك لم تعد تستطيع التغلب عليها ؟	0	1	2	3	4

GAD7

اضطراب القلق العام

ما مدى تكرار انزعاجك من أي مشكلة من المشكلات التالية خلال الاسابيع الاربعة الاخيرة؟	ابدا	عدة ايام نصف الايام	اكثر من تقريبا	كل يوم
	0	**1**	**2**	**3**
1. الشعور بالتوتر، العصبية أو القلق	☐	☐	☐	☐
2. عدم القدرة على ايقاف قلقك وهمومك او السيطرة عليه	☐	☐	☐	☐
3. القلق و الهم الزائد حول عدة أمور	☐	☐	☐	☐
4. **صعوبة في الاسترخاء**	☐	☐	☐	☐
5. **الشعور بعدم الاستقرار لدرجة تصعب عليك فيها الجلوس بلا حركة**	☐	☐	☐	☐
6. **الانفعال أو الانزعاج بسهولة**	☐	☐	☐	☐
7. **الشعور بالخوف وكأن شيء مريع قد يحدث لك**	☐	☐	☐	☐

المجموع = ( )

ما مدى الصعوبة التي سببتها لك هذه المشكلة عند أدائك لعملك أو دراستك أو القيام بمسؤولياتك في منزلك أو الانسجام مع الناس؟

لا توجد اي صعوبة ابدا	صعبة الى حد ما	صعبة جدا	صعبة بشكل لا يطاق
☐	☐	☐	☐

Appendix E

Photographs Taken during Data Collection

تأثير أستخدام الواقع الأفتراضي المعزز على الألم, التوتر, القلق والكفاءة الذاتية لدى مرضى السرطان الذين يخضعون للعلاج الكيميائي في الضفة الغربية

فريد صالح مصطفى ابوليل

د. بسمة سلامة

د. أحمد العايدي

د. عماد فشاشة

أ. د . محمد البشتاوي

أ. د . ملكة ملك

ملخص

الخلفية: يعتبر السرطان مرضًا خطيرًا وغالبًا ما يجعل المرضى يعانون من اضطرابات عاطفية ونفسية. يمارس السرطان تأثيرًا غير مرغوب فيه على حياتهم مما يؤثر على تطور المرض والتدخلات العلاجية وفترة المرض. يمكن أن يؤثر علاج السرطان ، بما في ذلك العلاج الكيميائي ، بشكل كبير على الأداء اليومي للمريض ونوعية حياته ، مما يساهم في زيادة الضغط النفسي وتدهور الصحة العقلية. للتغلب على هذه الآثار السلبية ، تم استخدام تدخل غير دوائي مثل الواقع الافتراضي المعزز في المستشفيات أو العيادات في السنوات الأخيرة. وجد أن تقنية الواقع الافتراضي المعزز تخفف الألم والأعراض النفسية للمرضى الذين يخضعون للعلاج الكيميائي.

الهدف: درست هذه الدراسة فعالية استخدام الواقع الافتراضي المعزز على الألم ,التوتر ,القلق والكفاءة الذاتية بين مرضى السرطان البالغين الذين يخضعون لجلسات العلاج الكيميائي في مستشفيات الضفة الغربية في فلسطين.

المنهجية: تم إجراء تصميم تجربة عشوائية محكومة بين يونيو وسبتمبر (2023) . أجريت الدراسة في ثلاثة مستشفيات كبيرة في شمال فلسطين متخصصة في رعاية مرضى السرطان وتحديداً داخل وحدات العلاج الكيميائي في مستشفى الوطني الحكومي ومستشفى ثابت ثابت ومستشفى خليل سليمان. وشملت عينة الدراسة المرضى الذين أدخلوا إلى قسم رعاية السرطان والذين استوفوا المعايير المحددة للدراسة. وبلغت العينة 150 مشاركًا ، 75 في المجموعة التدخلية التي استخدمت الواقع الافتراضي المعزز ، و 75 في المجموعات الضابطة التي عولجت بالروتين المعتاد في المستشفيات.

النتيجة: غالبية المشاركين 110 (73.3٪) لديهم سرطان الثدي. أكثر من نصفهم 79 (52.7٪) لديهم جلستان علاج كيماوي. كان هناك اختلاف كبير في متوسط درجة الألم بين المجموعتين التجريبية والضابطة (الاحتمالية أقل من 0.05). كانت متوسطات درجات الألم في المجموعة التجريبية (م = 2.6 ± انحراف معياري 1.7) أقل من درجات الألم في المجموعة الضابطة (م = 4.6 ± انحراف معياري 2.8) ، وكان هناك اختلاف كبير في متوسط درجات الثقة الذاتية العامة بين المجموعتين التجريبية والضابطة (الاحتمالية أقل من 0.05). كان متوسط درجات الكفاءة الذاتية العامة في المجموعة التجريبية (م = 31.0 ± انحراف معياري 6.7) أعلى من ذلك في المجموعة الضابطة (م = 28.8 ± انحراف معياري 6.8) ، وكان هناك اختلاف كبير في متوسط درجات التوتر بين المجموعتين التجريبية والضابطة (الاحتمالية أقل من 0.05). كانت متوسطات درجات التوتر في المجموعة التجريبية (م = 17.7 ± انحراف معياري 2.8) أقل من ذلك في المجموعة الضابطة (م = 19.2 ± انحراف معياري 2.5) ، وكان هناك اختلاف كبير في مستويات القلق بين المجموعتين التجريبية والضابطة (الاحتمالية أقل من 0.05). وكشف التحليل أيضًا أن 41 (54.7٪) من المجموعة التجريبية يعانون من قلق بسيط بينما 20 (26.7٪) فقط من المجموعة الضابطة لديهم نتائج مماثلة.

الاستنتاج: تتوفر استراتيجيات مختلفة لتقليل الألم والتوتر والقلق المصاحب لعلاج السرطان. إن استخدام تقنية الواقع الافتراضي من خلال نظارات الواقع الافتراضي يقلل بشكل كبير من الألم والتوتر والقلق ، مع تعزيز الكفاءة الذاتية بين مرضى السرطان الذين يخضعون لجلسات العلاج الكيميائي. لذلك ، يوصى بشدة باستخدام الواقع الافتراضي المعزز وإدراجه في معايير الرعاية المقدمة لمرضى السرطان.

الكلمات المفتاحية: القلق، الواقع الافتراضي المعزز، ألم، الكفاءة الذاتية، ضغط.