A Virtual Reality Intervention for Anxiety Relief During Initial Chemotherapy Treatment

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In Brief

Patients with cancer often experience significant anxiety and fear with their first chemotherapy treatment. Nurses at this NCI-designated Comprehensive Cancer Center piloted an evidence-based project that provided an immersive virtual reality (VR) experience with the goal of reducing this anxiety. After initial pretreatment education, nurses administered the State-Trait-Anxiety Inventory Scale short version (STAIS-5) to new patients receiving cycle 1, day 1 of their chemotherapy regimen. Patients then participated in an 8-minute immersive VR experience using the TRIPP VR app and the Meta Quest VR headset. The program focused on mindful awareness and breathing techniques. After viewing the video, patients completed the STAIS-5 questionnaire to reassess their state of anxiety and provided qualitative feedback in a comment field. The results of this evidence-based pilot project demonstrated that VR-based mindfulness applications (apps) are a feasible, holistic, nonpharmacologic modality that may be used to provide anxiety relief during chemotherapy infusion. The findings further support the benefits of integrating technology into oncology care.

The high levels of stress and anxiety experienced by oncology patients during their first chemotherapy treatment can stem from multiple factors, including coping with a new diagnosis, having existing pain, processing an overwhelming amount of information, and experiencing overstimulation from an unfamiliar environment. Treatment-related anxiety is thought to create apprehension and increase the potential for anxiety-related adverse events. In 2021, The Infusion Center at Moffitt Cancer Center at Wesley Chapel piloted an evidence-based project using VR technology and an immersive mindfulness meditation app to provide a relaxing experience for patients receiving chemotherapy treatment. Integration of innovative, nonpharmacologic means of symptom management is a cutting-edge way to offer support for those who are adjusting to the difficult nuances of anticancer treatment, honoring their need for comfort in a holistic manner.

Our Literature Review

VR has been successfully used in infusion centers to mitigate the effects of treatment anxiety by creating an immersive experience. The brain can only respond to 1 source of stimuli at a time; therefore, creating an environment where the patient can focus on pleasant, nature-related imagery can distract patients from the stressful clinical environment, create positive emotions, and induce a relaxed state. The Attention Restoration Theory shows that involvement in environments with peaceful stimuli creates a *soft fascination* effect, where attention is restored in a therapeutic fashion using nature-related environments that have been shown to have a restorative effect.[1] Reducing anxiety can also help improve the patient's ability to recall information and engage with the nurse in discussions about symptom management and the treatment regimen.

> Patients experiencing the lifting of mental fatigue have improved processing capabilities and the ability to perform tasks with a higher level of cognitive function, which may be helpful in retention of knowledge about self-management of symptoms.

In a recent study of patients in an outpatient cancer center receiving chemotherapy over a consecutive 30-day period, patients reported feeling less distracted and more relaxed after viewing a brief nature video prior to treatment, as evidenced by their stress and anxiety scores and open-ended responses on preintervention and postintervention surveys.[2] VR programs showing nature scenes were provided to patients during their infusion treatments. Participants self-reported their anxiety to be lower, and strongly agreed to feeling immersed in

the environment. Qualitative feedback revealed that patients appreciated and valued the intervention, feeling less anxious, worried, and more relaxed.[1] In another study, patients receiving immunotherapy for irritable bowel syndrome were provided with a VR experience via a headset during their treatments.[3] Using the STAIS tool, the patients self-reported an improvement in their sense of well-being and decreased anxiety while waiting for medication administration. This study determined that further research was needed in terms of VR reducing anticipatory anxiety prior to infusion, as it was administered prior to the start of their treatment.[3]

In terms of the more concrete, quantitative measures of the physiologic response, studies that provided patients with exposure to nature scenes for 10-minute intervals showed a noticeable shift from a state of *fight or flight* to a parasympathetic nervous system response, as evidenced by electromyography studies and pulse. Functional MRIs of patients exposed to nature scenes reported increased blood flow to the cingulate cortex, an area of the brain that promotes stability of thought processes. Restorative effects were noted, especially when patients viewed a scene containing water.[4]

The Stress Reduction Theory supports the use of *green* nature-based environments to reduce stress and adverse emotions. By creating a nature-based environment, we not only improve the environment of care, but adhere to the theoretical basis that changing the environment virtually can have a positive effect on one's mood.[5] Nature-based scenes have been shown to have a lower level of stimuli, therefore, while Stress Reduction Theory focuses on reducing psychological stressors, the Attention Restoration Theory is geared more towards the resolution of mental fatigue due to stress.[6] Patients experiencing the lifting of mental fatigue have improved processing capabilities and the ability to perform tasks with a higher level of cognitive function, which may be helpful in retention of knowledge about self-management of symptoms.[7] In this theoretically based way, this can promote patient self-efficacy.

Our Methodology

In planning the intervention, our project team reviewed Press Ganey patient satisfaction data, which reflected an opportunity to improve upon staff's concern for the patient's comfort during their infusion treatments. A main component of the patient's comfort is anxiety management; thus, the STAIS tool was chosen. STAIS is widely considered to be the *gold standard* for this measurement; however, it is lengthy, leading our team to use the adapted STAIS-5 tool. This 5-question measure, developed by Zsido, et al,[8] is a validated tool measuring factors indicative of anxiety on a 5-point Likert-type scale. The tool was selected because of its abbreviated nature to reduce the *paperwork fatigue* and overwhelm that often manifests during new patient appointments.

This project was an exploratory venture, testing different VR apps and products. The study compared a cardboard-based, low-tech system to an advanced VR gaming device to determine which process would be most cost-effective, conducive to nursing workflow, and produce positive patient outcomes. The Infusion Center at Moffitt Cancer Center at Wesley Chapel served as the pilot site, averaging anywhere from 35 to 40 patients per day. Initially, our project team purchased 40 cardboard headsets in anticipation of surveying 40

patients undergoing their first chemotherapy treatment during this time. Cycle 1, day 1 patients were selected due to the high degree of stress and uncertainty during the first exposure to treatment in an unfamiliar environment.

The cardboard headsets were selected due to low initial costs and their reduced risk of transmitting pathogens. As the COVID-19 pandemic presented a high risk at the time of initial planning, our project team felt that a computerized headset would not be advisable, as it would need to be cleaned between each patient. Due to the variability of cleaning practices, the risk of potential infection was thought to be higher than with a single-use headset.

In December 2021, our infusion nurses underwent an in-service training to provide information about the intervention process and purpose and orient them to the device. At the start of the intervention, the nurse assessed the patient's level of anxiety using the STAIS-5 tool. Patients were asked to rate common symptoms of anxiety on a 5-point Likert-type scale. Nurses explained the rationale for the survey and educated patients about the intervention. If patients agreed to participate, they were provided with a cardboard VR headset for use with their own cell phone. Because the devices are single use, they could be taken home and brought to each appointment. The nurse assisted patients with setting up the device and choosing a VR video from a YouTube playlist. Patients then watched a 10- to 15-minute nature-themed video during their infusion. After the intervention, nurses reassessed patients again using the adapted STAIS-5 tool.

After 2 months of initial data collection in May 2022, our project team conducted a PDCA (plan, do, check, act) cycle to evaluate progress. Comments from patients and nurses revealed that the initial cardboard headset did not fit a variety of phone types and required separate earphones for sound. Patients had to choose their own YouTube video; it was challenging to find a high-quality 360-degree video that showed clearly through the headset. Patients reported blurry visuals, as the lenses were not adjustable to accommodate different pupillary distances. There was low patient participation due to an overwhelming number of steps in the process, creating an additional stressor instead of a relaxing experience as planned. Additionally, nurse workflow was affected due to the complicated set up, creating delays in patient care. To mitigate these barriers, our project team applied for an evidence-based practice grant through the Florida Organization for Nursing Leadership (formerly the Florida Organization of Nurse Leaders) and was granted funding towards purchasing a Meta Quest headset for the infusion suite. Nurses ceased the use of cardboard headsets after the Meta Quest headset arrived. TRIPP VR was chosen as the primary app for delivery of mindfulness content.

> This pilot project illustrated the process of pivoting to a more advanced system, supporting that more complex VR technology is a worthy investment.

After the pivot was made to the Meta Quest system in June 2022, additional in-services were held with the infusion nurses, and flyers were created to promote use. Our project team found that the padding and head strap made the headset much more comfortable for patients and presented a clearer image and sound. Nurse workflow became more streamlined, as the TRIPP VR app was preloaded, and nurses only needed to provide a brief tutorial prior to use. The simplicity greatly improved the patients' degree of autonomy in the use of the technology and garnered increased interest from patients due to ease

of use. Our team created a guide to orient patients to the features and processes, including wearing the headset, adjusting the view, safety precautions, and an overview of the app.

Participation greatly increased during the months following implementation of the electronic system, generating positive responses from both patients and nurses. The video was limited to 15 minutes to prevent cybersickness, potential nausea, dizziness, and vomiting due to dysregulation when readjusting to the real-world environment. The same process was followed using the STAIS-5 tool preintervention and postintervention, with a comment feature that allowed patients to share their perception of the intervention in their own words.

Our Data Analysis

Twenty-five surveys were collected from March 2022 to October 2022 for the initial intervention period. Figures 1-3 provide data from these surveys. We would like to note that prior to implementation of Meta Quest, patients responded with negative comments related to difficulty with the cardboard set-up, audio, and visuals. After June 2022, patients responded favorably to the Meta Quest headset:

- "I tried VR immersion to see if it would help distract from the side effects, and I can tell you it does. The only time I received those insane shivers and my fingers going ice cold was when I went to the bathroom. When I came back and put that VR headset on and got immersed in that light, I felt that my concentration was elsewhere other than the way I was feeling and even when I took the headset off, I never regained the tremors."
- "…the experience did make me laugh and distract me from the infusion, so I think it helped with my anxiety."
- "In the short time I viewed the calm experience, I can see how beneficial it can be. Truly enjoyed it."
- "Absolutely recommend VR for anyone that is nervous. Extremely relaxing."
- "This is my first chemo treatment, and I find this very helpful. I know how potent it is to have a good distraction at times to help you relax and refocus."
- "Very interesting and different kind of experience thanks!"
- "Good distraction from the normal setting."
- "I love it!"

Our Current State and Future Directions

The pilot project has been sustained as the standard of care in the Infusion Center at Moffitt Cancer Center at Wesley Chapel since October 2022. In January 2023, the intervention was opened to all patients undergoing infusions, regardless of type or cycle phase. By expanding the patient population, our project team has noticed enthusiastic interest from patients of all ages and diagnoses. Eventually, VR will be disseminated as standard of care across multiple infusion centers throughout the health care system. Additional data are being collected as part of continued efforts to pilot implementation

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Figure 1. Virtual Reality Patient Survey: STAIS-5 Results, March-October 2022

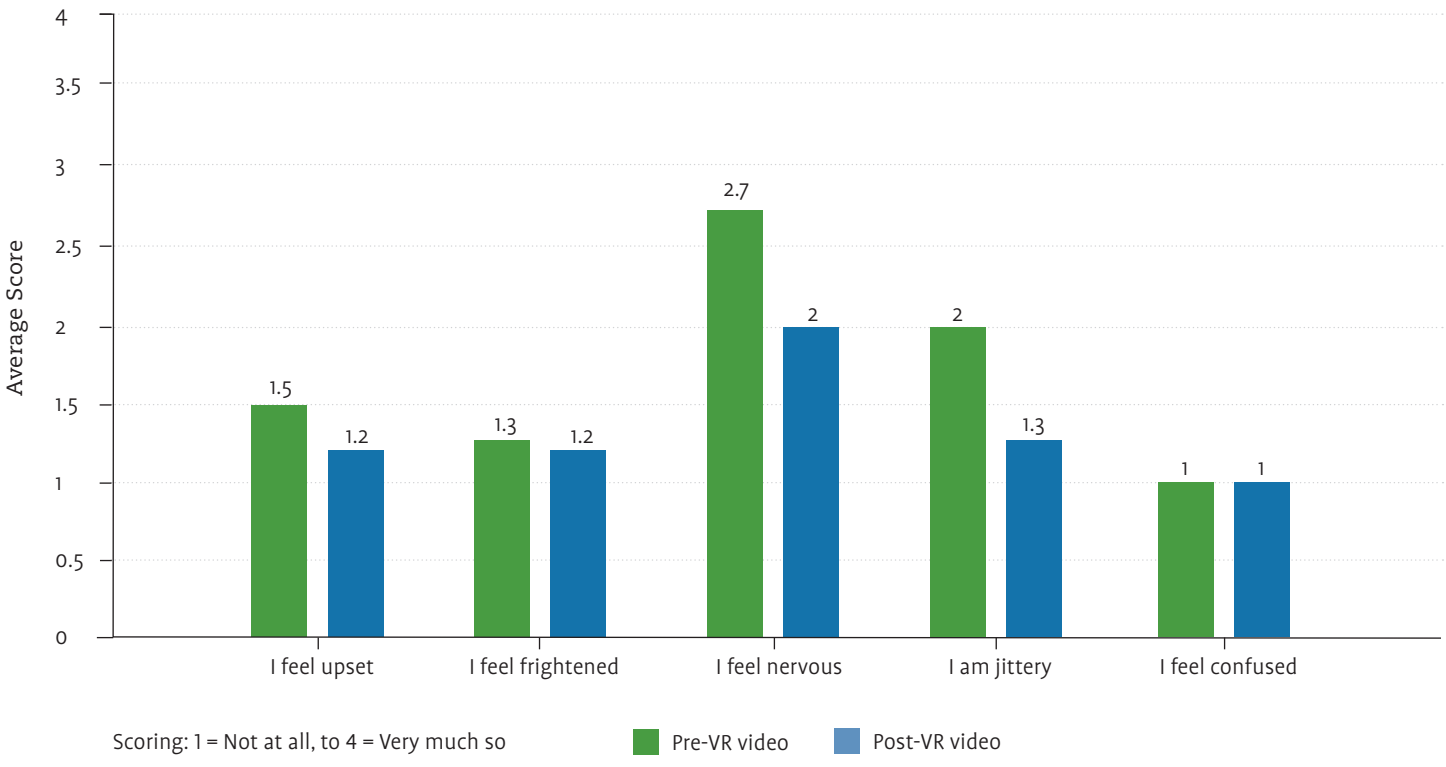


Figure 2. Percentage of Patients With Improved Symptoms

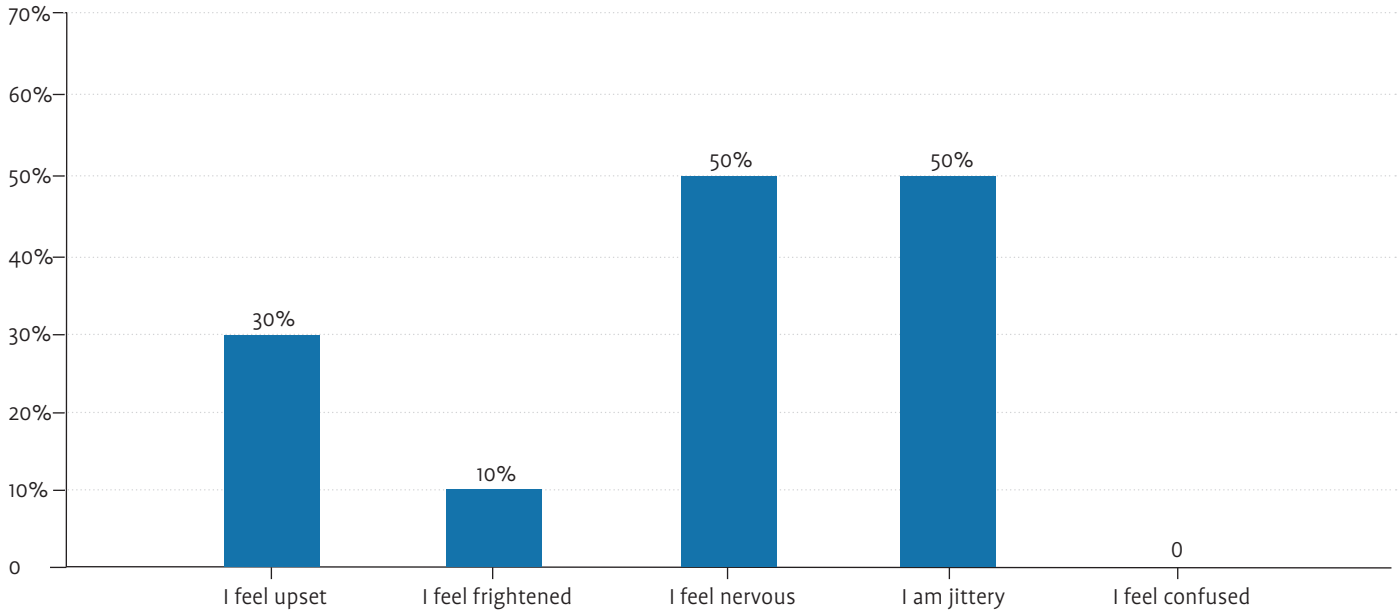
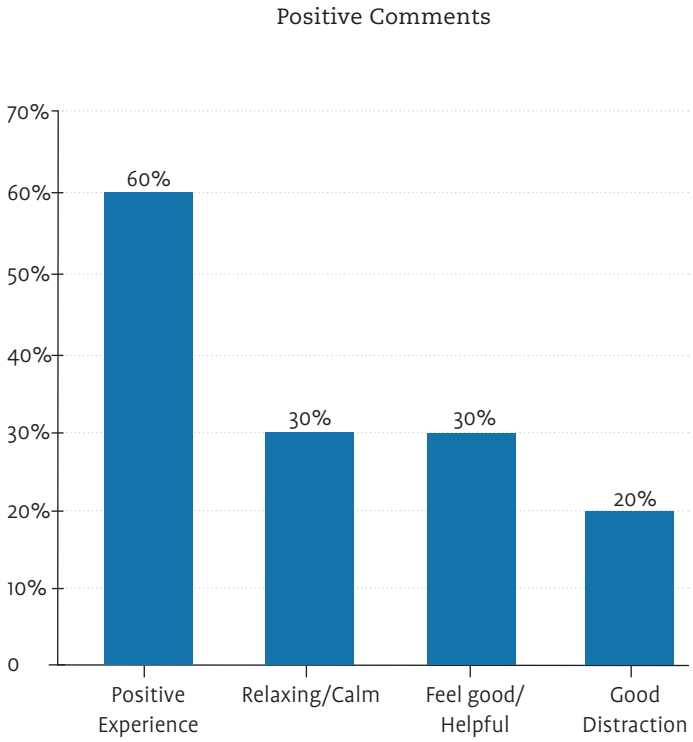
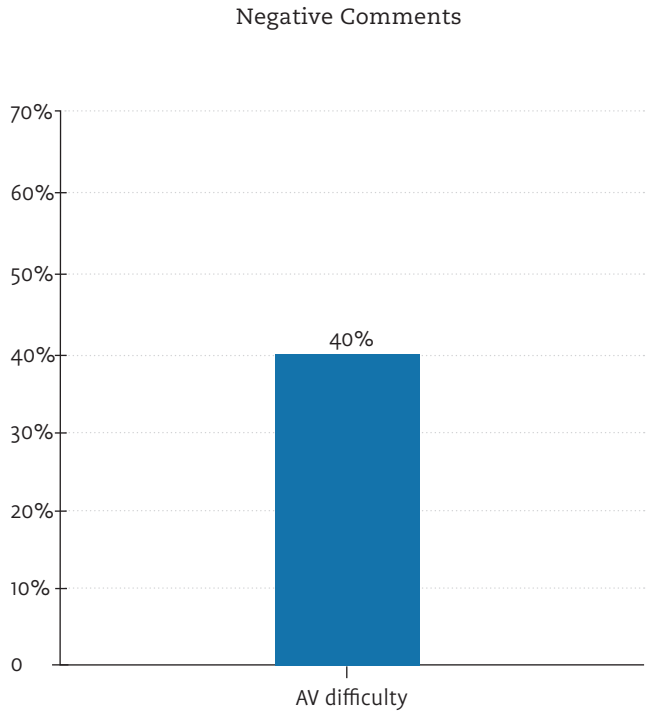


Figure 3. Qualitative Feedback





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of science-based research on use of virtual reality.

This pilot project illustrated the process of pivoting to a more advanced system, supporting that more complex VR technology is a worthy investment. Subsequently, this technology empowered patients—young and old—to expand their comfort with using technology in the health care environment. Although this technology was easily adopted by participants, additional exploration into other VR devices and apps should be carried out to evaluate ease of use. Information on age and diagnosis was not collected during this project; however, comparison of usage between patients of varying ages and diagnoses would be beneficial in creating future systems that are adaptable to meet individual needs and challenges. While state of anxiety and patient satisfaction were the sole metrics for this pilot project, biologic feedback using heart rate could provide an additional indicator of parasympathetic nervous system activation during the intervention. Future studies are needed to investigate integration of technology into nurse workflow and ease of use from a nursing perspective.

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Acknowledgments

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TRIPP VR is an evidence-based application for VR headsets. Although used in this intervention, Moffitt Cancer Center does not promote this product, or the Meta Quest. Neither the project leads nor Moffitt Cancer Center have received any financial compensation or incentive for the use of these products.

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PHOTOS OF PATIENTS AND PROJECT TEAM HAVE BEEN USED WITH PERMISSIONS.