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The Use of Distraction Techniques During Painful Procedures in Pediatric Patients

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Pediatric patients can experience significant anxiety about receiving care from a healthcare provider, mostly due to the fear of the unknown (Oommen et al., 2014). The use of distraction techniques in school-aged pediatric patients can significantly decrease their pain and anxiety during painful procedures, making the visit less traumatic for the patient, their caregivers, and healthcare providers (Drayton et al., 2019). When a pediatric patient requires a procedure that can elicit pain there are many options on how to manage that pain (Song et al., 2020). Some providers choose to use pharmacological interventions such as internasal medications, topical numbing agents, or intradermal numbing agents (Gold et al., 2021). While these interventions work, they have drawbacks, initial side effects, and a time frame of onset (Gold et al., 2021). In these instances, a non-pharmacological technique, such as the use of distraction techniques is a great option to offer (Koller & Goldman, 2012). It is important to find what works for each patient based on their age, level of cognitive function, and likes or interests (Drayton et al., 2019).

Problem Statement

When distraction techniques are not utilized during painful procedures, undue stress can affect patients, their caregivers, and healthcare workers (Drayton et al., 2019). Patients frequently experience discomfort and/or fear in the hospital setting, and they are more likely to have negative experiences when seeking care (Gearhart, 2018). The pain and anxiety felt during these procedures set the patient and their caregiver up for fear and can decrease their willingness to be compliant with healthcare in the future (Atzori et al., 2022). Fear and anxiety can harm the relationship between a provider and a young patient, making the patient's evaluation and treatment more challenging and complex (Longobardi et al., 2018).

There are typically two types of distraction techniques, active and passive. Active distractions require active participation, i.e., playing cards, video games, and viewing a kaleidoscope (Boles, 2018). Passive distraction techniques do not require active participation, i.e., watching tv or a movie (Boles, 2018). While active distraction techniques have been found to be helpful, passive is also an option over not doing any interventions, which tends to be the standard of care (Boles, 2018).

Evidence to Identify the Clinical Problem and Need for Intervention

Pediatric patients have their own individual and unique response to pain, and many of them create a memory associated with that pain putting them at higher risk for non-compliance with procedures in the future (Koller & Goldman, 2012). When a pediatric patient's pain is not properly managed, both short-term and long-term detrimental effects may result (Hoefner-Notz, 2018). Management of pain and anxiety in school-aged pediatric patients can be challenging and many factors play into the management of pain such as age, developmental level, the ability to share or display that they are in pain, and the unique responses each pediatric patient displays about pain and anxiety (Alotaibi et al., 2018). Also, the pain and anxiety a patient may experience with a procedure can negatively impact the relationship between a pediatric patient and the healthcare team (Koller & Goldman, 2012). The use of distraction techniques provides movement of the patient's focus to something more pleasant (Drape & Greenshields, 2020). Given that excessive levels of anxiety can intensify the experience of pain, managing anxiety is equally crucial (Michalska et al., 2018). Distraction techniques effectively decrease school-aged pediatric patients' pain and anxiety when they undergo painful procedures, improving the patient experience.

PICO

In school-aged pediatric patients, do distraction techniques during painful procedures vs standard of care decrease the pediatric patient's pain level?

Background and Significance

While there is a multitude of evidence supporting the use of distraction techniques the application of this in healthcare settings is sparse (Drayton et al., 2019). Healthcare workers, specifically nurses, are trained to be advocates for their patients, especially when they work with vulnerable populations such as pediatric patients (Adjei, 2020). Advocating for patients and focusing on lessening pain during painful procedures does not seem to be a top priority.

In a study by Alotaibi et al. (2018), 27 studies were reviewed and found many areas that contributed to the lack of adequate pain management in pediatric patients, including the use of pharmacological and non-pharmacological options. Some of the reasons nurses don't use distraction techniques include a lack of education on the effectiveness of non-pharmacological interventions, a belief that the non-pharmacological interventions only work for lower pain levels, a belief that repeated procedures that caused pain would help the pediatric patient tolerate them better in the future, and that infants either do not experience pain and/or do not remember the pain. Many of the participants of the studies do not believe the results that come from the use of pediatric patient self-reporting pain scales, many times because their behavior was providing conflicting information. Unfortunately, many of the studies showed that adequately providing pain management to pediatric patients was not a priority (Alotaibi et al., 2018). Not only can pain harm brain growth but children who experience pain in infancy or early childhood and receive inadequate pain management report having lower pain thresholds as teenagers and adults

(Koller & Goldman, 2012). Natale (2021) emphasized the challenge of caring for an age group that lacks developmental and emotional maturity. This challenge may be further exasperated by removing children from their caregiver's presence and possibly restraining them to perform necessary procedures.

Improving health outcomes and quality of care is an important part of health care. Using distraction techniques has been found to do just that. Distraction techniques are just as effective as sedating a pediatric patient or providing them with pharmacological interventions without the potential side effects (Boles, 2018). Distraction techniques have been found to improve a pediatric patient's emotional and behavioral response to treatments (Khandelwal et al., 2019). Pediatric preprocedural anxiety can be reduced without medication, which may also lower the risk of infection, exposure to pharmaceutical side effects, treatment delays, and related healthcare costs (Natale, 2021). Anxiety, fear, and discomfort can be significantly reduced with the help of distraction techniques (Longobardi et al., 2018).

The outcomes from all studies researched were obtained by comparing a control group that received the standard of care against the test group that received some type of distraction technique. The standard of care is considered what patients normally received during painful procedures (Gold et al., 2021). Many times, this involves restraining the child. The outcomes of Boles (2018) study found that when a distraction technique was used, the child's and/or the parent's perception of their child's pain and anxiety was reduced.

Khandelwal et al. (2019) measured their success by using a variety of methods; the mean pulse rate, RMS pictorial scale (RMS-PS), which is comparable to the FACES pain scale, the Venham picture test (VPT), and oxygen saturation. After four visits to have a painful dental procedure completed, they compared the data collected to the control group. They found that

there was a significant increase in the mean pulse rate for the control group as compared to the groups with distraction techniques utilized, the average RMS-PS and VPT scores decreased from the first to the second and third visits, and there were no significant changes to the oxygen saturation between any of the groups.

Longobardi et al. (2018) measured their success using a variety of scales also. They obtained a baseline assessment of all participants before placing them randomly into groups, another assessment before the medical visit, and the last one after the medical visit. For the assessment of pain specifically, Longobardi et al. (2018) utilized the visual analog scale (VAS) and found that the mean at the baseline for the control group was 4.68 and the experimental group was 3.62. The mean before the medical visit for the control group was 4.19 and 2.62 for the experimental group. The mean after the medical visit for the control group was 3.65 and for the experimental group was 3.68 indicating that the use of distraction techniques was useful.

Barriers to Implementing the Intervention in the Population/Setting

As with any quality improvement project, there are identifiable barriers to the implementation of the intervention. The first and most significant barrier is the lack of education for healthcare providers on the types of distraction techniques (Alotaibi et al., 2018). Healthcare providers' personal beliefs and attitudes cause barriers to implementing the intervention of distraction techniques, with many believing that their evaluation of the patient's response was more valid than the results of using a scoring tool (Alotaibi et al., 2018). Additional evidence indicates that the workplace setting provides barriers to adequately attending to pain, such as inadequate staffing, heavy workloads, lack of time, lack of pain education, and lack of assessment tools (Boztepe & Kerimoğlu Yıldız, 2017). When healthcare workers are unfamiliar with the use of distraction techniques, the pediatric patient is not offered an opportunity to have a

better experience during healthcare visits (Alotaibi et al., 2018). In addition, barriers to resources such as equipment to perform the distraction techniques play a role in the ability to implement the intervention (Boles, 2018). Utilizing the gate control theory and Lazarus and Folkman's theory of stress and coping when addressing these barriers will help to support the interventions needed.

Introduction of Theories

Gate Control Theory

Ronald Melzack and Patrick Wall discovered in the early 1960s that pain is not related to the degree of damage to the injured site, but that it is related to mechanisms in the nervous system that determine which pain signals will be sent forth through the spinal cord to the brain, ultimately acting as a gatekeeper, creating the gate control theory (GCT) (Beychok, 2018). The GCT discovered that there are two types of pain nerve fibers that fire when pain occurs in the human body, A fibers and C fibers (Sandweiss, 2019). The A fibers are mechanoreceptors that detect mechanical pressure and distortion, such as touch, while the C fibers are nociceptors, and they recognize pain signals that they will send rapidly through to the brain, many times to prevent continued injury. When outside factors are applied, such as rubbing an injured area, the A fibers will interrupt the C fibers and close the gate to the C fibers from transmitting pain to the brain.

Sandweiss (2019) reported that the founders of the theory discovered that multiple factors would affect the neurological gates of the spinal cord from opening and closing, including cognitive, physical, electrical, and chemical factors. These factors will determine if the gates will be open for the pain signal to reach the brain. With the use of techniques such as guided imagery,

electrical stimulation, and topical analgesics, the neurological gates will close preventing the pain signal from reaching the brain and eliciting a response of pain sensations (Sandweiss, 2019).

Lazarus and Folkman's Theory of Stress and Coping

Lazarus and Folkman's theory of stress and coping was developed in 1987 demonstrating that it takes behavioral and cognitive responses to cope with stressors that are outside a person's resources (Echemendia et al., 2019). Lazarus and Folkman found that the stress a person feels psychologically is about the person and their environment and whether that person feels the situation is more than they can handle or if their well-being is in danger. This theory considers the inequality between perceived external and internal demands an individual is experiencing (Weber, 2004). Within the theory, there are phases that are responsible for the individual's response to stress.

According to the theory, there are two phases of an individual's response to stress which include cognitive appraisal and coping. In the cognitive appraisal phase, the person assesses the experience to determine the level of stress or threat it is to their well-being, determining what is at stake (Berjot & Gillet, 2011). For pediatric patients, this can be seen when they are restrained for a procedure. The patient will recognize that their well-being may be in danger as they can no longer defend themselves. The coping phase assesses if the person will be able to cope with the situation based on the resources available to them. Some of these resources include health, energy, social support, self-esteem, finances, etc. (Berjot & Gillet, 2011). For pediatric patients, these resources are often their caregivers, favorite toy, fidget items, etc. (Boles, 2018).

How Theories Have Influenced the Advance Practice of Nursing

Advanced practice nurses have an educational and clinical background which provides them with the training to care for the patient and look at all factors in their life, not just their current disease process (Anderson et al., 2020). The GCT has influenced the advanced practice registered nurse (APRN) in how to address chronic pain (Squellati, 2017). This theory helps the APRN to better understand the physiological reasons for chronic pain and how to help the patient more holistically (McCaffrey et al., 2003). An example of how the GCT has influenced APRNs is the provider's use of breastfeeding as a distraction technique with infants during painful procedures (Tansky & Lindberg, 2010).

Lazarus and Folkman's theory of stress and coping has influenced the practice of the APRN in many ways. For example, how the APRN treats a patient with breast cancer will focus on coping with the stress (Sternas, 2019). The APRN focuses on educating women on ways to have a positive appraisal of the new diagnosis (Sternas, 2019). The education includes ways to cope with the diagnosis, lifestyle changes they can make to improve outcomes, and resources such as support groups or referrals to counseling (Sternas, 2019). APRNs are trained to recognize when a patient is under stress and may need assistance with coping and this training will carry over into caring for patients as an advanced practitioner and will help direct what interventions will be most appropriate for their patients (Papathanasiou et al., 2015).

Theoretical Framework for Project

Two related theories will be used for this Master of Science in Nursing (MSN) project including, gate control theory, and Lazarus and Folkman's theory of stress and coping. These theories address the pain and stress associated with painful procedures, which many times healthcare providers do not take into consideration when performing non-emergent procedures (Alotaibi et al., 2018). Gate control theory is grounded in the research findings that the body can

control the gate through which pain passes from the site of injury through the spinal cord and into the brain to elicit the pain response (Beychok, 2018). If distraction techniques are used, the body can close the gate control to prevent or decrease the amount of pain the body senses (Squellati, 2017). Incorporating the GCT into this MSN project will provide the theoretical framework to encourage care practitioners to use distraction techniques in school-aged pediatric patients to decrease their sense of pain.

Lazarus and Folkman's theory of stress and coping is grounded in recognizing that a human's reaction to stress and their ability to cope is directly related to their behavioral and cognitive responses. When providing the patient with distraction techniques that bring them comfort and provide a sense of security during a painful procedure, they are less likely to have a stressful response (Koller & Goldman, 2012). Incorporating this theory into the MSN project helps to provide a theoretical foundation supporting the use of distraction techniques in school-aged pediatric patients to decrease their level of stress and improve coping.

Theoretical Contributions to the Profession

Treatment of acute pain in pediatric patients undergoing medical procedures is severely under-managed. There is a multitude of sources that support the use of convenient and safe methods, but rarely are they used (Committee on Psychosocial Aspects of Child and Family Health, 2001). Standardizing the use of distraction techniques in school-aged pediatric patients during painful procedures, such as immunizations, laceration repairs, incision and drainage of an abscess, etc., can improve pain and stress in the pediatric patient. APRNs can create an order set for their use that automatically accompanies any order that may include a painful procedure. As part of onboarding new staff, training on distraction techniques can be provided and set forth as the expectation. Another contribution of the APRN may be the improvement of the provider and

patient/family relationship. School-aged pediatric patients who experience pain and anxiety with a previous visit tend to have increased anxiety and decreased cooperation in future visits (Koller & Goldman, 2012). As a practitioner this can increase the time of future visits, possibly putting them behind on their schedule. The APRN will perform procedures on pediatric patients in their practice that will elicit stress and pain. Applying the gate control theory and Lazarus and Folkman's theory of stress and coping during their practice can improve the experience for pediatric patients. The provider can recognize the importance of using non-pharmacological techniques such as distraction techniques to decrease the pain and stress experienced during the procedures

How Chosen Theories Will Guide Personal Practice

As a future practitioner, implementing standardized care practices involving distraction techniques will be at the forefront of practice. When the opportunity to perform a pain-provoking procedure occurs, an evaluation of the patient can be made to determine their level of stress and the potential pain the patient may incur (Koller & Goldman, 2012). Options can be offered to the accompanying adult(s) and a plan can be made to utilize the best option for the pediatric patient (Koller & Goldman, 2012). When the procedure is not emergent, there is time to assess the need for non-pharmacological interventions (Koller & Goldman, 2012). As a practitioner, it will be important to collaborate with the other members of the interdisciplinary team to ensure they are aware of the expectation and that necessary resources are available (Drayton et al., 2019).

Literature Search

To determine the impact of distraction techniques on school-aged children, a literature search was conducted. The databases Cumulative Index to Nursing and Allied Health Literature (CINAHL) and PubMed were used. The following search terms: "Distraction techniques with

pediatric patients AND pain management or pain relief or pain control or pain reduction" yielded 80 results. The search was narrowed down to peer-reviewed studies, current studies within the past five years, school-aged, primary studies, as well as access to the full-text article. The final search resulted in 11 total studies; one study was excluded due to it not being a primary study and not meeting the inclusion criteria, and three other publications were excluded because they took place in dental practices rather than hospitals or medical clinics. The final studies that met the criteria for the literature review are seven randomized controlled trials (Ali et al., 2018; Atzori et al., 2022; Gold et al., 2021; Hoag et al., 2022; Susam et al., 2018; Trost et al., 2020; Xiang et al., 2021).

Definitions

This project will use the following definitions:

1) *Distraction techniques* are techniques that are used to distract the patient away from the pain-inducing event (Guinot et al., 2021).
2) *Virtual reality (VR)* is a human-to-computer interface that permits dynamic user interaction with the artificially produced environment (Felemban et al., 2021)
3) *School-aged* is a child between the ages of 5 to 13 years of age (Hoefner-Notz, 2018)
4) *Faces pain scale-Revised (FPS-R)* is a self-reporting pain scale that is composed of six faces arranged in a horizontal row, each indicating a variety of pain levels, from zero to high (10 points). The patient will use it to indicate which face best represented their current level of discomfort by pointing at it (Gold et al., 2021)
5) *Wong-Baker Faces scale* is a self-report measure of pain intensity for children which uses pictures of faces to help guide the child to describe their pain level (Felemban et al., 2021)

6) *Numeric rating scale* is a self-reported measurement of pain intensity on a scale of 0-10, 0 being no pain and 10 being the worst pain (Atzori et al., 2022)
7) *Visual analog scale (VAS)* is a scale that assesses four areas of pain; greatest pain, average pain level, pain anxiety, and time spent thinking about pain. Higher ratings indicate worsening symptoms. Scores range from zero to 100 (Hoag et al., 2022)
8) *Standard of care* is the care patients normally received, for this example it will be for distraction techniques, i.e., music, singing, talking, books, coloring, toys, etc. (Gold et al., 2021).

Literature Review

Distraction Techniques

The first theme noted was that all seven studies used either active or passive distraction techniques as their intervention. Hoag et al. (2022) compared two types of interventions to create a distraction, non-immersive distractions with an audio recording of guided imagery, and immersive distractions by using a virtual reality game. They found that the patients who were predisposed to pain due to ingrained pain beliefs or a history of chronic pain responded better to virtual reality than to guided imagery. However, when comparing those who were not previously predisposed to pain, virtual reality was just as effective as guided imagery in managing patients' pain during procedures. This study did not compare their interventions against a control group of no interventions or standards of care. Patients who have experienced painful procedures before know what to expect before their upcoming procedure, and their anxiety about the procedure would make it difficult to get them to engage in guided imagery, leading them to require a more active distraction like the virtual reality game. The significance of active participation in children's procedure discomfort is highlighted by this study.

Xiang et al. (2021) also utilized active and passive distractions with a virtual reality game with one group playing the active game, one group playing the passive game, and a control group with the standard of care distraction techniques. The patients who had the active virtual reality game reported lower pain scores compared to the passive group, and the control group reported significantly higher pain compared to the other two groups. Of the three options for interventions in this study, the active virtual reality distraction technique was most effective in decreasing pain. This study emphasizes the significance of patient participation during procedural discomfort.

Susam et al. (2018) utilized a device known as the Buzzy System, which was placed on the patient in the area an intravenous catheter was to be inserted, they applied cryotherapy with a vibration system in addition to distraction cards to help not only numb the area for the procedure but to also create an active distraction for the procedure. The study group was compared to the control group using guided imagery and found that there were significantly lower pain scores in the patients who were in the study group using the active and passive distraction technique compared to the control group. The significance of active participation in children's procedural discomfort is highlighted by this study.

Trost et al. (2020) used active robots to interact with patients. This study had three groups which were broken down into two groups of active robots, one that used a program that provided empathy to the patient and one that did not. The third group was the control group which received the standard of care with distraction techniques. The self-reported mean scores of the patients in the empathy arm were the lowest. This study highlighted the significance of the active participation of school-aged pediatric patients during painful procedures. In both groups, the interaction with the robot had decreased levels of pain compared to the group with the standard

of care. This is the only study that included empathy as a variable in their study, which showed positive outcomes for pain.

Gold et al. (2021) made use of an active distraction technique of a computer-generated virtual reality scheme which was compared to the standard of care. The virtual reality game engaged both visual and auditory senses. Results indicate that in comparison to the control group, which received the standard of care treatment, patients in the virtual reality group reported much less discomfort. This study emphasizes how crucial it is for school-aged pediatric patients to have active distraction techniques during painful procedures.

Atzori et al. (2022) had participants interact with a virtual reality helmet. The virtual reality helmet was an active distraction technique that engaged the patient in visual and auditory senses while the control group utilized the standard of care. Results reported that patients in the group that had interactive virtual reality helmets were considerably lower than those who did not have any distraction techniques. This study supports that pain is considerably reduced by virtual reality.

Ali et al. (2018), used active interactions with robots and compared them to the standard of care. Currently, they do not have any data to contribute, as they are still in the process of completing their study. Based on the previous studies, it is anticipated that they will also decrease pain with active distraction techniques when compared to the standard of care.

The outcome for each study found the use of distraction techniques did decrease the pain a school-age child experienced during painful procedures. While the studies utilized either passive and/or active distraction techniques, when compared to each other they found that passive methods were not as effective as active methods for providing distraction techniques (Xiang et al., 2021). A similar theme was found in the studies that did not utilize both active and

passive but used no distraction techniques as their control group and the other received distraction techniques.

The most effective intervention or the one a group opts to utilize will depend on many factors, such as cost. Of the distraction techniques used in these studies, there were some additional distinctions of what was more successful: choosing between passive devices, active devices, or guided imagery. Overall, active distraction techniques were found to be more effective in controlling pain management in school-aged children. Each study used different equipment for their distraction techniques with the active ones reporting the most significant decrease in pain.

Evidence for Pain Relief

In each of the studies reviewed, results indicated that distraction techniques decrease pain during painful procedures in school-aged pediatric patients. Gold et al. (2021) reported a *p*-value of .002 between patients who had virtual reality as their distraction technique versus those who received the standard of care. They reported a decrease of pain by 50% for those who utilized virtual reality. Ali et al. (2018) results were not available currently, as the study is still ongoing. Trost et al. (2020) found a *p*-value of .026 in the patients who had interactions with the empathy robot versus those who had interactions with the distraction-only robot, showing a 34% reduction in reported pain.

Hoag et al. (2022) compared virtual reality to guided imagery and found there to be no statistically significant decrease in pain from one group to the next. Xiang et al. (2021) eliminated any patient who had received pain medication in the past six hours to ensure all participants would be able to feel the same level of pain and not have it masked by the pain medication. They reported a lower pain score with the patients who had the active (*p*-value .04)

and passive (*p*-value .03) virtual reality distraction technique versus those who had been provided the standard of care. When compared there was a 54% decrease in pain between passive virtual reality and the standard of care and a 61% decrease in pain between active virtual reality and the standard of care.

Atzori et al. (2022) reported a *p*-value of <.05 with a *t*-value of 1.86 between the patients who did not have a distraction technique of virtual reality used and those who did, showing a 55% reduction in reported pain. Susam et al. (2018) found that pain was lower in the group that utilized the distraction technique of the *Buzzy System* than those who received standardized care (*p*=.039, *t*=-2.16). These results support the use of distraction techniques in this population.

Six of the seven studies showed positive results in improving pain by using distraction techniques compared to using the standard of care, some with significant improvement. Strong evidence suggests that untreated pain negatively affects patients' experiences throughout medical operations, and severe procedural pain is a strong indicator of increased pain and anxiety levels during subsequent procedures. Additionally, negative medical experiences can cause patients to avoid hospitals, reduce preventative treatment, and raise healthcare expenses.

Pain Assessment Tools

There are many rating scales for pain available to evaluate the effectiveness of distraction techniques and choosing the age-appropriate one is essential to support the validity of the results. Gold et al. (2021) utilized Faces Pain Scale-Revised (FPS-R) and reported a decrease in pain by 50% for those who utilized virtual reality. Ali et al. (2018) are utilizing Faces Pain Scale-Revised (FPS-R), however, results are not available currently, as the study is still ongoing. Trost et al. (2020) utilized the Wong-Baker Faces scale, which is similar to FPS-R, as it was the original pain scale before it was revised. They found a 34% reduction in reported pain.

Hoag et al. (2022) and Xiang et al. (2021) both utilized the visual analog scale (VAS). Hoag et al. (2022) compared virtual reality to guided imagery and found there to be no statistically significant decrease in pain from one group to the next. Xiang et al. (2021), which had three groups analyzed, utilized a visual analog scale (VAS) for their pain assessment tool. In their results, they eliminated any patient who had received pain medication in the past six hours to ensure all participants would be able to feel the same level of pain and not have it masked by the pain medication. They reported a lower pain score with the patients who had the active and passive virtual reality distraction technique versus those who had been provided the standard of care. When compared there was a 54% decrease in pain between passive virtual reality and the standard of care and a 61% decrease in pain between active virtual reality and the standard of care.

Atzori et al. (2022) was the only study that utilized a verbal numeric rating scale and found a 55% reduction in reported pain. Susam et al. (2018) were unique, as they utilized three pain evaluation scales: visual analog scale (VAS), numeric rating scale (NRS), and Wong-Baker Scale. However, only the VAS and NRS data were relative to the research of this paper, as they were the ones utilized for the age group studied. The study found that pain was lower in the group that utilized the distraction technique of the *Buzzy System* than those who received standardized care.

Although six of the seven studies showed positive results in improving pain by using distraction techniques, only the studies by Ali et al. (2018) and Gold et al. (2021) utilized the FPS-R which is the gold standard for pain assessment in school-aged pediatric patients. The FPS-R is a revised version of the Wong-Baker Faces scale and is more reliable than the original as it strongly resembles a linear interval scale (Hicks et al., 2001). Most children, regardless of

age, even the youngest ones, have been found to benefit from the FPS-R pain scale (Hicks et al., 2001).

Limitations and Strengths

As with all studies, there were strengths and limitations. All the studies used one event of a pain-inducing procedure per patient and this limits whether the distraction technique used will continue to be effective after multiple uses. Not all the studies tested their theories against procedures that would elicit high levels of pain, which could change the outcome of which distraction techniques work the best. Xiang et al. (2021) performed the study on patients who were undergoing dressing changes on burns while all the others were on peripheral venipuncture or accessing ports to draw blood. Their study also only included pediatric burn patients aged six to 17 years old due to safety concerns and the requirement that they self-report their pain and experiences, even though 60% of pediatric burn patients in the US are under the age of four (Xiang et al., 2021). Another limitation is that the settings for the studies varied, some were in outpatient ambulatory settings, which tend to have lower stress-inducing procedures than the patients that were in a high-stress location such as the emergency department or the burn clinic.

Ali et al. (2018), with their ongoing study, have a potential limitation in that they will exclude many additional patients who could benefit from the distraction technique including those who have an impairment of vision or hearing, neurocognitive delays, or an inability to feel pain the same as others with their sensory impairment. Xiang et al. (2021) and Trost et al. (2020) required all participants to be English speaking as their primary language. While some of the studies also assessed anxiety and fear in addition to pain, Susam et al. (2018) did not and were unable to confirm if the *Buzzy System* works to relieve pain in school-aged pediatric patients who

are experiencing emotional instability. Susam et al. (2018) did not assess the level of distraction offered may differ between caregivers and affect how well the strategy works either.

All studies used a variety of pain reporting scales which could flaw the data collected when compared together. Limitations to the use of this passive and active distraction start with costs. Many of the active virtual reality devices are extremely costly and many locations may not be able to afford them.

One of the strengths of the research under evaluation is that all of the participants were randomized control groups. Xiang et al. (2021) ensured that the patients that participated in the study did not have any pain medication within six hours of the study to ensure pain medication did not mask the effectiveness of the distraction technique. All studies analyzed pain reported by the patient themselves providing more reliable results than if they had utilized data from the parent's or healthcare staff's perception of the pain ratings. Xiang et al. (2021) used an intervention that would be easy to implement into practice in the future with their virtual reality games.

Ali et al. (2018) set their statistical significance level to $p = .05$, as did Atzori et al. (2022), Gold et al. (2021), and Xiang et al. (2021). The sample sizes for the next studies were checked using power analysis to ensure their study design would be adequate for determining the significance level, statistical power, and effect size. Hoag et al. (2022) designed the study with a power analysis, employing a 2-sided paired t-test at a Bonferroni corrected =.025. The lead investigator for Gold et al. (2021) performed a power analysis utilizing preliminary data from a prior study of VR usage among patients undergoing phlebotomy and decided that 100 participants were required for this trial.

Gaps in the Literature

Continuing research will need to be performed on the use of distraction techniques in school-aged pediatric patients. Atzori et al. (2022) advised conducting additional research and development using immersive virtual reality was needed. Future research is needed to reveal how many experiences the patients have previously undergone before participation to define if the distraction technique is successful in only first-time painful procedures or if they can still have success after they have had a previous experience with painful procedures (Atzori et al., 2022). Future research may examine fresh approaches to enhancing well-being and health support for school-aged pediatric patients with chronic illnesses, such as breathing exercises, VR mindfulness coping techniques, VR exposure therapy, and psychological treatments for chronic pain for age-appropriate pediatric patients (Atzori et al., 2022).

It would be beneficial for future studies to keep looking into multi-rater evaluations, which include ratings from patients, caregivers, and physicians. Video recordings of the patient experience before, during, and after medical treatments might be a useful addition to further objectively measuring outcomes (Gold et al., 2021). Future studies on lowering discomfort and anxiety during other medical procedures might profit from looking at strategies that minimize or completely forgo the use of pharmaceuticals (i.e., narcotic drugs). A shift toward non-sedating medical treatments and employing VR interventions may lessen many of the well-known side effects of drugs and enhance general health outcomes for patients with urgent and/or long-term medical requirements (Gold et al., 2021). More research is needed to determine the extent of anxiety caused by needle phobia and perform randomized clinical trials, when the inclusion criteria are less stringent, potentially increasing the external validity (Susam et al., 2018). Trost

et al. (2020) were one of the only studies that used socially assistive robots which leaves the need for more research on this distraction technique in a variety of other settings.

Conclusion

Pediatric patients experience anxiety and pain with procedures during healthcare visits. There are many options to help address these concerns, including pharmacological and nonpharmacological interventions (Gold et al., 2021). Pharmacological interventions carry additional risks; however, nonpharmacological interventions, such as distraction techniques are another great option with minimal risks (Koller & Goldman, 2012). Distraction is a quick and efficient strategy that can be used to divert the pediatric patient's attention away from harmful stimuli (Koller & Goldman, 2012). The research supports the use of multiple distraction techniques and demonstrates a decrease in pain when used in practice. Both active and passive distraction methods are useful and are available as options. However, when compared to one another, active distraction methods are more effective at lowering the patient's stated pain level (Xiang et al., 2021). While there are great options for distraction techniques, they are not always readily used in practice. Additional research is still needed on using distraction techniques on more than one occasion, in a variety of settings, and evaluating if this technique is as effective on patients who have previous experience with painful procedures versus those who have not had previous experience.

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