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The Effectiveness of Virtual Reality for Pain Management Among Palliative Care Patients

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Abstract

Management of pain in palliative care patients remains to be a highly complex and individualized process that involves a combination of both pharmacological and non-pharmacological interventions (Garrett et al., 2020). However, despite current standards for care, pain remains to be poorly controlled compared to all other symptoms (Guenther et al., 2022; Natoli et al., 2015). Due to the prevalence and severity of pain among palliative care patients, many non-pharmacological interventions have been explored to improve quality of life. Recent studies have shown virtual reality (VR) to be successful in the management of acute pain (Chan et al., 2018). However, the effectiveness of virtual reality to manage pain among palliative care patients remains unclear. The purpose of this systematic review of research was to evaluate the effectiveness of virtual reality alone compared to the effectiveness of virtual reality with standard of care (SOC) at controlling pain among palliative care patients. Methodology for this study included a comprehensive search of multiple databases using keywords to identify articles that met inclusion criteria. Thirteen articles published between 2018-2022 were eligible for inclusion. Out of 13 articles included, 3 articles compared VR alone to VR plus SOC and 9 articles evaluated the use of VR for pain management among palliative care patients. One article compared VR to guided imagery (Groninger et al., 2021). The results of the 3 articles revealed that compared to VR alone, VR plus SOC was more effective at reducing pain and anxiety among palliative care patients (Ahmad et al., 2020; Bani and Ahmad, 2018; Mallari et al., 2019). In addition, the results of the 9 articles found VR to be an effective intervention for reducing pain (Austin et al., 2022; Garrett et al., 2020; Grassini, 2022; Guenther et al., 2022; Kelleher et al., 2022; Martin et al., 2022; Moscato et al., 2021; Niki et al., 2019; Seiler et al., 2022). The results of the last article revealed that VR was more effective at reducing pain than guided imagery

(Groninger et al., 2021). According to the results of this study, nurses may consider virtual reality as an adjunctive intervention for pain and anxiety management among palliative care patients. However, despite these results, more high-methodological studies are recommended to confirm these findings.

Keywords: “Pain management in nursing,” “Virtual Reality for Cancer patients,” “Immersive virtual reality distraction compared to the analgesic effects of opioids”, “VR Technology vs morphine”, “VR therapy vs standard interventions for pain,” “Palliative care”, “Pain treatment”, “terminal cancer patients”, “pain treatment using Virtual Reality technology”, “chronic pain management”, “pain control for patients with chronic pain”, and “pain management in terminal cancer patients using VR technology.”

The Effectiveness of Virtual Reality for Pain Management Among Palliative Care Patients

According to the World Health Organization (WHO), an estimated 56.8 million people require palliative care annually, and the majority of them have chronic illnesses like diabetes (4.6%), chronic respiratory diseases (10.3%), acquired immunodeficiency syndrome (AIDS) (5.7%), cancer (34%), and cardiovascular disorders (38.5%; 2020). Some of the most common symptoms in palliative care patients are pain, fatigue, lack of energy, loss of appetite, and nervousness. However, pain is poorly managed compared to all the other symptoms (Guenther et al., 2022; Natoli et al., 2015). According to a journal written by Pottle, there are three categories of pain, acute, chronic, and cancer. Pain from cancer and other terminal illnesses is frequently considered within the particular domain of palliative care (2019). Meta-analysis research states that compared to 39% following curative treatment and 55% during anticancer treatment, the prevalence of pain in cancer patients with advanced metastatic illness was 66%. In addition, 33% of patients classified their pain level as moderate or severe (Van den Beuken-van Everdingen et al., 2016).

These statistics show pain as the most frequent symptom palliative patients encounter. Due to the prevalence and severity of pain in palliative care patients, many non-pharmacological interventions have been explored in an effort to improve quality of life. One such intervention that is gaining interest among researchers is the use of virtual reality (VR) for pain management. The aim of this research is to explore the efficacy of virtual reality therapy and determine if it can be used alone or as an adjunct in the management of pain in palliative care.

Background

Virtual reality is the art of simulating a physical presence for a client in places of both natural and imaginary as it often involves the senses of sound and vision in experiencing the

past, present, and future (Moscato, 2021). Recently, research has revealed VR to play an important role in the management of pain. For example, VR has been shown to be successful in managing psychological and somatic pain (Martin et al., 2022). A few studies support the use of VR to reduce acute pain both during and following procedures (Mallari et al., 2019; Martin et al., 2022 & Moscato, 2021). While the use of VR has been found to reduce acute pain, its ability to have a lasting effect in the management of chronic pain is yet to be established. Research has demonstrated the use of VR as a complementary therapy for the management of physical and psychological symptoms of chronic (cancer) pain (Moscato, 2021).

The use of VR in palliative care is welcomed by participants and various research has ensured that it conforms with standard care in healthcare (Ahmad, 2020). Some researchers have emphasized that VR acts as a nonpharmacological form of analgesia by exerting an emotional effect on the user (Garrett, 2020). Virtual reality may relieve pain by affecting the cognitive and attentional processes on the body's complex pain modulation system. However, the precise neurobiological mechanisms behind VR's action is still vague (2020).

When using VR, the patient uses a variety of sets of technology including built-in head tracking systems, headphones with noise reduction, rumble pads, joysticks, or other devices to navigate a virtual environment. These devices follow the user's head movements, giving them the illusion of being entirely in the center of a virtual world. Virtual reality has a multi-modal effect (visual, auditory, kinesthetic and tactile) which further contributes to a sense of actual immersion in the virtual environment. This effect makes VR distinct from watching television or playing a 2D handheld video game or game console (Mallari et al., 2019; Martin et al., 2022).

The WHO (2020) recommends a SOC to be used within the palliative community. They recommend starting the patients on non-steroidal anti-inflammatory drug therapy (NSAID) such

as ibuprofen. If pain continues or worsens, they prescribe a weak opioid medicine like hydrocodone, and if the pain still persists, then more potent analgesics like morphine and fentanyl are used. Additionally, some medications can be used as an adjuvant therapy with painkillers. The downside to using these pharmacological interventions is that they are sometimes contraindicated in patients receiving palliative care due to comorbidities and adverse effects associated with the analgesics (Groninger et al., 2021). Due to these side effects and other contraindications, many palliative care patients continue to experience symptoms and limitations associated with their illness. Pain that is left untreated is not only debilitating but can lead to many negative long-term outcomes including decreased mobility, weakened immunity, difficulty sleeping, loss of appetite, depression and more (King et al., 2013).

The standard of care for palliative care clients further encourages an active lifestyle since active patients survive longer than those with a passive lifestyle (Martin et al., 2022). The use of VR therapy may also be used to assist palliative care clients to accept their disease process because focus is shifted from the pain to the subjective illusion in the participant's mind that he or she has gone inside the virtual world (Mallari et al., 2019). The mental state of a patient in palliative care changes regularly from denial, hope for a cure, suspicion of medical treatment, uneasiness regarding their future life, irritation, depression, and acceptance or despair (Martin et al., 2022).

Significance

According to WHO, palliative care enhances the lives of both patients and families experiencing debilitating health conditions, whether they are physical, psychological, social, or spiritual (2020). Patients receiving palliative care have at least one or more chronic diseases such as cardiovascular disease, AIDS, cancer, chronic respiratory disease, or diabetes. Pain and

difficulty breathing are the most common symptoms palliative care patients experience (2020). A meta-analysis shows that 66% of patients with cancer in advanced metastatic disease experience pain as the most common symptom compared to 39% after curative treatments and 55% during anticancer treatment (Van den Beuken-van Everdingen et al., 2016)

Standard of care (SOC) within our research consists of pharmacological interventions such as opioids, anxiolytics, and antiemetic medications. However, despite SOC, pain is largely unmanaged. According to Wiederhold et al.(2014), painkillers are inadequate to relieve pain in about 50% of cancer patients. In addition, many pharmacological interventions have adverse side effects such as constipation, nausea and vomiting, dry mouth, respiratory depression, pruritus, and hallucinations which can adversely affect the patient's health outcome (Bani and Ahmad, 2018). Benzodiazepines are commonly used to treat anxiety among these patients, however, they also have many side effects including tolerance, dependence, and drug interactions. As a result, non-pharmacological interventions are a safer option to treat both pain and anxiety (Platt et al., 2016). Because SOC is inadequate in managing pain and anxiety among palliative care patients, more options need to be explored to treat pain.

Virtual reality (VR) is a safe non-pharmacological intervention that does not require a doctor's order to start treatment and has very few side effects (Bani and Ahmad, 2018). Additionally, VR not only relieves pain, but also reduces fatigue, depression, and stress which play a huge role in improving the patient's health outcome (Reynolds et al., 2022). Furthermore, VR also decreases anxiety which is often a secondary characteristic of pain (Bani and Ahmad, 2018). Lastly, VR is both accessible and convenient for nurses to incorporate into their plan of care. However, more research needs to be done so that clinical guidelines can be created for VR.

Virtual reality has very few side effects including cybersickness, headaches, neck aches, and eyestrain. Cybersickness can occur from the depiction of motion on the VR screen and eye strain can result from the closeness of the participant's eyes to the screen. Headaches, and neck aches may occur from prolonged use of VR (Garrett et al., 2020). Despite these few side effects, VR is a relatively safe and non-invasive intervention and may serve as a better alternative for patients with severe allergies or patients that are afraid to take pharmaceuticals due to adverse side effects (Bani, 2018).

Problem Statement

According to the WHO, "Each year, an estimated 56.8 million people require palliative care" (2020). Despite standard care including pharmacological interventions in outpatients, hospitals, and long-term care facilities, pain remains one of the most common symptoms requiring treatment in palliative care patients. Therefore, the goal of our research is to identify cost-effective interventions for pain management.

Research Question

In patients receiving palliative care, is the use of virtual reality technology alone compared to the use of virtual reality with standard of care (SOC) better at controlling pain?

Purpose Statement

Due to the prevalence of pain in palliative care patients, the need for better pain management is necessary. Recent studies have demonstrated the use of VR as an effective intervention to reduce acute pain through distraction (Chan et al., 2018). Although studies have

shown VR to be effective in reducing pain, the ability of VR alone to control pain in palliative care patients remains unclear (2018). The purpose of this review is to summarize current studies and evaluate the effectiveness of VR alone compared to the effectiveness of VR with SOC in managing pain among palliative care patients. This literature review helps to identify gaps in current research for future studies and practice. In addition, research findings help to provide a basis for the application and utilization of VR for pain management among palliative care patients. For the purpose of this research, a systematic literature search was conducted to identify evidence-based articles for pain management. Only articles from the year 2018 and onward were considered for this literature review, and selected articles had to meet the following inclusion criteria: (1) involved participants were receiving palliative care; (2) researched any type of virtual reality (immersive or non-immersive) either alone or in combination with standard care treatment; and (3) reported measured pain using a numerical scale, visual analogue scale or any other form of valid pain measurement.

Study Variables

The purpose of this study was to explore the use of VR alone compared with VR plus SOC for pain management among palliative care patients. The independent variable in this study is VR which was defined as a computer-generated simulation of a three-dimensional image or environment (Ahmad et al. 2020; Austin et al. 2022). It includes two categories known as immersive and non-immersive VR. Immersive VR allows users to interact within a 360-degree environment through the use of a head-mounted display while non-immersive VR allows users to view the environment based on how the device is held or moved (Ahmad et al., 2020). Standard of care is another independent variable in this study which was defined as any type of accepted medical treatment that is deemed by medical experts as appropriate for specific diseases and

includes but is not limited to the use of pharmacological interventions (Ahamad et al., 2020; Bani and Ahmad, 2018). The dependent variable in this study is pain management. Pain management was defined as a significant overall reduction of a numerical pain score as well as a reduction of secondary characteristics of pain such as anxiety (Austin et al., 2022; Groninger et al., 2021). Lastly, palliative care in this study can be defined as any form of specialized care provided to people with serious and often terminal health conditions such as cancer or heart failure (U.S Department of Health and Human Services, 2021).

Methodology: Sources of Evidence

Searches for articles for this research were carried out between the beginning of March 2022, and the end of September 2022. The database and websites used were EBSCO Eagle Search, Academic Search Complete, SpringerOpen, Google Scholar Search, PubMed Central, CINAHL Complete, and Science Direct Database. Our key search words included, “Pain management in nursing,” “Virtual Reality for Cancer patients,” “Immersive virtual reality distraction compared to the analgesic effects of opioids”, “ VR Technology vs morphine”, “ VR therapy vs standard interventions for pain,” “Palliative care”, “Pain treatment”, “terminal cancer patients”, “pain treatment using Virtual Reality technology”, “chronic pain management”, “pain control for patients with chronic pain”, and “ pain management in terminal cancer patients using VR technology.”

Inclusion criteria included articles published within the last five years to ensure they were not outdated and still relevant. Articles had to be peer-reviewed to ensure they provided meaningful information backed up with reliable conclusions per evidence-based practice guidelines. Finally, the articles had to be written in English, in full-text, and available for download through PDF or HTML. Articles found were relevant to our PICO statement using the

above inclusion criteria. The total results generated from the initial search was about 837 articles. Articles were filtered by reading through the article titles and applying inclusion criteria leaving 28 articles left. The remaining 28 articles were further narrowed based on whether they answered the research question for this study. Articles that did not answer the research question, either in whole or in part, were dropped, leaving 11 articles. Two more articles were added using the snowballing method. Therefore, thirteen articles in total were used for this research study.

Research Evidence

Thirteen articles were included in this systematic review of research. The dates of these articles range from 2018-2022. Among these studies, four were a systematic review and meta-analysis of literature (Ahmad et al., 2020; Grassini et al., 2022; Mallari et al. 2019; Martin et al., 2022). Three were randomized control trials (Bani and Ahmad, 2018; Groninger et al., 2021; Moscato et al., 2022). One was a preliminary prospective, multicenter study (Niki et al., 2019). One was a randomized crossover study (Austin et al. 2022). One was a controlled pilot trial (Guenther et al., 2022). One was a single center, pilot, and randomized crossover study (Niki et al. 2021). One was a qualitative study (Garrett et al., 2020) and one was a mixed methods study (Kelleher et al., 2022). Lastly, one study was a case series (Seiler et al., 2022).

Table 1 gives a brief description of each article including its relation to our research, design type/level of evidence, basic demographics, study population, and key findings.

Table 1*Summarized Findings of Articles for VR and Pain Management*

Authors	Issue Related to EBP	Design Type	Study Design & Study Outcome Measure(s)	Study Settings & Population	Study Interventions	Key Findings
Ahmad et al., 2020	Analyzing management of pain and anxiety amongst cancer patients using Virtual reality	Systematic Review and Meta-Analysis (I)	Design: Systematic Review and Meta-Analysis of research. Outcome Measure: Pain measured using a visual analogue scale (VAS), numerical rating scale, or other validated outcome measures; anxiety measured using the State Anxiety Inventory or other validated outcome measures.	Setting: Multiple databases from their inception through November 2018. Population: 13 studies involving patients with cancer	Use of VR in managing pain and anxiety	-VR and SOC is more effective in reducing pain and anxiety in children, adolescent patients (painful procedures), adult patients and elderly patients who were undergoing anti-cancer treatments and during their hospitalization.
Austin et al., 2022	Compared the effects of 3D HMD VR and 2D screen applications to decrease cancer pain via distraction.	Randomized crossover study (II)	Design: Randomized cross over study comparing 3D HMD VR and 2D screen application in treating cancer pain Outcome Measure: Pain measured using 11 point- pain numerical rating scale (NRS), Edmonton Symptom Assessment System (ESAS), Australian-modified Karnofsky Performance Status (AKPS), and iGroup Presence Questionnaire (IPQ)	Setting: inpatient unit patient or home-based palliative care Population: 14 people receiving palliative care	Use of VR to treat cancer pain	-3D HMD VR decreased cancer pain by 43% compared to 34% using 2D screen applications. - 3D HMD VR also has a higher level of presence which helps in decreasing pain intensity.
Bani and Ahmad., 2018	To show the benefit of using VR as an adjuvant intervention than morphine alone to decrease pain and anxiety in breast cancer patients.	Randomized control trial (I)	Design: A randomized control trial to compare morphine vs VR as an adjuvant intervention with morphine in decreasing cancer pain Outcome Measure: Pain assessed using a visual analog scale(VAS) out of 10 point and anxiety level measured using State Anxiety Inventory (SAI)	Setting: Cancer center in Jordan in medical and surgical wards Population: 80 female patients with breast cancer	Using morphine and VR as an adjuvant intervention to decrease cancer pain	-Immersive VR is a non-pharmacological treatment in reducing pain and anxiety among breast cancer patients and works better if it's being used as an adjuvant with morphine to manage pain. - VR also decreases anxiety levels. - $p < 0.0001$ -pain: post-intervention group mean: 0.33, post control group mean: 4.84 -anxiety: post-intervention group mean: 37.68, post-control group mean: 50.13
Garrett et al., 2020	Analyzing patient perception of VR therapy in chronic cancer pain management through comparison of contemplative and cognitive-based VR.	Qualitative study (III)	Design: Qualitative study of patients with chronic cancer pain using VR as adjunctive therapy Outcome Measure: Daily pain scores using the Visual Analogue Scale, weekly neuropathic pain and health quality scores using the McGill Pain Questionnaire and the Health Survey Short Form, sleep quality measure using the Pittsburgh Sleep Quality Index	Setting: Vancouver, British Columbia, and Canada as one element of a larger RCT study. Population: 12 patients with cancer	Using VR for chronic cancer pain control	- Mixed results for using VR as adjunctive therapy to manage chronic cancer pain - Majority of respondents found VR to be beneficial in reducing pain. - Positive themes include decreased pain, positive emotional response, increased sleep, positive effects over time, increased mobility. Negative themes include cybersickness, negative emotional response, increased pain, eyestrain, and reduced sleep. - Patients preferred either cognitive or contemplative- based VR but not both.

Grassini, 2022	Assessment of the efficacy of the use of VR for chronic pain management	Systematic Review and Meta-Analysis (I)	Design: Meta-analysis and literature review of public studies that have employed the most updated types of VR Outcome Measure: Visual analogue scale, Tampa scale for Kinesiophobia, and present pain intensity	Setting: Multiple databases Population: 9 studies involving patients with chronic pain	Use of VR for chronic pain management	-VR interventions may be useful for chronic pain management. -The analyses does not suggest the effectiveness of VR therapy over other types of treatments for pain management. -Out of the 9 studies that were included in this study, 5 had a p value of < 0.05 and the remaining 4 had a p value of < 0.86 respectively. -There is limited evidence that supports the use of VR therapy alone in the context of chronic pain in patients with cancer
Groninger et al., 2021	Virtual Reality for pain management in advanced heart failure	Randomized control trial (I)	Design: Single-center prospective randomized controlled study that compared VR to guided imagery. Outcome Measure: Difference in pre- versus post- intervention self-reported pain scores on a numerical rating scale from 0 to 10. Secondary outcomes included changes in quality-of- life scores, general distress, and satisfaction with the intervention.	Setting: Urban tertiary academic medical center Population: 88 participants hospitalized with advanced heart failure	Use of VR for pain management among patients with heart failure	-Participants experienced significant improvement in pain score after either 10 minutes of virtual reality (change from pre- to post -2.9 ± 2.6 , $p < 0.0001$) or 10 minutes of guided imagery (change from pre- to post -1.3 ± 1.8 , $p = 0.0001$) - The virtual reality arm experienced a 1.5 unit comparatively greater reduction in pain score compared to guided imagery ($p = 0.0011$). -Seventy-eight participants (89%) would be willing to use the assigned intervention again.
Guenther et al., 2022	To evaluate if one time VR experience is a feasible, satisfactory and effective tool for improving end of life-symptoms in palliative care patients	Controlled Pilot Trial (II)	Design: Controlled Pilot Trial where participants got a one-time intervention of VR and were followed up for one hour. Outcome Measure: A Visual analogue scale, and using pain out questionnaires.	Setting: University Hospital Muenster, an urban, tertiary care hospital. Population: 45 patients who got treatment by the PCCS of the University Hospital Muenster.	Using the Samsung Gear VR and PICO G2 4K VR for symptom control, especially alleviation of pain	-A significant pain reduction in comparison to baseline values was shown during, directly after, and one hour after the VR intervention. - VAS scores were as follows; pre interventional $p < 0.000$, post interventional $p = 0.0001$, one hour post interventional $p = 0.0004$
Kelleher et al., 2022	Focus on using VR Blue to reduce pain and pain-related symptoms in advanced colorectal cancer patients.	A quantitative and qualitative study (III)	Design: Pre-, mid-, and post VR Blue session assessment were completed online via REDCAP using iPad and semi-structured exit interview to assess their preferences, thoughts and feelings about the VR experience. Outcome Measure: Pain assessed using 4-item Pain Severity subscale of Brief Pain Inventory (BPI) and tension, stress, anxiety, relaxation, and mood measured using a Visual Analog Scale out of 100.	Setting: 30 min VR session under/sea environment (VR Blue) Population: 20 participants with stage IV colorectal cancer	Using VR Blue to decrease pain, anxiety, stress, and tension as well as how it affects mood and relaxation.	-VR Blue is feasible, acceptable, and safe to use to treat cancer pain. -pre to post-VR blue, pain decreased by 58.93%. -Tension decreased by 74%. -Stress decreased by 68%. -anxiety decreased by 65%.% -Relaxation increased by 38%. -mood increased by 70%.

Mallari et al., 2019	Evaluation of the effectiveness of virtual reality on acute and chronic pain in adults	Systematic Review and Meta-Analysis (I)	Design: Systematic Review and Meta-analysis of 20 experimental and quasi-experimental studies published January 2007 through December 2018 Outcome Measure: Pain was assessed using Numeric rating Scale (NRS), 3D Blu-ray /DVD & joystick for input, PEDro tool & Modified Downs and Black (MD&B) quality index.	Setting: Multiple databases published from January 2007 through December 2018 Population: 20 experimental and quasi-experimental studies	VR to manage acute and chronic pain	-VR therapy should be used as adjunct therapy to standard care to decrease acute pain and chronic pain conditions. VR during a periodontist procedure, (standard care) (ES = 0.95, 95% CI: 0.64, 1.26) and watching a movie during the procedure (ES =0.44, 95%CI: 0.23, 0.65). Another study found VR reduced pain in episiotomy repairs (hymen repair ES=0.74, 95%CI:0.43, 1.04 and skin repair ES=1.00, 95%CI: 0.65, 1.36).
Martin et al., 2022	Evaluation of the efficacy of VR interventions in palliative care patients	Systematic Review and Meta-analysis (I)	Design: Systematic Review and Meta-analysis on the use of VR therapy in improving psychological and somatic results when in palliative care clients. Outcome Measure: Edmonton symptom Assessment Scale (ESAS) were used to measure the change in symptom burden in participants before and after VR intervention.	Setting: Palliative care facility and those receiving palliative care at home. Population: 8 studies between 2019 and 2021	The use of VR to address a range of symptoms in palliative care patients	-The Edmonton Symptom Assessment Scale (ESAS) found an improvement in appetite based 95% confidence interval (p=0.279). There was an overall trend of symptom improvement after VR intervention in terms of pain etc and an overall statistically significant improvement (p = < 0.05).
Moscato et al., 2021	To evaluate the effect of VR in the reduction of cancer pain in the care of palliative patients at home.	Randomized Control Trial (I)	Design: A randomized control trial supporting the use of immersive audiovisual technology (VR) to improve the symptomatology well-being of patients with advanced cancer. Outcome Measure: Edmonton Symptom Assessment Scale (ESAS), Brief Pain Inventory (BPI), Hospital Anxiety Depression Scale (HADS) & physiological parameters.	Setting: Patients at home in palliative care. Population: 14 participants with advanced cancer	Used VR as a complementary therapy for managing psychological & physical symptoms in cancer patients.	-Significant improvement in pain, depression, anxiety, well-being, and shortness of breath immediately after using the VR (p<0.01). The physiological parameters showed no significant changes before, during, and after the VR sessions. Brief Pain Inventory (BPI) item (r= 0.63, p<0.05). ESAS score for anxiety (r= - 0.27, p < 0.05) worst feeling of wellbeing (r = - 0.25, p < 0.05) and shortness of breath (r = - 0.28, p < 0.05).
Niki et al., 2019	To verify whether the use of VR is effective in reducing symptoms of cancer including pain	Preliminary Prospective Multicenter Study (I)	Design: Preliminary, prospective, multicenter study assessing the effectiveness of VR in reducing cancer pain and cancer symptoms. Outcome Measures: Assessed change in the Edmonton Symptom Assessment System scores for each symptom before and after VR travel.	Setting: Palliative care wards Population: 20 participants with terminal cancer	The use of Google Earth VR to relieve cancer symptoms	-Significant improvements observed for pain (2.35 vs. 1.15, p=0.005) -Improvements in anxiety (2.60 vs. 0.80, p<0.001) --VR is efficacious and safe for improving symptom burden in terminal cancer patients. - No patients complained of side effects
Seiler et al., 2022	To evaluate the feasibility and acceptability of VR therapy in reducing symptom burden in patients receiving palliative care.	Case series (IV)	Design: Case series to evaluate the feasibility and acceptability of VR therapy in reducing symptom burden in patients receiving palliative care via semi-structured survey Outcome Measure: Edmonton Symptom Assessment System (ESAS) and the NCCN Distress Thermometers were used to assess pre- and post-intervention.	Setting: University Hospital Zurich, Switzerland Population: 6 adult inpatient palliative care patients diagnosed with advanced, life-limiting diseases	The use of VR therapy to reduce symptom burden in patients receiving palliative care.	-VR technology is safe and acceptable in the palliative care setting, not only for the management of pain, but also in enhancing the patients' quality of life. -ESAS showed a post intervention mean difference of pain of -0.6 -Two patients reported difficulty with learning the hardware and button configuration on the remote controller; one patient reported distress and confusion during their VR session.

Narrative Discussion of Findings

As stated in the research question, this research aimed to explore the efficacy of VR therapy to determine if it could be used alone or as an adjunct to SOC in pain management among palliative care patients. Out of the thirteen articles used in this study, nine examined the effectiveness of using VR technology to reduce pain in patients receiving palliative care (Austin et al., 2022; Garret et al., 2020, Grassini et al., 2022; Guenther et al., 2022; Kelleher et al., 2022; Mallari et al., 2019; Martin et al., 2022; Moscato et al., 2021; Seiler et al., 2022), and three articles compared the use of VR alone to the use of VR as an adjunct to SOC in reducing pain (Ahmad et al., 2020; Bani and Ahmad, 2018; Mallari et al., 2019). One article compared VR to guided imagery in reducing pain among heart failure patients (Groninger et al., 2021).

VR Alone for Pain Management

Of those nine studies examining the effectiveness of VR in reducing pain, six demonstrated that VR was acceptable and highly effective in reducing pain in palliative care (Austin et al., 2022; Moscato et al., 2021; Garrett et al., 2020; Guenther et al., 2022; Kelleher et al., 2022; Niki et al., 2019). In one study, participants reported experiencing significant improvement in pain after only 10 minutes of receiving the VR experience (Groninger et al., 2021). One other study demonstrated that VR was safe and acceptable for use in palliative care and enhanced the patient's quality of life (Seiler et al., 2022). Furthermore, most patients were happy with the VR interventions, as they found them beneficial and easy to use (Garrett et al., 2020; Martin et al., 2022). In comparing VR to guided imagery, both interventions were found to be effective in reducing pain. However, patients using VR experienced a greater reduction in pain than patients using guided imagery (Groninger et al., 2021)

In one study investigating the effectiveness of VR in chronic pain management, one patient reported feeling overwhelmed by VR and experienced some distress and disorientation during their VR experience. In addition, two other patients had trouble getting used to the technology and learning how to use the remote controller's buttons (Seiler et al., 2022). With VR technology still being new in healthcare, multiple studies found that there is limited evidence to support the use of VR therapy alone to control chronic cancer pain (Grassini et al., 2022; Niki et al., 2021; Seiler et al., 2022). The use of VR technology was also found to have side effects. According to one study, patients reported symptoms such as headaches, cybersickness, eye strain and exacerbated pain (Garrett et al., 2020). However, another study reported that no patients complained of side effects (Niki et al., 2019).

VR Compared to VR and SOC for Pain Management

Compared to using VR alone, three studies illustrated that VR therapy was more efficient when combined with SOC in treating chronic pain in palliative care patients (Ahmad et al., 2020; Bani and Ahmad, 2018; Mallari et al., 2019). According to Bani and Ahmad, VR was found to be an excellent non-pharmacological treatment. It was effective for reducing pain and anxiety among breast cancer patients and worked better when used as an adjuvant with morphine to manage pain (2018). Furthermore, in their study, Bani and Ahmad (2018) found that VR technology worked well as an adjunctive intervention for pain and anxiety management, particularly in pediatric and adolescent patients undergoing painful procedures, as well as in adult and elderly patients undergoing anticancer treatments and hospitalization.

Interpretation of Findings

In our systematic review of research, a total of 13 studies were used and 9 studies demonstrated that VR is significantly effective in the reduction of pain amongst palliative care patients (Austin et al., 2022; Garret et al., 2020, Grassini et al., 2022; Guenther et al., 2022; Kelleher et al., 2022; Mallari et al., 2019; Martin et al., 2022; Moscato et al., 2021; Seiler et al., 2022). As a result of these findings, VR was shown to be an effective intervention for pain relief. There is little evidence to support VR therapy alone over standard care for the management of pain in chronic cancer (Grassini, 2022). Some mixed results were reported in one study, however, the majority of the participants involved in this study found VR to be beneficial for pain management (Garret et al., 2020). Our PICO statement is to evaluate whether VR can be used alone in the management of pain in palliative care or used in addition with standard care. Out of 13 studies included in this research, 3 studies revealed that standard care plus VR did better in the management of pain in palliative care patients than VR alone (Ahmad et al., 2020 & Bani, 2018). Lastly, out of 13 studies one study compared VR to guided imagery. Overall, VR was found to be more effective than guided imagery in treatment of pain for heart failure patients.

Implications

Nursing Education

Nurses should know the benefits of using VR compared to pharmacological treatment in treating pain and how the VR head-mounted display (HMD) works before using it in research studies. After that, nurses should focus on teaching the participants how to use VR (HMD), especially for the older population since it may be their first time using it, and they might have little knowledge of how it works. One of our articles discusses how some patients have difficulty

adjusting to VR, which can prevent the effectiveness of the treatment (Seiler et al., 2022). So, it is very crucial that nurses have full knowledge of how VR works so that they can educate their patients. Also, educating the VR participants to have a set time frame to use VR treatment and not use it for too long as it may cause cybersickness and head and neck aches.

Nursing Practice

While researching the usefulness of VR in treating pain, most of our articles state VR is a safe, non-pharmacological treatment for decreasing pain in a medical and nonmedical setting. It is practical to use VR to treat cancer pain because it does not have pharmacological side effects and reduces anxiety, stress, fatigue, and depression which also play a significant role in the patient's health condition. Furthermore, virtual reality is a safe and easy-to-use treatment that can be taken anywhere. Additionally, VR does not require a doctor's order. This allows nurses to freely implement VR to a patient's plan of care. Although VR is relatively safe and easy to use, the high cost of VR technology potentially limits its accessibility to low income families.

Future Research

Future research should focus on using larger sample sizes in treating pain in palliative care patients since most articles had a small sample size. In addition, more research should be done to compare the use of VR in a home setting (only two articles used a home setting) compared to medical care settings to see if it's more effective as the participant would feel more comfortable, less anxious, and more at peace when using it at home. Furthermore, research should examine how long the effect can last in combination with using a SOC and VR. Future research should focus on if using other painkillers other than morphine with VR will have more lasting or fewer effects in palliative care patients. Furthermore, not only should further studies be conducted on the subject, but the use of VR in other aspects of nursing should also be investigated. While our

results show VR plus SOC to be the better alternative, more studies comparing VR alone and VR plus SOC are recommended to support the creation of clinical guidelines.

Strengths and Limitations

This systematic research review contains both strengths and weaknesses. Strengths identified in this research include the level of evidence of the articles included. Out of thirteen articles, four were systematic reviews and meta-analysis studies (Ahmad et al. 2020; Grassini et al., 2022; Mallari et al., 2019; Martin et al., 2022), three were randomized control trials (Bani et al., 2019, Groninger et al., 2021; Moscato et al., 2021) and one was a multi-center study representing higher levels of evidence (Niki et al., 2019). Further strengths of our research include current research articles ranging from years 2018-2022, variation in study design types and demographics and limited bias of researchers.

Limitations of our research include a limited number of current articles for study, not all of the articles used were level I evidence, and research addressed only a specific population. In addition, many of the articles had small population sample sizes with the largest sample size including 88 participants and the smallest sample size including only 6 participants (Groninger et al., 2021; Seiler et al., 2022). Furthermore, one of the articles had only one author which may allow for bias in interpreting results (Grassini, 2022). Lastly, 9 articles did not include a comparison of VR alone to VR plus SOC.

Recommendation

Our research investigated whether immersive VR is effective if used in palliative care for pain management alone or used with standard care. To improve our research, more articles should be used as this will enable the results to be improved and have better outcomes. More time will afford researchers to gather enough materials from level 1 evidence for the study. In

addition, researching articles with larger population sample sizes should be included. In this study our access was limited as we found only three articles comparing VR alone to VR plus SOC (Ahmad et al., 2020; Mallari et al., 2019 & Bani and Ahmad, 2018). The research on VR should be expanded to explore new databases with the objective of getting more studies for comparison (Grassini et. al 2022 & Niki et. al 2019).

Conclusion

The purpose of this study was to evaluate the effectiveness of virtual reality alone compared to the use of virtual reality with SOC at controlling pain among palliative care patients. Out of 13 articles included, 3 articles compared VR alone to VR plus SOC and 9 articles evaluated the use of VR for pain management among palliative care patients. One article compared VR to guided imagery (Groninger et al., 2021). The results of the 3 articles revealed that compared to VR alone, VR plus SOC was more effective at reducing pain and anxiety among palliative care patients (Ahmad et al., 2020; Bani and Ahmad, 2018; Mallari et al., 2019). In addition, the results of the 9 articles found VR to be an effective intervention for reducing pain (Austin et al., 2022; Garrett et al., 2020; Grassini, 2022; Guenther et al., 2022; Kelleher et al., 2022; Martin et al., 2022; Moscato et al., 2021; Niki et al., 2019; Seiler et al., 2022). The results of the last article revealed that VR was more effective at reducing pain than guided imagery (Groninger et al., 2021). According to the results of this study, nurses may consider virtual reality as an adjunctive intervention for pain and anxiety management among palliative care patients. However, despite these results, more high-methodological studies are recommended to confirm these findings.

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