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Unlocking VR Magic: Duration of Anxiety Relief for Pediatric Needle Procedures

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Unlocking VR Magic: Duration of Anxiety Relief for Pediatric Needle Procedures

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NURS 4500: Nursing Research and Senior Thesis

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November 23, 2023

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Abstract

There have been various studies that show the effectiveness of virtual reality (VR) being used as a non-pharmacologic and distraction method on school-aged children ranging from 6-12 years old. Despite this research, there has not been a follow-up with the use of VR and its duration of effect between each patient visit within this certain population. This study focuses on measuring the participants' anxiety and pain levels during the needle-related procedure. The assessment tools that will be used to measure these important variables are the Children's Fear Scale and Wong-Baker's FACES scale. The participants of this study will be placed into two groups: VR intervention and standard care (SC) group. The SC group will be followed for the first month and after their trial, the VR group will also be going through the same process for the second. Statistical analysis will also be used to see correlation coefficients. The goal of this study is to evaluate the duration of effectiveness for VR being used in an outpatient setting. Ethical considerations are highly important for the safety and privacy of the participants in the study.

Unlocking VR Magic: Duration of Anxiety Relief for Pediatric Needle Procedure

Pain is an unpleasant sensory and emotional experience that is associated with actual or potential tissue damage (Malik, 2020). Pediatric medical treatments frequently involve procedures that can cause discomfort including vaccinations, intravenous injections, laceration repairs, and dressing changes for burn wounds (Arane, et al., 2017). Postier et al. (2018) found significant variation in pain prevalence among the hospitalized pediatric patients, ranging from 24% to 80%, encompassing both moderate and severe pain levels. The fear of pain can consume a hospitalized patient, leading to both physical and psychological suffering. The studies have been found that the top fear among hospitalized school children from ages 6-12 years old—is needle-related procedures (Hart and Bossert, 1994). Children tend to exhibit such fear with sobbing, yelling, body twisting, and tightening their muscles (Chen, et al., 2020). They frequently experience psychological distress, which may manifest as anxiety, anger, and other emotional expressions, stemming from their limited control over their environment. The feeling of helplessness, combined with fear and pain, can lead to a sense of powerlessness among children in healthcare settings. These emotional reactions have the potential to impede timely medical treatment, extend treatment duration, and diminish the quality of patient satisfaction. (Lerwick, 2016). Common methods for pediatric pain reduction are pharmacological treatment including opioid therapy. The use of opioids is associated with a high tolerance and dependence, resulting in various side effects such as nausea, constipation, cognitive impairment, and respiratory depression. Prolonged or regular use may further contribute to physiological complications like dependence and tolerance (Arane, et al., 2017). To avoid these complications, researchers have been exploring non-pharmacological interventions for children undergoing needle-related procedures to reduce pain and anxiety. Among those, virtual reality shows great promise.

Virtual reality (VR) is a sophisticated computer technology that replicates a three-dimensional environment, mirroring real-world experiences. VR consists of a head-mounted display and a pair of goggles, which are connected to either a computer or mobile device. The user's head motions are tracked by sensors in the headset, giving the impression that they are moving around in the simulated environment (Arane, et al., 2017). Recent high-quality research indicates that immersing children in a virtual world during needle-related procedures in a hospital effectively reduced or eliminated the typical fear and anxiety they would otherwise experience.

Problem Statement

School-aged children perceive that needle-related procedures are painful. This association intensifies their anxiety levels, posing challenges for staff to administer medical treatments and collect specimens for testing that does not traumatize the pediatric patient and their loved ones safely, efficiently, and compassionately. There have been various studies performed that VR has been effective for school-aged children receiving needle-related procedures. Although, there are several factors that have not been studied such as the type of environments used while the patient is receiving the treatment.

Hospitals can already be overwhelming places and introducing highly stimulating atmospheres can lead to sensory overload. Chen et al. (2020) conducted a study offering patients a choice between four VR environments: a roller coaster, space exploration, a wildlife park, or a travel destination. It was discovered that roller coasters heightened anxiety, especially in children with pre-existing fears of environments. The intense and unpredictable nature of roller coaster simulations increased anxiety and fear levels in these children, which is counterproductive to their treatment and recovery. Figuring out the best virtual environments to ease fear and anxiety

in school-aged children undergoing needle-related procedures is still a challenge. Anxiety stemming from procedure-related pain, coupled with elements like loud noises and the presence of multiple healthcare professionals, can further amplify children's fears.

The current research endorses the use of virtual reality to alleviate fear and anxiety in school-aged children undergoing needle-related procedures, but it is not well understood which simulated environments will have the best outcomes. The existing research highlights the immediate benefits of virtual reality in distracting children during outpatient needle-related procedures. However, there is a notable gap in understanding how the positive effects of VR endure over extended periods, emphasizing the need for investigations into its prolonged effectiveness in alleviating anxiety across multiple outpatient sessions.

Purpose Statement

The purpose of this research is to conduct a longitudinal research study to observe the long-term effects of how virtual reality can be used as a non-pharmacological approach for school-aged children receiving needle-related procedures, while improving the quality of care in an outpatient setting.

Problem Question

How does the implementation of Virtual Reality (VR) impact the long-term effectiveness in alleviating anticipatory fear and distress among school-aged children undergoing needle-related procedures in outpatient settings?

Hypothesis

If VR is used as a distraction method during needle-related procedures for school-aged children, then there will be a positive carry-over effect, which will reduce their anxiety, distress, and pain perception levels. This long duration of effect will enable children undergoing needle-related procedures to feel safer and more comfortable, and staff to be more efficient.

Literature Review

School-aged children frequently encounter pain and anxiety during needle-based procedures. VR has been shown in multiple randomized controlled trials to be a compelling and effective intervention to mitigate anxiety and pain experienced by pediatric patients undergoing needle-related procedures and elevate care satisfaction (Walther-Larson et al., 2019). This literature review aims to investigate the impact of VR on elementary school-aged children, considering the immediate and long-term effects, patient and family satisfaction, and the influence of VR environment. The articles included in this review were retrieved from the following databases: PubMed, Iceberg, Google Scholar, and CINAHL, which were accessed via the Dominican University of California Archbishop Alemany database. The database search terms used to find each article were: “pain management for children”, “anxiety management”, “virtual reality (VR) and augmented reality (AR) technologies”, “school-aged children”, “Venipuncture Procedures”, and “Needle-related Procedures”.

The criteria for the research articles were as follows:

- Primary studies
- Peer reviewed
- Publication between 2018-2023

A total of six articles were selected and are organized under the following subheadings:

- Efficacy of Virtual Reality
- Physical and Psychological Impact after Receiving VR Therapy
- Patient Satisfaction and Experience Post Therapy

Efficacy of Virtual Reality

The first theme explores the efficacy of virtual reality used on school-aged children who are receiving needle-related procedures. Chen et al. (2020) executed a randomized controlled study with the objective of assessing the impact of virtual reality as a distractive intervention on the reduction of pain and fear experienced by school-aged children receiving intravenous (IV) injections within an emergency department. The participants consisted of 136 children in total ranging from 7-12 years. Participants were randomized into two groups, each with 68 children. The intervention group was exposed to VR via headsets just prior to and during the procedure. In contrast, the control group received standard care (i.e., topical anesthetics and parental presence). Participants, caregivers, and nurses who assessed pain and fear levels underwent evaluation within each group (controlled and experimental). This evaluation utilized the Wong-Baker FACES scale and the Children's Fear scale, with ratings provided by the children, their caregivers, and nurses. The researchers measured the time required for successful IV injections throughout this study.

The participants, on average, were of 9.13-year-old (± 1.71) with a mean body mass index of 17.18 (± 2.79). Many of the participants were male (77; 56.6%), and a substantial proportion (107; 78.7%) had no prior experience with virtual reality (VR). The use of VR reduced procedure duration. The differences in the times required for intravenous injections between the experimental and control groups were statistically significant ($p = .046$). In one scenario, the

children received intravenous injections in an emergency department's setting. The numbers closely followed the ratings given by their caregivers and nurses and this had significant correspondence to their degree of fear and pain. All of which, led to significantly low statistical numbers of the group of kids in VR ($p = .031; .043$). The strength in accordance with this study is the use of a randomized controlled study as a robust method for assessing intervention effectiveness. Another is that there was a very large sample size that added to the research's statistical power and generalizability. Regarding its limitations, it did not explore the long-term effects of the intervention of VR beyond reduction in pain and fear during and immediately after the procedure.

Wong et al. (2020) also investigated to what extent VR gaming as a distraction strategy could enhance a child's experience with needle-related procedures. In their prospective pilot study, the researchers randomly assigned 30 children and young adults (aged 5 to 21) scheduled for IV starts or undergoing peripherally inserted central catheter (PICC) dressing changes or placements to either receive the VR intervention or standard care.

Patients, along with their caregivers, were requested to evaluate their pain levels using the FACES scale both prior to and following the initiation of IV starts and PICC line dressing changes and replacements. The children in the VR group reported less post-procedure pain. Caregivers in the same group also noted reduced pain in their children. This highlights the effectiveness of virtual reality (VR) in mitigating pain for patients undergoing frequent IV placements and dressing changes. The weakness in this study, however, has a relatively small sample size that may have limited the chances to detect statistically significant differences. Additionally, this research did not investigate the long-term effects of using VR for pain management or its application in more acute settings. A strength regarding this study is that it

addressed an important clinical question regarding pain management for children receiving needle-related procedures. Both studies emphasized the efficacy of virtual reality being used on pediatric patients to reduce their pain and anxiety levels when they received their treatment.

Physical and Psychological Impact After Receiving VR Therapy

The next concept is how VR leaves an impact towards the physical and psychological well-being of pediatric patients. Kjeldgaard et al. (2023) investigated the effect of immersive virtual reality on pressure pain threshold in a clinical pediatric setting. Finding the pressure pain threshold had eventually ruled out to have no correlations between background characteristics and the effect of VR. The study executed a crossover randomized controlled trial (RCT) in which participants were randomly assigned to 24 sequences of four interventions that include: immersive VR game, immersive VR video, tabled-based 2D video, and a controlled condition that involved small talk. The sample population included 72 children ranging between ages 6-14 years. The researchers measured outcomes by checking each patient's heart rate, pressure pain threshold (PPT) and anxiety levels before and after the medical procedure. They measured anxiety with the Modified Yale Preoperative Anxiety Scale (mYPAS).

Data from 33 girls and 39 boys were included for analysis with the median age of 10.5 years. Statistically, there were no significant differences associated with age or gender between the groups. The assessment of pressure pain threshold (PPT) was well-tolerated by using a handheld algometer, which is placed on the surface of the skin to apply and increase pressure. This pressure then reaches a point where the perception of pain is determined. Although the increase in heart rate during the VR game did not reach statistical significance (HR diff (VR game): 1.5 bpm, $p = 0.1196$), anxiety levels were statistically significantly reduced during the VR game and VR video interventions ($p < 0.0001$). In the context of non-pharmacological pain and anxiety

management for children, VR proved the most effective, surpassing 2D video and small talk interventions in the control group with a mean difference of 136 kPa (CI 112;161) and 122 kPa (CI 91-153). This study highlights VR's ability to assess the pain and anxiety level of a child without introducing biases of standard of care and without the presence of well-controlled designs. Since the study focused on the short-term effects, it is not possible to extrapolate the duration of VR's effect on reducing anxiety levels.

Another study conducted by Orhan and Gozen (2023) investigated the impact of utilizing VR headsets during venipuncture procedures on pain levels, heart rate, and oxygen saturation values among pediatric patients aged 7-12 years. The study sought to evaluate the potential of VR as a non-pharmacological strategy for enhancing children's tolerance to invasive procedures and reducing their pain experiences. There were 102 participants in this RCT with 52 assigned to undergo venipuncture while using VR and 50 assigned to undergo the usual venipuncture procedure. Throughout the experiment, Face Pain Scale-Revised (FPS-R) and State-Trait Anxiety Inventory for Children (STAIC) were utilized to assess the pain and anxiety in the children. The FPS-R consisted of 0 to 10 facial expression points; points 1-3 were considered mild pain, points 4-6 considered moderate pain, and points 7 to 10 considered severe pain. STAIC, on the other hand, used two separate scales that had 20 items in each and reversed items. STAIC was once previously used for a study to determine the control and experimental groups anxiety levels prior to the procedure. The post-procedure pain scores were found to be 1.46 +/- 1.49 in the experimental group and 4.44 +/- 2.26 in the control group. The VR intervention significantly reduced post-venipuncture pain scores in the experimental group compared to the control group ($Z=-6.574$; $P=0.001$). Regarding secondary outcomes, the mean heart rate (HR) during the procedure demonstrated a noteworthy decrease in the experimental group ($99.27 \pm$

18.34/min) in comparison to the control group (108.20 \pm 21.42/min) ($P = 0.026$; $t = -2.265$). However, no statistically significant difference was observed in the before and after procedure changes in oxygen saturation values between the two groups (Experimental Group: -0.15 ± 1.54 ; Control Group: 0.04 ± 0.93) ($Z = -0.023$; $P = 0.982$). These findings suggest that VR can be deemed an effective means to alleviate pain in children during venipuncture procedures. The utilization of VR headsets could thus be acknowledged as a valuable tool for mitigating the pain experienced by children in hospital environments. A strength about this study is that the researchers focused on having the range of 7-12 years old school-aged children to provide insights from this certain population. The limitation regarding this study was that the sample size is relatively small for this research and did not investigate the long-term effects of VR.

These two experiments were able to show the impacts of virtual reality in a physical and psychological approach. However, it is also a known commonality that the limitations of both experiments are the duration of effect of using this non-pharmacological approach. There was not any evidence of a follow-up appointment when receiving another needle-related procedure, so it is uncertain of how effective VR is for a long-term effect.

Patient Satisfaction and Experience Post Therapy

The last theme regarding this study is the patient satisfaction after receiving the procedure and using VR as a distraction method. In their RCT, Gold and Mahrer (2018) evaluated not only the feasibility and efficacy of having participants aged 10-21 years engage with VR during venipuncture, but they also examined its impact on patient and caregiver satisfaction with the encounter. The study of this article was a randomized controlled trial, which consisted of a triad group that includes: the patient themselves receiving the blood draws, their caregivers, and phlebotomists. Outcomes measured were pain, anxiety, and satisfaction scores before and after

the procedure and compared with those of the control group that received usual care. An interaction between patient-reported anxiety sensitivity and treatment conditions was explored to assess the effects of VR on the participants with high anxiety sensitivity.

The results of Gold and Mahrer's study demonstrated a significant reduction in acute procedural pain and anxiety when using VR compared to usual care. Notably, an important interaction emerged between patient-reported anxiety sensitivity and the treatment condition, suggesting that patients undergoing routine blood draws derive greater benefits from VR intervention when they experience heightened fear related to physiological sensations associated with anxiety. Both patients and their caregivers who participated in the VR condition reported elevated levels of satisfaction with the procedure. The strengths regarding this study were that researchers were able to assess the outcome and different aspects between the patients, caregivers, and phlebotomists. It also assessed the outcomes from different perspectives between the patients, caregivers, and phlebotomists. However, the limitation within this study is that there might have been variations in the VR environment and content, especially with the age differences that ranged from 10-21 years old.

Walther-Larsen et al. (2019) conducted an RCT with 64 children aged 7-16 undergoing venous cannulation before anesthesia. Walther-Larsen et al., (2019) divided the participants into two groups: the control group receiving usual care and the intervention group receiving standard care with VR-based distraction in the form of a custom-designed 3D interactive game.

The Visual Analog Scale (VAS) was used to capture participants' procedural pain levels. The researchers hypothesized they would detect at least a 20 millimeters difference on the VAS between groups, however, there was not such a spread. VAS scores for procedural pain between the VR and control groups were 27 out of 100 and 15 out of 100, respectively. There was a high

level of patient satisfaction with the intervention group scoring approximately 80 out of 100 for their contentment with the distraction measures. When questioned about their willingness to employ the same distraction method again for procedural pain, all 28 out of 28 children (100%) in the VR group responded affirmatively, compared to 26 out of 31 (84.9%) in the control group, representing a marginally significant difference. One of the strengths within the study was the inclusion of patient satisfaction as an outcome measure to provide insights to the acceptability of VR as a non-pharmacologic approach. Another strength is that the researchers considered a difference of 20 in pain score to be clinically relevant on a scale of 0 to 100. They conducted a power analysis which recommended a sample size of 42 patients with 90% power at the 5% significance level. They enrolled about 50% more participants to allow for attrition and were able to maintain a large enough participant to power the study as planned. One of the strengths in this study was that patient satisfaction was also measured as an outcome to observe the effect of VR as a distraction method. Although, the limitations towards this research were that there were more boy participants than girls. There were a total number of 27 boys who participated in the VR group and 25 boys in the control group. Unlike those numbers, only one girl took part in the VR group and 6 girls in the control group. Given these numbers, there would not be any biases if the experimental and controlled groups had similar numbers in girls and boys.

The findings presented in these six articles strongly support the idea of equipping children with VR headsets. This technology can immerse them in a simulated environment, effectively distracting them from needle-related procedures such as IV starts, venipuncture, PICC line placement, and PICC line dressing changes. This clearly demonstrates that virtual reality (VR) offers valuable benefits not only to individuals undergoing needle-related procedures but also to healthcare professionals performing these skills on pediatric patients. Nevertheless, there is still

the concern if virtual reality can be taken for the use on long-term effects to have the overall satisfaction of therapeutic intervention.

Theoretical Framework

The theoretical framework that is used to support this research is Jean Watson's Theory of Human Caring. According to Watson, the core concept of this theory is that individuals should be regarded with dignity and not be objectified, as they are inseparable from their own selves, other individuals, the natural environment, and the broader societal context (Watson 1997). Watson emphasizes the importance of nurses addressing the spiritual dimension of individuals to deliver the best quality of care. Regarding the fundamental aspects of an individual and their health, this theory elucidates the interdependence of these elements with the patient's overall well-being. Watson highlights the importance of concepts such as an individual's capacity for self-healing, the seamless integration of mental, physical, and spiritual elements, and the advancement of consciousness (Nikfarid et al., 2018, p. 2). The nursing paradigm with an environmental focus prioritizes the patient's overall health, considering a comprehensive evaluation of both internal and external environmental factors (Nikfarid et al., 2018).

Jean Watson's Theory of Human Caring plays a pivotal role in enhancing our understanding of the use of virtual reality as a pain and anxiety management tool for school-aged children undergoing needle procedures. Watson's theory emphasizes the holistic nature of care, emphasizing the importance of recognizing and addressing not only the physical but also the emotional, psychological, and spiritual dimensions of the patient. In the context of needle procedures for children, this theory underscores the significance of acknowledging the anxiety and fear these young patients may experience. Virtual reality interventions can be seen to align

with Watson's principles by providing a therapeutic and immersive experience that transcends the mere alleviation of physical pain. This theory helps healthcare professionals use VR to reduce pain and anxiety in school-aged children during medical procedures by focusing on their emotions and creating a caring environment, leading to more complete and patient-centered care.

Research Design

The application of Virtual Reality (VR) technology to reduce pain and suffering, provide patient education, and promote rehabilitation has ushered in a new era of innovative, patient-centered care. There is overwhelming evidence that VR alleviates the distress and anxiety experienced by school-aged children undergoing needle-related medical procedures. While the immediate benefits of VR as a distraction tool in such settings, there remains a gap in our understanding of its long-term effects on these young patients. This thesis proposes a longitudinal study to explore VRs duration of effect in this population. The investigation aims to determine if virtual reality confers benefits between encounters by alleviating anticipatory fear and distress previously encountered by young patients in connection with upcoming needle-related procedures. By delving into the extended effects of VR technology on this vulnerable population, we can better inform healthcare practitioners, educators, and policymakers on the most effective ways to incorporate VR into the care continuum, ultimately enhancing the well-being of children and promoting more compassionate healthcare practices.

Objective

A longitudinal mixed methods research study will be conducted to analyze the long-term effect of VR on school-aged children in an outpatient infusion center. The study's objective is to provide critical insights into the enduring effectiveness of VR as a coping tool in pediatric care.

The goal is to enhance the quality of care for school-aged children during needle-related procedures and to contribute to the development of evidence-based, patient-centered healthcare practices for the long term.

Method

We will recruit a cohort of children aged 6-12 years scheduled for needle-related medical procedures and administer VR interventions during these procedures. Data will be collected during the immediate intervention and at multiple time points post-procedure within a month. Standardized psychological assessment tools will be used to measure anxiety levels (Children's Fear Scale) and pain (Wong-Baker's FACES Pain Scale) perception over time, allowing for an examination of how the use of VR during the initial procedure influences these variables longitudinally. The Children's Face Scale (CFS) will be measured when assessing the participants' anxiety level between the time of entering the outpatient infusion center and starting the procedure. The parents/guardians of the participants will also rate their child's anxiety levels. Regarding the Wong Baker's FACES Pain Scale, it be used to measure the child's pain level immediately after the needle-related procedure has been performed.

Sample

To investigate the long-term effects of Virtual Reality (VR) interventions on school-aged children undergoing needle-related procedures, this study will employ a carefully selected sample. The participants in this study will consist of 128 children ranging from 6-12 years old. This sample population will be recruited with posters and flyers that are seen visibly in the outpatient infusion center. These children will be placed into two groups which includes: VR intervention (experimental) group and standard care (control) group. The control group will receive traditional distractions such as hugging a teddy bear or their parents holding them during

the treatment to place their focus away from the procedure. The inclusion criteria for these individuals to part take in this research design is that it needs to be the child's first time to encounter a blood draw at the study clinic. They also need to have at least one subsequent encounter within 2 weeks of this study. A last criterion is that they are needed to be accompanied by their parent/guardian to measure their CFS through their perspective.

Data Collection

To rigorously investigate the long-term effects of Virtual Reality (VR) interventions on school-aged children undergoing needle-related procedures, a meticulous data collection strategy will be implemented. As a longitudinal research design is central to this study, data will be gathered at multiple time points to track the sustained impact of VR interventions. The initial data collection will take place immediately following the needle-related procedure, providing valuable insights into the immediate effects of VR on variables such as anxiety and pain perception. Data that needs to be collected is to first follow the control group and to assess them for Month 1. After each visit until the end of the study, participants will use both assessment tools to record the findings of their pain and anxiety levels. Once the control group has been done with their trial, Month 2 consists of following the experimental group to observe the duration of effect for VR being used. The same concept of the assessment tools will be used within this group as the control group. Towards the end of this study, the intervention group of parents/guardians will complete a 10-point scale to evaluate the duration of VR effect. Statistical analysis will also consist of looking at the correlation coefficients by using Pearson r-test to view the directionality between relationships. A t-test will also be used to measure the impact of VR intervention, whether it is statistically significant.

Limitations

One significant limitation in our research design arises from the potential variability introduced when children are accompanied by a different parent/guardian than the one present at the beginning of the experiment. This situation could lead to diverse reactions from the children during their regular blood draws, as the presence and involvement of different caregivers might influence their behavior and comfort levels in the clinic setting. This variability introduces a potential confounding factor, making it more challenging to attribute observed differences solely to the intervention rather than external factors associated with the change in the accompanying adult. Therefore, the impact of this variation needs to be carefully considered when interpreting the results of the study.

Ethical Considerations

The study of this design will obtain approval from Dominican University of California's Institutional Review Board (IRB) to proceed with this research. Informed consent from both the children and their caregivers, as well as ongoing assent from the participants, must be sought and respected throughout the study. Researchers must prioritize the comfort and safety of the children, addressing any potential distress or discomfort that may arise during the VR interventions and data collection. In addressing these ethical considerations, the research can not only contribute to our understanding of long-term VR effects but also strives to serve as a model for conducting research with children in a responsible and compassionate approach.

Conclusion

Virtual reality should not only be able to reduce fear and anxiety during needle-related procedures but between them as well. When VR's positive effects persist across encounters, children and their caregivers will be more likely to not associate these encounters with stress.

These effects will also help maintain a calm and safe environment for everyone. This methodological approach will enable a comprehensive evaluation of the extended impact of VR in pediatric care, contributing to the advancement of evidence-based practices in healthcare settings. VR has proven to be a feasible, well-tolerated, and favorably received tool among patients, caregivers, and phlebotomists, particularly in the context of routine blood draws. The immersive and engaging nature of the VR experience has the potential to transform the blood draw process, making it a less distressing and, in some cases, pain-free routine medical procedure, especially for pediatric patients with high anxiety sensitivity. In conclusion, VR is shown to have evidenced-based practices that will contribute to the reduction of pain and suffering in this clinical setting.

A recommendation for future study is to see how long the duration of effect lasts beyond this experiment's 1-month period. Another recommendation is to see if VR shortened the length of the procedure itself. This is to explore the secondary outcome for this experiment by measuring the time a participant got into the cleaning of the draw site to the removal of the tourniquet and placement of the band-aid. It would also be prudent to modify the CFS assessment tool to make its pictures more inclusive and pleasant for the child to interact with.

References

- Arane, K., Behboudi, A., & Goldman, R. D. (2017). Virtual reality for pain and anxiety management in children. *Canadian family physician Medecin de Famille Canadien*, 63(12), 932–934.
- Chen, Y., Cheng, S., Lee, P., Lai, C., Hou, I., & Chen, C. (2020). Distraction using virtual reality for children during intravenous injections in an emergency department: A randomised trial. *Journal of Clinical Nursing*, 29(3–4), 503–510.
<https://doi-org.dominican.idm.oclc.org/10.1111/jocn.15088>
- Gold JI., & Mahrer N.E. (2018). Is Virtual Reality Ready for Prime Time in the Medical Space? A Randomized Control Trial of Pediatric Virtual Reality for Acute Procedural Pain Management. *Journal of Pediatric Psychology*, 43(3), 266–275.
<https://doi-org.dominican.idm.oclc.org/10.1093/jpepsy/jsx129>
- Hart, D., & Bossert, E. (1994). Self-reported fears of hospitalized school-age children. *Journal of pediatric Nursing*, 9(2), 83-90.
- Kjeldgaard Pedersen, L., Fisker, L. Y. V., Rölfing, J. D., Ahlburg, P., Veien, M., Vase, L., & Møller, M. B. (2023). Virtual reality increases pressure pain threshold and lowers anxiety in children compared with control and non-immersive control—A randomized, crossover trial. *European Journal of Pain*, 27(7), 805–815. <https://doi.org/10.1002/ejp.2108>
- Lerwick J. L. (2016). Minimizing pediatric healthcare-induced anxiety and trauma. *World journal of clinical pediatrics*, 5(2), 143–150. <https://doi.org/10.5409/wjcp.v5.i2.143>
- Malik N.A., n.d. Revised definition of pain by “International Association for the Study of Pain”: Concepts, challenges and compromises. *Anaesthesia, Pain & Intensive Care*. 2020;24(5):481-483. doi:10.35975/apic.v24i5.1352

- Nikfarid, L., Hekmat, N., Vedad, A., & Rajabi, A. (2018). The main nursing metaparadigm concepts in human caring theory and Persian mysticism: A comparative study. *Journal of Medical Ethics & History of Medicine*, 11(6), 1–N.PAG.
- Orhan E, & Gozen D. (2023). The Effect of Virtual Reality on Pain Experienced by School-Age Children During Venipuncture: A Randomized Controlled Study. *Games for Health Journal*, 12(4), 330–339. <https://doi-org.dominican.idm.oclc.org/10.1089/g4h.2022.0232>
- Postier, A. C., Eull, D., Schulz, C., Fitzgerald, M., Symalla, B., Watson, D., Goertzen, L., & Friedrichsdorf, S. J. (2018). Pain Experience in a US Children’s Hospital: A Point Prevalence Survey Undertaken After the Implementation of a System-Wide Protocol to Eliminate or Decrease Pain Caused by Needles. *Hospital Pediatrics*, 8(9), 515–523. <https://doi-org.dominican.idm.oclc.org/10.1542/hpeds.2018-0039>
- Walther-Larsen S, Petersen T, Friis SM, Aagaard G, Drivenes B, & Opstrup P. (2019). Immersive Virtual Reality for Pediatric Procedural Pain: A Randomized Clinical Trial. *Hospital Pediatrics*, 9(7), 501–507. <https://doi-org.dominican.idm.oclc.org/10.1542/hpeds.2018-0249>
- Wong, J., Ghiasuddin, A., Tamaye, H., & Siu, A. (2020). Effectiveness of Virtual Reality Gaming on Pain Reduction in Children During PIV/PICC Placement. *Journal of Technology in Behavioral Science*, 5(4), 378–3

APPENDIX A

Literature Review Table

Title of your paper: **Unlocking VR Magic: Duration of Anxiety Relief for Pediatric Needle Procedures**

Your Name: Anna Angelica Mendoza

Date: November 23, 2023

Author/Citation	Purpose/Objective of Study	Sample - Population of interest, sample size	Study Design	Study Methods	Major Findings	Strengths	Limitations
Chen, Y., Cheng, S., Lee, P., Lai, C., Hou, I., & Chen, C. (2020). Distraction using virtual reality for children during intravenous injections in an emergency department: A randomised trial. <i>Journal of Clinical Nursing</i> , 29(3-4), 503-510. https://doi-org.dominican.idm.oclc	Investigate whether using virtual reality (VR) as a distracting intervention could reduce pain and fear in school-age children receiving intravenous (IV) injections at an emergency department	Consisted of school-age children aged 7-12 years who are receiving IV injections in an emergency department. The study included 136 children in total	Randomized controlled study	Pain and fear levels were evaluated using the Wong-Baker FACES scale and the Children's Fear scale, with ratings provided by the children, their caregivers, and nurses	Those who were placed in the VR group showed a significantly lower pain and fear scores	<p>The use of a randomized controlled study is a robust method for assessing intervention effectiveness</p> <p>There was a very large sample size that adds to the study's statistical power and generalizability</p>	<p>Did not explore the long-term effects of the intervention of VR beyond reduction in pain and fear</p> <p>The design of the study may not account for individual differences in children's responses to VR</p>

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Walther-Larsen S, Petersen T, Friis SM, Aagaard G, Drivenes B, & Opstrup P. (2019). Immersive virtual reality for pediatric procedural pain: a randomized clinical trial. <i>Hospital Pediatrics</i> , 9(7), 501–507. https://doi-org.dominican.idm.oclc.org/10.1542/hpeds.2018-0249	Investigate patient satisfaction and pain reduction in children undergoing venous cannulation procedures by using VR as a distraction method	The study enrolled 64 children aged 7-16 years who were scheduled to venous cannulation procedures	Randomized clinical trial design	The primary outcomes measured were patient satisfaction and procedural pain, assessed using a visual analog score (VAS) Secondary outcomes included procedural time and occurrence of adverse events	The study found a high level of patient satisfaction with the use of VR interactive game	Inclusion of patient satisfaction as an outcome measure in order to provide insights to the acceptability of VR as a non-pharmacologic method	Sample size of this research was small, which could impact the study's ability to detect significance in statistics Study did not elaborate on the specific VR game that was used or potential variations in its content, which could affect distraction effectiveness
Wong, J., Ghiasuddin, A., Tamaye, H., & Siu, A. (2020). Effectiveness of virtual reality gaming on pain reduction in children during	Investigate the use of VR gaming as a distraction technique to improve the experiences of children undergoing	Consisted a total of 30 children ages 5-21 years who were scheduled to undergo IV starts and PICC line dressing changes and placements	Study was a prospective pilot study that used a randomized design in order to compare the two groups: those receiving VR intervention	Patients and their caregivers were asked to rate their pain using the FACES scale before and after the IV start and PICC line dressing change	While there was no statistically significant difference in pain scores between the VR and standard care group, participants in	The study addressed an important clinical question related to pain management regarding pediatric patients,	The research had a relatively small sample size, which may have limited the chances to detect statistically significant differences

<p>PIV/PICC placement. <i>Journal of Technology in Behavioral Science</i>, 5(4), 378–382.</p>	<p>needle procedures</p>		<p>and the others receiving standard routine care</p>	<p>and replacements Caregivers were also asked to provide ratings of their perception based on their child's pain</p>	<p>the VR group reported the lowest post-procedure pain scores</p>	<p>especially when they receive needle-related procedures</p>	<p>the study did not investigate the long-term effects of using VR for pain management or its application in more acute settings</p>
<p>Gold JI, & Mahrer NE. (2018). Is Virtual Reality Ready for Prime Time in the Medical Space? A Randomized Control Trial of Pediatric Virtual Reality for Acute Procedural Pain Management. <i>Journal of Pediatric Psychology</i>, 43(3), 266–275. https://doi-org.dominican.idm.oclc.org/10.1093/jpepsy/jsx129</p>	<p>Evaluate the feasibility and efficacy of VR compared to standard care for reducing pain, anxiety, and improving satisfaction associated with blood draws within pediatric patients ranging from ages 10-21 years.</p>	<p>Consisted of a triad group, which includes the patient themselves receiving the blood draws, their caregivers, and phlebotomists.</p>	<p>Randomized controlled trial</p>	<p>Patients and their caregivers completed standardized measures of pain, anxiety, and satisfaction before and after the blood draw procedure</p>	<p>VR therapy significantly reduced acute procedural pain and anxiety compared to those within the standar care group Significant interaction between patient-reported anxiety sensitivity and treatment condition that resulted for participants with higher anxiety sensitivity</p>	<p>Assessed the outcomes from different perspectives between the patients, caregivers, and phlebotomists</p>	<p>There might be variations in the VR content and experience that were not mentioned in the study</p>

					benefitted more from the interaction of VR therapy		
Orhan E, & Gozen D. (2023). The Effect of Virtual Reality on Pain Experienced by School-Age Children During Venipuncture: a Randomized Controlled Study. <i>Games for Health Journal</i> , 12(4), 330–339. https://doi-org.dominican.idm.oclc.org/10.1089/g4h.2022.0232	determine the effect of using VR headsets during venipuncture on pain level, heart rate, oxygen saturation values for pediatric patients ranging from ages 7-12 years old	The study had a total of 102 participants with 52 of them using VR during the medical procedure and 50 going through standard venipuncture	Randomized controlled experimental design	Data that was collected included details from the Child and Family Information Form, State Anxiety Inventory for Children, and Faces Pain Scale-Revised (FPS-R) Pain scores were reevaluated for both groups after receiving venipuncture Pulse and oxygen saturation values were also measured in the study before, during, and after the medical	Participants who were in the VR group have lower pain scores post venipuncture Their heart rates during the procedure was also low compared to those in the standard care group There isn't a difference of numbers in oxygen saturation values before and after the medical procedure for both groups	Focused between ages 7-12 years old in order to provide insights of the school-aged population	Study did not investigate the long-term effects of using VR or the potential impact on different age groups

				procedure			
<p>Kjeldgaard Pedersen, L., Fisker, L. Y. V., Rölfing, J. D., Ahlburg, P., Veien, M., Vase, L., & Møller, M. B. (2023). Virtual reality increases pressure pain threshold and lowers anxiety in children compared with control and non-immersive control—A randomized, crossover trial. <i>European Journal of Pain</i>, 27(7), 805–815. https://doi.org/10.1002/ejp.2108</p>	<p>investigates the effect of immersive virtual reality on pressure pain threshold (PPT) and anxiety levels in children</p>	<p>Sample size of this study includes 72 children ranging between ages 6-14 years old.</p>	<p>Crossover randomized controlled design</p>	<p>Measures the pressure pain threshold, anxiety levels by using the modified Yale Preoperative Anxiety Scale (mYPAS), and heart rate before and after the medical procedure</p> <p>Comparison of statistical analysis of each intervention on PPT and anxiety levels</p>	<p>The immersive VR game and VR video show a large increased PPT, which resulted in a positive effect regarding pain tolerance</p> <p>Anxiety levels remarkably reduced during the VR game and video interventions.</p>	<p>The study showed the potential benefits of VR in a well-controlled experimental setting.</p>	<p>The study focused on short-term effects and wasn't able to assess long-term outcomes</p>