

EFFECTIVENESS OF AN IPAD AS A DISTRACTION TOOL FOR CHILDREN  
DURING A MEDICAL PROCEDURE

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## ABSTRACT

**RESEARCH PAPER:** Effectiveness of an iPad as a Distraction Tool for Children  
During a Medical Procedure

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Distraction techniques can be successful in reducing the discomfort and anxiety children sometimes feel when experiencing medical procedures. The purpose of this study was to examine the effectiveness of an iPad as a distraction tool. Ten preschool age children participated in an ice pack procedure three times; once with no distraction, once while watching a cartoon (passive distraction), and once while interacting with an iPad (active distraction). Distraction type was randomly sequenced for each child. Children were timed to determine how long they could tolerate an ice pack on their foot for three trials. Although the results suggested that active and passive distraction techniques helped children tolerate discomfort for a longer amount of time than no distraction, the differences were not statistically significant. Active distraction helped children to tolerate discomfort for the longest amount of time.

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## **CHAPTER 1**

### **INTRODUCTION**

Pain is an important clinical problem that, if persists, can slow down the healing process (Carlson, Broome, & Vessey, 2000; U.S. Department of Health and Human Services, 1992a, 1992b). Distraction is a technique that has been used in hospitals to help children tolerate medical procedures. Child Life Specialists--experts in child development, who promote effective coping in the hospital setting through play, preparation, education, and self-expression activities—often use distraction techniques to reduce children’s experience of discomfort and anxiety during medical procedures (Child Life Council, 2012). Distraction is involves a Child Life Specialist using materials and/or activities that the child enjoys in order to divert their attention from the procedure. Distraction is important because discomfort or pain from medical procedures can last anywhere from 5 to 45 minutes and sometimes longer (Relieving Pain without Medications, 2013). Recent studies have shown that distraction can be successful in reducing discomfort and anxiety among children during medical procedures (Bray, Callery, & Kirk, 2012; Cohen, MacLaren, Fortson, Friedman, DeMore, Lim, & Gangaram, 2006; Dahlquist, Weiss, Law, Sil, Herbert, Horn, & Ackerman, 2010; Gold, Seok Hyeon, Kant, Joseph, & Rizzo, 2006; Miller, Rodger, Bucolo, Greer, & Kimble,

2010). However, a limited number of studies have compared different types of technological distractions to determine which are more effective.

Technological based distraction has been demonstrated to have a positive impact on children's pain tolerance and anxiety levels during medical procedures (Dahlquist et al., 2002). Technology delivers multi-sensory, novel, cognitive and physically engaging activities to the patient throughout treatment (Miller, Rodger, Kipping, & Kimble, 2010). Active distraction engages the child by using multi-sensory-- visual and auditory sensations as well tactile and kinesthetic senses-- activities while passive distraction only involves auditory and visual sensations (Dahlquist et al., 2007). Some research suggests that passive distraction techniques, such as watching a movie, are more effective with infants than toddlers or preschoolers because older children might activities that are actively engaging in order to sustain their attention (Law et al., 2011). Studies have documented the positive impact of technological based active distraction in reducing discomfort and anxiety children sometimes experience during medical procedures (Dahlquist et al., 2010; Law, et al., 2011; Miller, Rodger, Kipping, & Kimble, 2011), but limited research has been identified that has evaluated the use of an iPad as a distraction device for preschool age children undergoing medical procedures. The current study expands previous work in this area by examining the iPad as an active distraction tool in comparison to a passive distraction (i.e., watching a cartoon) and no distraction.

## **Problem**

Children who are hospitalized at a young age are often subjected to multiple medical procedures that can be stressful, painful, and anxiety-provoking, all of which can

have a negative effect on the healing process and have long-term repercussions, including emotional trauma associated with medical interventions (Cohen, 2006). The role of Certified Child Life Specialists is to help children get through medical procedures as quickly as possible and with less discomfort or pain experienced by the child. Thus, increasing children's pain tolerance as much as possible is a goal of most Child Life Specialists. Although Child Life Specialists use a variety of methods to distract children during medical procedures, a limited numbers of studies have systematically evaluated the use of an iPad as a user-friendly and active distraction tool for preschool children. The current study investigated the use of an iPad, in comparison to no distraction and a passive distraction, and its ability to enhance children's pain tolerance during a simple, noninvasive medical procedure.

### **Purpose**

The purpose of this study is to determine the effectiveness of an iPad as a distraction device to reduce discomfort associated with medical procedures for preschool-aged children. Specifically, I examine the effectiveness of an iPad-- by timing how long the child could tolerate an ice pack on their foot-- in comparison to no distraction, active distraction (engaging with an iPad), and a passive distraction (watching a cartoon) in a series of three ice pack procedures.

## **Research Question**

The following research question was examined in this study:

Is there a difference in the length of time children are able to keep an icepack on their foot while actively engaging with an iPad compared to when they are watching a cartoon or doing nothing?

## **Research Hypotheses**

H<sub>1</sub>: Children will be able to tolerate the ice pack on their foot for a longer amount of time with the active technological distraction, compared to passive technological distraction and no distraction.

H<sub>0</sub>: There will be no difference in the amount of time that the children can keep the ice pack on their foot when using active technological distraction, passive technological distraction, and no distraction.

## **Rationale**

Technological devices, like a virtual reality helmet and multi-modal distraction device, have successfully been used in the medical field for procedural preparation and distraction to help children prepare and cope with painful procedures (Dahlquist et al., 2010). Limited information is available, however, on the effectiveness of a more diverse, user-friendly, and actively engaging device such as the iPad. The iPad has a variety of activities to choose from which increases the likelihood that the child can choose an engaging activity to aid in the distraction during the procedure. Since children are able to choose the program, he or she will be more likely to be interested and engaged in the

activity throughout the entire procedure which may help reduce the child's pain and anxiety levels. In addition, at a cost of several hundred dollars, the iPad is significantly less costly than the least expensive multi-modal distraction device, a device specifically manufactured to be used as distraction tool, used in hospitals today (Dahlquist et al., 2010), making it more likely that a healthcare provider could purchase and use the iPad as a distraction tool. Moreover, technological distraction, particularly those that actively engage the child, has the potential to reduce procedural time allowing for more non-procedural time that can be spent with each patient and/or allowing more procedures to be completed each day.

### **Assumptions**

The researcher made the following assumptions in the implementation of the study and in the interpretation of the data:

- The response obtained from the children at the Child Study Center will be representative of preschool age children in general;
- The children will be able to use the iPad;
- The iPad will function properly for every child throughout the entire procedure;
- The children will understand the questions and answer them honestly;
- The procedure will be completed in the same manner for every child.

## **Definitions**

For the purpose of this study, the following definitions were used:

- Distraction- to draw or direct one's attention to a different object or in different directions at the same time.
- Immunization- A process or procedure that protects the body against an infectious disease. For example: a vaccination is a type of immunization.
- iPad- A tablet computer from Apple, introduced in April 2010. The iPad has a similar interface to the iPod touch and iPhone, but its 9.7" screen enables it to replace a laptop for many purposes. Designed for Web browsing, e-book reading and entertainment, flash-based storage holds up to 64GB of apps and data.
- Multi Modal Distraction- A hand held console that is manipulated by the user through movement, character insertion and touch and uses specifically developed content to engage the child.
- Pain- localized physical suffering associated with a basic bodily sensation induced by a physically harmful stimulus characterized by physical discomfort (as pricking, throbbing, or aching), and typically leading to evasive action.

## **Summary**

Distraction plays an integral role in procedural efficiency and the child's hospital experience. It is hypothesized that the use of an iPad as a distraction device will help children tolerate a medical procedure longer than when watching a cartoon or having no distraction during the procedure. This study assesses children's "pain" tolerance during medical procedures by comparing the amount of time they are able to tolerate an ice pack

on their foot (a noninvasive, but common medical procedure) when using an iPad, while watching a cartoon, and with no distraction. Results of this study can be used to support the use of an iPad as an active technological distraction tool during medical procedures with preschool age children.

## **CHAPTER 2**

### **REVIEW OF LITERATURE**

The purpose of this study was to determine the effectiveness of an iPad as an active distraction device to increase preschool-aged children's tolerance for discomfort associated with a simple, noninvasive medical procedure. It was hypothesized that children who are exposed to active technological distraction will be able to tolerate the discomfort of an ice pack procedure for a longer duration of time compared to children who are exposed to a passive distraction or no distraction. The following review of the literature: 1) describes parents' and children's outlook and experiences on pain; 2) explores the impact that current technological devices have on children's pain; 3) discusses the versatility, usability, and cost of iPads and other technological devices as distraction tools in the hospital setting; 4) the difference between passive and active distraction and their effectiveness.

#### **Pain and Discomfort**

Pain can impact a person's outlook about a situation which can, in turn, change the way the person handles the situation. Pain is defined as localized physical suffering associated with a basic bodily sensation induced by a physically harmful stimulus

characterized by physical discomfort (as pricking, throbbing, or aching), and typically leading to evasive action. (*Merriam-Webster*, 2012).

Providing appropriate information is a vital part of preparing children and young people for procedures and surgery indicated that children and young people who were not given appropriate information felt unprepared compared to those who had a positive preparation process (Bray et al., 2012). Children and young people who are uninformed and poorly prepared for medical procedures tend to be more anxious about the procedures and experience more pain than children who are informed and well-prepared (Bray et al., 2012).

Bray et al. (2012) surveyed 17 children and young adults between the ages of 9-19 years and their parents (n = 49) who were scheduled to undergo pre-operative surgery of continent stoma formation and examined their experiences throughout the surgical process. The respondents indicated that the children's pre-operative preparation could have been improved, with many highlighting both the lack of information and the inability of the information that was delivered to meet their individual needs.

The results obtained by Bray et al. (2012) are relevant to the proposed study because both studies hypothesize that children who experience procedural preparation will have lower anxiety levels than the children who do not experience procedural preparation. Although the results of Bray et al. (2012) support this hypothesis, the current study was needed to determine if the use of a new type of technology (e.g., an iPad) can further diminish the anxiety by the way the information is presented to the child. An iPad can be used to actively engage children by using a multitude of applications and

activities. The opportunity to choose an activity that the child is interested in will help hold their attention longer and they will be less focused on the medical procedure.

### **Impact of Distraction Devices**

Distraction is a pain management technique that has been shown to successfully reduce pain and behavioral stress in children while undergoing invasive medical procedures (Law et al., 2011). Distraction aids in pain management because children's attention is temporarily shifted away from the medical procedure to something more enjoyable that, in theory, will not elicit a distress response from the child. Distraction can be accomplished with or without a digital device, but the child's options become more limited without a digital device. For example if the child has the option of playing with three toys and their procedure takes 30 minutes, it is likely that the child will become disinterested in all of the toys before the procedure is completed. When a child becomes disinterested in the toy, then the distraction becomes unsuccessful and the child's pain level and behavior worsen. Modern technological devices, such as the iPad, provide children with virtually unlimited options, which may help to sustain their attention longer than other (non-technological) toys.

Cohen et al. (2006) conducted a study that addressed the topic of distraction as it relates to pain management. The researcher attempted to determine the effectiveness of a movie in distracting and reducing infants' distress during their immunizations. The researchers measured the effectiveness of using a movie to distract infants prior to the immunization, during the immunization, and during the recovery from the procedure. The sample consisted of 136 infants (80 girls; 55 boys) ranging in age from 1 to 21 months.

The results indicated that the movie distraction was effective in reducing infants' behavioral distress, both in the anticipatory and recovery phases of the immunization. These results are relevant to the current study because it confirms that distraction can have a positive effect on children's behavior and perceptions of a medical procedure. This demonstrates that lowering anxiety and stress has the potential to improve children's behavior which will in turn make the procedural process more efficient. One limitation of this study is that the sample was predominantly White families from the Southeastern United States all undergoing routine immunizations. This can be problematic because people from different regions and of different race may vary with how well they cope with pain. This makes it difficult to apply these findings to the general population of children of diverse backgrounds who may be undergoing different kinds of procedures and under different circumstances. Also, while the use of a movie was an effective distraction for infants, it has not been shown to be as effective in toddlers and preschool age children as it does not engage them in the activity (Law et al., 2011).

Miller, Rodger, Bucolo, Greer, & Kimble (2010) suggested that a new technology developed from collaboration between healthcare professionals and IT teams can enhance distraction approaches used with children. These researchers created a Multi Modal Distraction (MMD) device with which the children interact through movement, touch screen and multi-sensory feedback (including visual, auditory and vibration). The results indicated the MMD reduced the time needed to complete the procedure by about 4 minutes and decreased patients' healing time by about 3 days. One limitation in this study is that the MMD is only capable of having one program being active during the entire

procedure. In comparison, the iPad provides children with the option to change activities, which could hold their attention longer and distract them from the pain.

Jameson, Trevena, and Swain (2011) suggested that using an active distraction increases pain tolerance time and lower anxiety scores. They found that pain tolerance time while using no distraction was a mean score of 56.93 seconds compared to a mean score of 76.02 seconds with an active distraction. These researchers used a cold pressor to create pain and a Wii gaming system as the distraction device. These results indicate that pain tolerance time can be increased significantly which is effective during medical procedures. An extra 20 seconds could be the difference of a medical procedure being completed or having to do it all over again because the child cannot sit still and tolerate the pain. One limitation in this study is that it was only tested with adults 18 years of age to 46 years. At that stage in life people are able to better control their reactions to pain. The current study examines active distraction among children much younger, ages 3 to 5, and to determine if it is beneficial in helping them tolerate pain for a longer period of time.

### **Virtual Reality Technology**

Dahlquist et al. (2010) investigated the use of virtual reality type head-mounted display helmet to distract children during painful procedures. The main focus of this study was to use the head-mounted display helmet with headphones that engaged the child's visual and auditory sensory modalities which would block the external stimuli during painful procedures. The sample consisted of 50 children with the mean age of 8.14 years. The authors predicted that the virtual reality helmet would provide sufficient

distraction during the painful procedure in order to increase the child's pain threshold and pain tolerance. The results indicated that pain threshold and pain tolerance increased with the use of the virtual reality helmet. The increase in pain tolerance between distraction and distraction with the helmet was very slight, at twenty additional seconds. However, twenty extra seconds for a procedure could make a significant impact because a lot can be completed with that extra allotted time. One limitation of this study is that the cost of the mid-range quality virtual reality helmet was approximately \$4,000. This study is relevant to the current study because it confirms that some kind of technological distraction can have a positive impact on children's pain tolerance during a medical procedure. The limitation of this study also shows that a study, with less costly equipment, needs to be performed to find out if the results are comparable.

### **Distraction**

Miller et al. (2010) hypothesized that the multi-modal distraction MMD will have a greater impact on child pain reduction compared to standard distraction and hand held video games, as well as clinic efficiency. Subjects included 80 children between the ages of 3 to 10 years who were receiving their first full dressing change for their burns. MMD distraction participants reported reduced pain during the procedures compared to standard distraction and video game distraction groups. The researchers concluded that the MMD reduced the procedural time and increased the clinics efficiency. One limitation of this study is that the child only had access to one distraction that was a touch and find story. This article is relevant to the current study because it demonstrates the use of technology as a distraction tool. The limitation in this study demonstrates that more research needs to

be compiled with a device that has more functions and choices for the child could make during the procedure. These additional choices could keep the child's interest longer and provide a better distraction throughout the entire procedure.

Gold et al. (2006) investigated the effectiveness of virtual reality for pediatric pain distraction during intravenous placement. The study addressed two specific questions: 1) Does virtual reality pain distraction reduce pain during intravenous placement more than standard care? 2) What is the relationship between child, parent, and nurse pre- and post-assessments of pain, anxiety, generalized distress surrounding the intravenous placement, and satisfaction with pain management? The authors hypothesized that children who used the virtual reality distraction would have a better pain management than the children getting standard care. The sample consisted of 20 children, 12 boys and 8 girls, ages 8 to 12 years, and their parents from the Children's Hospital Los Angeles Department of Radiology. The Faces Pain Scale-Revised revealed that children in the control condition experienced a significant fourfold increase in affective pain following the intravenous placement ( $t = -3.25$ ;  $p < 0.05$ ); by contrast, no significant change was detected within the virtual reality condition for affective pain ( $t = -1.00$ ). These results supported the hypothesis that virtual reality distraction managed the child's pain during the intravenous placement when compared to the child's pain with standard care. The limitation in this study was the number of children who participated. With such a small sample size it is difficult to generalize these findings for all medical procedures and children. This article is relevant to the current study because it confirms that a hands-on, interactive technological device can be used during medical procedures that involve the child's arm. This is significant because the child wants to use the arm in

order the play and interact with the game, and this study shows that constricting the use of the arm does not take away the effectiveness of the distraction.

### **Active and Passive Distraction**

Distraction has shown to be an effective non-pharmaceutical technique for pain control (Jameson, Trevena, & Swain, 2011). Distraction interventions are presumed to work because: pain perception is a controlled process; attention must be directed toward the painful stimulus for it to cause distress, and attentional capacity is limited (McCaul & Malott, 1984). Passive distractions like watching cartoons or listening to music are likely to be inadequate pain distractors because they only involve auditory and visual attention resources, leaving the tactile and kinesthetic sensations associated with acute pain unaffected (Dahlquist, McKenna, Jones, Dillinger, Weiss, & Ackerman, 2007). Electronic games, or an iPad, are multi-sensory and involve the child as they play with the device.

Dahlquist et al. (2007) tested the effectiveness of interactive versus passive distraction that was delivered via a virtual reality head-mounted helmet for children aged 5 to 13 years. They found that although both types of distraction conditions were effective, the interactive distraction condition was significantly more effective. These results are promising, but they are age range restrictive because it is not known how children younger than 5 years of age would respond to the distraction interventions. This is relevant to the current study because the subjects are ages 3 to 5 years. The results from the current study will show that interactive distraction is effective for young children as well.

## **Summary**

Hospitalized children endure multiple medical procedures every day around the world and in our country. Shrestha-Ranjit & Manias (2010) argued that non-pharmacological interventions provide complementary pain relief in children by reducing emotional perception of pain, strengthening coping abilities and enhancing comfort (Rush & Harr, 2001; Allen, et al., 2002; Dahlquist, et al., 2002; Tanabe, et al., 2002; Nahit, et al., 2003; NHMRC, 2005; Van Epps, et al., 2007). Each of these research articles play an integral part in the research study that has the potential to find a reasonably priced device that can be used in a multitude of settings and situations, and will decrease children's pain and anxiety level considerably.

## **CHAPTER 3**

### **METHODS**

The purpose of this study is to determine the effectiveness of an iPad as an active distraction device in order to increase preschool-aged children's tolerance for discomfort associated with a simple medical procedure. It was hypothesized that children who are exposed to active technological distraction will be able to tolerate an ice pack procedure for a longer period of time than when they experienced a passive distraction or no distraction. This chapter will describe methods used to conduct the study.

#### **IRB Approval**

The present study received approval from Ball State University's Institutional Review Board (IRB). The researcher conducting this analysis completed the Collaborative Institutional Training Initiative training (Appendix A).

#### **Subject Selection**

The researcher worked with the Co-Director of the Ball State University Child Study Center Preschool (CSC) to recruit participants. A letter of permission to conduct the study was obtained from Co-Director, Ms. Kresha Warnock. (Appendix C). Parents

and children were given information about the study, including procedures, risks, and benefits. (Appendix D). Parents provided written consent for their child and children verbally assented to participate in the study. The parents had 3 weeks to ask questions, sign, and return the consent form. Over the 3 week period, two reminder emails were sent by the researcher, one reminder email was sent by the Co-Director of the CSC Preschool, and the teacher reminded the parents at pick-up and drop-off.

The informed consent was reviewed with all of the children, and verbal assent was obtained from children aged 3 to 5 years. All of the children were told they could stop participating in the study at any time without negative consequences, and the researcher ensured each child understood this concept before proceeding with the study.

Subjects of this study included 10 selected preschool children between the ages of 3 and 5 years who attended the Ball State University Child Study Center (CSC) during the Spring of 2013 from whom parental consent was obtained. The CSC enrolls about 35 children each semester.

### **Sample Size**

In the spring of 2013, about 35 Ball State University Child Study Center preschoolers were invited to participate in this study. A total of 10 participants were involved in the study (5 male, 5 female). All subjects were between 3 and 4 year of age (3 years of age = 3; 4 years of age = 7) and all subjects were Caucasian.

## **Instrumentation**

The procedural preparation instruments included a research-created Likert scale that was used to measure anxiety both before the ice pack procedure and using an iPad (Appendix B-1). The Likert scale, adapted from Gold et al. (2006) included five animated faces that depict five levels of anxiety (e.g., “I am really nervous,” “I am more nervous,” “I am nervous,” “I am a little nervous,” “I am not nervous at all.” Children were asked to indicate their anxiety level by pointing to the face that best reflected their current emotional state.

The distraction instrument was an iPad, which was used in two ways (as an active and passive distraction tool). . The iPad was used as a passive distraction tool by showing the child a cartoon (similar to what a child would experience when watching a television in the hospital). The iPad was used in the procedure as an active distraction tool by engaging the child in an activity that was programmed on the iPad. The child could choose from one of four following applications on the iPad: Mr. Potato Head, Kids Music, Paint Sparkles, and Vehicle Fun. The timer was used to measure the amount of time the child was able to endure having the ice pack placed on the top of their foot three times: once when they had no distraction, once when they watched a cartoon, and once when they interacted with a game on the iPad. Time was recorded in seconds. The ice pack was used to simulate a simple, noninvasive medical procedure that a child might experience in the hospital setting.

The post-procedural instruments included reuse of The Anxiety Scale after the iPad procedure (Appendix B-1) and a lukewarm washcloth. The washcloth was applied

to the child's foot to help the child's foot reach room temperature faster and to make the child feel more comfortable.

## **Procedures**

The study took place in a carpeted room in the Ball State University Child Study Center Preschool. To minimize unintended distractions, the room was dimly lit and the door to the room was closed. Only the child and the researcher, a graduate student in Family and Consumer sciences, and a Certified Child Life Specialist was present during the ice pack trials. The researcher read the instructions and set up the iPad for the child to watch or engage with, depending on the distraction condition.

Each child was seated at a table where the iPad was setup. The child's shoe and sock were removed from their foot. The researcher read the following script which was adapted from Dahlquist et al., (2010):

*In a minute, an ice pack will be paced on your foot. After a while, you will notice that your foot will start to feel uncomfortable or hurt. I want to see how long you can keep the ice pack on your foot. I want you to try to keep the icepack on your foot as long as you can, even after it starts to hurt. But, when the icepack becomes too uncomfortable or hurts too much, you should remove the ice pack from your foot.*

The researcher probed the child's understanding of these procedures by asking the following questions: "What are we going to do during the ice pack session?" and "When should you remove the ice pack?" The child's responses were documented and any confusion or misunderstanding was addressed before continuing the study.

Next, a Likert scale (Appendix B-1) was used to rate the child's anxiety level about the icepack session (with the iPad distraction). The Likert scale was used before the procedure began but after the child knew what was going to happen. The Likert scale was used again after the child found out s/he was going to play with an iPad. The researcher showed the scale to the child, pointed to each face and asked "How scared are you about the ice pack session? Are you not nervous at all? Are you a little nervous? Are you nervous? Are you more nervous? Are you really nervous?" The child's response was documented before continuing the study.

Participants were told that they going to have the ice pack placed on their foot three times. The order of the type of distraction was different depending on child. The child either had nothing to watch or interact with, got to choose an activity that they could play on the iPad, or they watched a cartoon on the iPad. After giving the child the instructions, the icepack was placed on their foot. The length of time that the ice pack was on the child's foot was recorded. Participants were not allowed to keep the ice pack on their foot for more than 4 minutes. After the ice pack was removed, a warm washcloth was placed on the child's foot while the researcher asked the child post trial questions about the distraction tool. The researcher asked questions such as "Did you like using the iPad during the icepack session?", "If you had to do the icepack session again, would you want to use the iPad?" The child's response was documented before starting the second session and with the iPad. The session consisted of the same steps above and was completed two more times for each child. Each session differed by one aspect, the type of distraction technique used: an activity to play on the iPad, watch a cartoon on the iPad, or doing nothing at all. The order of the type of distraction varied from child to child in

order to ensure validity. All of the information was documented before the child is returned to the classroom.

### **Data Analysis**

Data were collected and analyzed to answer the research question if there is a difference in the length of time children are able to keep the icepack on their foot while actively engaging with an iPad compared to when they are watching a cartoon or doing nothing? It was hypothesized that children who are exposed to active technological distraction will be able to tolerate an ice pack procedure for a longer period of time than when they experienced a passive distraction or no distraction. Data were recorded on a legal pad and entered into SPSS v 21.0.0 for Mac (SPSS, 2012). The research question investigated was: Is there a difference in the length of time children are able to keep the icepack on their foot while actively engaging with an iPad compared to when they are watching a cartoon or doing nothing? Statistical analysis techniques to answer this research question included frequency statistics, descriptive statistics, paired samples t-test, and one-way analysis of variance (ANOVA). Paired samples t-test is appropriate because there are three measurements of each subject (i.e., one time recording for three ice pack trials).

## **CHAPTER 4**

### **RESULTS**

The purpose of this study was to determine the effectiveness of an iPad as an active distraction device in order to increase preschool-aged children's tolerance for discomfort associated with a simple medical procedure. It was hypothesized that children who are exposed to active technological distraction will be able to tolerate an ice pack procedure for a longer period of time than when they experienced a passive distraction or no distraction. This chapter will describe the results of the current study. Can children keep an icepack on their foot longer while actively engaging with the iPad compared to when they are watching a cartoon or doing nothing? It was hypothesized that children would be able to tolerate the ice pack on their foot for a longer amount of time with the active technological distraction (e.g., iPad), compared to passive technological distraction (i.e., cartoon) and no distraction.

To test this hypothesis this researcher used SPSS v. 21.0.0 for statistical analysis. Statistical analysis techniques included frequency statistics, descriptive statistics, paired samples t-test, and one-way ANOVA (e.g., means and standard deviations). Frequency statistics were used for categorical variables, descriptive statistics for continuous variables,

paired samples t-test for time variables, and one-way ANOVA for comparing average time scores (in seconds) by gender.

## **Subjects**

Frequency statistics showed that fifty percent of the subjects were female and fifty percent of the subjects were male. The mean age of children was 3.8 years old ( $SD = .42$ ).

## **Results**

Prior to testing the central hypothesis for this study, descriptive statistics were computed for time. The time variable was the total time, in seconds, that children were able to endure the ice pack procedure across three trials. Children endured the ice pack procedure for an average of 115 seconds ( $SD = 89.84s$ ) with no distraction, 170.3 seconds ( $SD = 94.08s$ ) with the cartoon distraction, and 205.8 seconds ( $SD = 62.21s$ ) with the iPad distraction (Table 1). It was hypothesized that children would be able to tolerate the ice pack on their foot for a longer amount of time with the active technological distraction (e.g., iPad), compared to passive technological distraction (i.e., cartoon) and no distraction. A paired samples t-test was conducted to test this hypothesis, and average total time (in seconds) was compared across three trials (with no distraction, with the cartoon/ passive distraction, and with the iPad/ active distraction). Results showed that there were significant mean differences between the no distraction and iPad trials ( $t_9 = -3.37, p = .008$ ), where average time with the ice pack was greater when the iPad/active distraction was used compared to having no distraction ( $M\ diff = -90.80s, SD\ diff = 85.23s$ ). Mean time differences between the cartoon and iPad trials were not significant

( $t_9 = -1.69$ ,  $p = .12$ ), despite the observed mean difference between trials (M diff = 35.50s, SD diff = 66.06s). There were mean differences between the no distraction and cartoon trials at the trend level ( $t_9 = -2.08$ ,  $p = .06$ ), such that average time with the ice pack was greater when children watched the cartoon versus having no distraction (M diff = -55.30s, SD diff = 84.03s) (Table 1).

Table 1. Mean Number of Seconds the Ice Pack was Tolerated by Distraction Method and by Gender (N = 10).

<b>Variable</b>	<b>M</b>	<b>SD</b>	<b>F</b>	<b>df</b>	<b>p</b>
No Distraction			0.593	9	0.463
Girls, time in seconds	137.40	95.57			
Boys, time in seconds	92.60	88.18			
Cartoon Distraction			3.472	9	0.099
Girls, time in seconds	219.40	108.47			
Boys, time in seconds	121.20	94.08			
iPad distraction			1.085	9	0.328
Girls, time in seconds	226.20	30.86			
Boys, time in seconds	185.40	81.96			

In addition to testing the central hypothesis, post-hoc analyses were conducted to determine if there were significant mean differences on each ice pack trial by child gender. Basic descriptive analyses suggested that girls were able to tolerate the ice pack procedure longer across all three trials (Table 1). However, results from one-way

ANOVA revealed no significant gender differences in average time with no distraction, the cartoon distraction, or the iPad distraction (Table 1).

### **Summary**

Results showed that active distraction with an iPad was more effective as a distraction tool to help the subjects tolerate pain longer than passive distraction and no distraction intervention. Active distraction was significantly more effective than no intervention. Passive distraction and no distraction intervention had a trending difference in time that subjects were able to tolerate the ice pack. Lastly, no significant difference in the average time across all three trials between genders was observed.

## **CHAPTER 5**

### **DISCUSSION**

The purpose of this study was to determine the effectiveness of an iPad as an distraction device in order to alleviate pain associated with medical procedures for preschool-aged children. It was hypothesized that children who are exposed to active technological distraction will have lower levels of pain during painful medical procedures than children who exposed to passive distraction or no distraction intervention and therefore will be able to tolerate a medical procedure for a longer amount of time. This chapter will discuss the results of the study that was completed.

The hypothesis constructed stated that children will be able to tolerate the ice pack on their foot for a longer amount of time with the active technological distraction, compared to passive technological distraction and no distraction. The research question that was examined to prove this hypothesis were, (1) Was there a difference in the length of time children are able to keep the icepack on their foot while actively engaging with the iPad compared to when they were watching a cartoon or doing nothing?.

#### **Relevant Research**

Although passive and active distraction were effective; active distraction, using an iPad, was a more effective tool to help children tolerate pain in the current study.

Jameson et al. (2011) also found that active distraction was more effective and that people were more willing to repeat the study if they were given the active distraction compared to passive or no distraction.

This research revealed the effects of active and passive distraction while participants experienced pain through the ice pack procedure. The findings support McCaul's & Malott's (1984) idea that attention must be directed toward the painful stimulus for it to cause distress. Participants chose an activity or game to play with on the iPad, active distraction; watched an episode of Sponge Bob Squarepants, passive distraction; or did nothing at all, no intervention. These intervention methods were assigned in a random order, so to eliminate the effect of the child building a tolerance to the icepack. The length of time the child could keep the icepack on their foot and anxiety ratings were recorded and analyzed.

Similar studies by Dalhquist et al. (2007), Law et al. (2011), and Miller (2011) found that non-pharmacological interventions (i.e., distraction) provided complementary pain relief in children by reducing emotional perception of pain (Shrestha-Ranjit and Manias, 2010). The idea of having an iPad as the distraction device is different from many others studies because the child has thousands of applications to choose from to keep them engaged and distracted. While other studies show similar results of success, none of their distraction devices are capable of such a large variety of child friendly distraction activities, games, and more.

The results supported the hypothesis that children will be able to tolerate an ice pack on their foot for a longer amount of time with active technological distraction,

compared to passive technological distraction and no distraction. Participants' times were longer with active distraction than passive distraction and no distraction.

These results also support Jameson et al. (2011) and Dahlquist et al.'s (2007) findings that children, ages 5-13 years, and adults who experience either passive or interactive distraction demonstrated significant improvements in pain tolerance. This study expands these findings to younger children, ages 3 to 4 years with the use of an iPad. Specifically, the current study showed that children were able to wait longer with the ice pack on their foot when playing with an iPad, compared to when they had no distraction. These findings show that an iPad is an effective distraction device and could be beneficial for hospitals.

While the MMD used by Dahlquist et al.(2007) cost more than \$4,000, the iPad costs only \$400. Miller et al. (2010) also used an MMD, it had three applications that could be used and it was specifically designed to be a distraction device. The cost to buy this MMD is unknown, but since the functionality and simplicity is similar to the one used is Dahlquist et al (2007), one can speculate that it is similar in price as well. The iPad is cost effective, user friendly, and has a variety of tools and activities. The savings are much easier on the hospital's child life departmental budget and can be used for multiple purposes.

## **CHAPTER 6**

### **CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS**

The purpose of this study is to determine the effectiveness of an iPad as an active distraction device in order to alleviate pain associated with medical procedures for preschool-aged children. It was hypothesized that children who are exposed to active technological distraction will have lower levels of pain during painful medical procedures than children who exposed to passive distraction or no distraction intervention and therefore will be able to tolerate a medical procedure for a longer amount of time. The conclusion of the study, limitations, and recommendations for future research are presented in this chapter.

#### **Conclusion**

Results showed that active distraction with an iPad was more effective as a distraction tool to help the subjects tolerate pain longer than passive distraction and no distraction intervention. Active distraction was significantly more effective than no intervention. A trend difference between genders was noted across all three trials, but with a small sample size it was not able to reach the level of a significant difference.

## **Limitations**

Although the results of the ice pack distraction procedure were effective, a clinical setting with invasive medical procedures may have different results. The participants during the current study knew exactly what was going to happen and understood that they could stop the procedure at any time. During an invasive medical procedure in a clinical setting, the environment is much more chaotic and creates a higher level of anxiety which can change the willingness of the child to participate with the active distraction. In general, children in the current study reported lower levels of anxiety before the ice pack trial with the iPad, which suggests that having an ice pack on their foot was not particularly distressing to them.

It is unknown, and therefore a limitation, if the child was familiar with an iPad prior to the procedure. This could affect how the child engages with the iPad and if s/he understands how to use the iPad. The size of the iPad could have also affected how engaged the child was during the procedure. If the child had a smaller and more appropriate size device to hold (i.e., the iPad Mini) and engage with, the child may have been able to tolerate the ice pack for a longer time.

It is also unknown, if any of the children knew what was going to happen during the procedure before they were asked to participate. Parents were given information that stated an iPad would be used during the study. If the child were to know about the use of the iPad before the procedure, it could have changed their perception about pain and skewed the results.

The procedure of the study took place at a preschool where the children were sent back to class afterwards. The children were told not to speak to the other children about

the procedure, but it is unknown if that occurred. This is a limitation because the children could have talked about competing to see who could keep the ice pack on their foot the longest. This could distort the results because the children are thinking about the time instead of becoming engaged with the distraction.

The study is also limited by the number of participants in the current sample. The study has such a small sample size that the statistical results cannot be generalized to the whole population because they are not powerful enough to detect significant results. Nonetheless, that significant results emerged when comparing ice pack trials, despite low statistical power, is noteworthy.

### **Recommendations**

Future research should be conducted to find whether an iPad can have similar results in a clinical setting with children from a very young age, about 2 years, to young adults. Due to the number of applications on the iPad, the iPad can be used as active and passive distraction which can be useful with a variety of different invasive procedures that take place in a clinical setting.

Future studies should include a larger sample size as well as a more diverse sample size. It is also suggested that future studies examine the child's anxiety levels for each trial. A study should be conducted in a medical setting to get better understanding if the same results will occur with the same significance.

Future studies should also investigate if the procedural length of time with active distraction (i.e. an iPad) is significantly different from passive distraction. Lastly, it

would be interesting to if an iPad is a better active distraction tool than other tool that are used (i.e. toys, board, games, video games, etc.).

Many children fear the unknown which can increase their anxiety and pain levels (Miller et al. 2010). It would be interesting to investigate if an iPad, used as a procedural preparation tool to show pictures and videos, to explain the procedure would decrease the child's anxiety levels.

Future research should also asses how well a child enjoys a certain type of distraction in comparison to how long the child is distracted and the fluctuation of their pain tolerance during the procedure. Giving the child options may also change the child's willingness to cooperate during the procedure.

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**APPENDIX A**

**INSTITUTIONAL REVIEW BOARD MATERIALS**

A-1: CITI Certificate of Completion

A-2: Approval Letter

A-1: CITI Certificate of Completion

**CITI Collaborative Institutional Training Initiative**

**Social & Behavioral Research - Basic/Refresher Curriculum Completion  
Report  
Printed on 9/19/2012**

**Learner:** Molly Greco (username: magreco)

**Institution:** Ball State University

**Contact Information** Department: Family and Consumer Sciences  
Email: mollyagreco@gmail.com

**Social & Behavioral Research - Basic/Refresher:** Choose this group to satisfy CITI training requirements for Investigators and staff involved primarily in Social/Behavioral Research with human subjects.

**Stage 1. Basic Course Passed on 09/19/12 (Ref # 8726229)**

<b>Required Modules</b>	<b>Date Completed</b>	<b>Score</b>
Belmont Report and CITI Course Introduction	09/12/12	3/3 (100%)
Students in Research	09/12/12	10/10 (100%)
History and Ethical Principles - SBR	09/12/12	5/5 (100%)
Defining Research with Human Subjects - SBR	09/12/12	5/5 (100%)
The Regulations and The Social and Behavioral Sciences - SBR	09/12/12	5/5 (100%)
Assessing Risk in Social and Behavioral Sciences - SBR	09/19/12	5/5 (100%)
Informed Consent - SBR	09/19/12	5/5 (100%)
Privacy and Confidentiality - SBR	09/19/12	5/5 (100%)
Research with Prisoners - SBR	09/19/12	3/4 (75%)
Research with Children - SBR	09/19/12	4/4 (100%)
Research in Public Elementary and Secondary Schools - SBR	09/19/12	4/4 (100%)
International Research - SBR	09/19/12	3/3 (100%)
Internet Research - SBR	09/19/12	5/5 (100%)
Research and HIPAA Privacy Protections	09/19/12	3/5 (60%)
Vulnerable Subjects - Research Involving Workers/Employees	09/19/12	4/4 (100%)
Conflicts of Interest in Research Involving Human Subjects	09/19/12	3/5 (60%)
Unanticipated Problems and Reporting Requirements in Social and Behavioral Research	09/19/12	3/3 (100%)
Ball State University	09/19/12	no quiz

**For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.**

Paul Braunschweiger Ph.D.  
Professor, University of Miami  
Director Office of Research Education  
CITI Course Coordinator

## A-2: Approval Letter



### Institutional Review Board

DATE:	February 27, 2013
TO:	Molly Greco, MA
FROM:	Ball State University IRB
RE:	IRB protocol # 407214-1
TITLE:	Effectiveness of an iPad as a Distraction for Children During Painful Procedures
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
DECISION DATE:	February 27, 2013
EXPIRATION DATE:	February 26, 2014
REVIEW TYPE:	Expedited Review

The Institutional Review Board has approved your New Project for the above protocol, effective February 27, 2013 through February 26, 2014. All research under this protocol must be conducted in accordance with the approved submission.

#### Editorial Notes:

1. None.

**As a reminder, it is the responsibility of the P.I. and/or faculty sponsor to inform the IRB in a timely manner:**

- when the project is completed,
- if the project is to be continued beyond the approved end date,
- if the project is to be modified,
- if the project encounters problems, or
- if the project is discontinued.

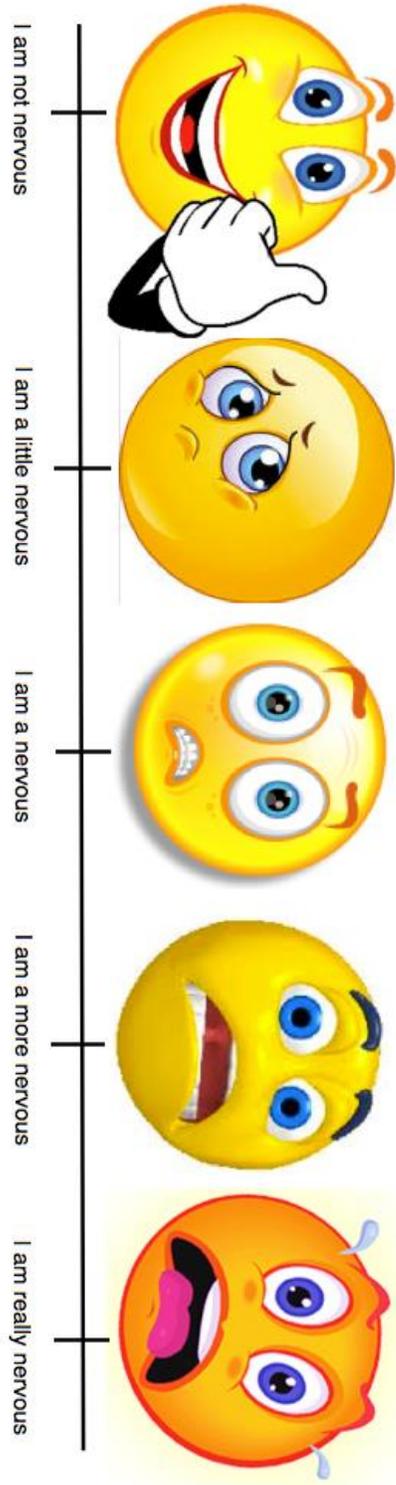
Any of the above notifications should be addressed in writing and submitted electronically to the IRB (<http://www.bsu.edu/irb>). Please reference the IRB protocol number given above in any communication to the IRB regarding this project. Be sure to allow sufficient time for review and approval of requests for modification or continuation. If you have questions, please contact Chris Mangelli at (765) 285-5070 or [cmmangelli@bsu.edu](mailto:cmmangelli@bsu.edu).

## **APPENDIX B**

### **INSTRUMENTS USED TO ASSESS ANXIETY**

B-1: Likert Scale

B-1: Likert Scale



The Anxiety Scale

## **APPENDIX C**

### **LETTERS OF COMMUNICATION**

C-1: Letter of Permission

C-2: Letter of Consent

C-3: Letter of Assent

## C-1: Letter of Permission

**From:** Warnock, Kresha <kwarnock@bsu.edu>  
**Subject:** RE: Research Project at the Preschool  
**Date:** February 28, 2013 9:52:11 AM EST  
**To:** Greco, Molly A <magreco@bsu.edu>  
**Cc:** Young, Jennifer <jyoung@bsu.edu>, Janette Stanley

Inbox - Ball State

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Molly,

I am fine to go ahead with this if you can work out the logistics with Mrs. Stanley. I think we should look to get the permissions the first two days parents are back, however. Getting this done before break sounds very difficult. Please let me review any materials that are sent out to parents. I think you have a standard form, and it tends to be a little overwhelming.

Kresha Warnock, M.A.

Program Chair, Family and Child

Department of Family and Consumer Sciences (765-285-2154)

Co-director, Child Study Center (765-285-1987)

Ball State University

"Our lives begin to end the day we become silent about things that matter." Dr. Martin Luther King, Jr.

## C-2: Letter of Consent

### **Consent Form** *Ball State University*

**Study Title:** *Effectiveness of an iPad as a Distraction for Children During Painful Procedures*

**Study Purpose and Rationale:** Your child are invited to participate in a research study led by Molly Greco, CCLS, Graduate Student at Ball State University. The main purpose of this study is to investigate and determine the effectiveness of an iPad as a procedural preparation and distraction device in order to alleviate pain and anxiety associated with medical procedures for preschool-aged children. The information gained through this study will be used to improve the methods used help children cope with pain and anxiety.

**Inclusion/Exclusion Criteria:** To be eligible to participate in this study, your child must (1) be between 3 and 6 years of age, and (2) be currently enrolled at Ball State University Child Study Center Preschool.

**Participation Procedures:** Your child will be asked to participate in two, seven minute icepack distraction sessions that will be facilitated by Molly Greco. The icepack distraction session will consist of a 3 minute introduction and preparation along with a 4 minute icepack application to the child's foot while engaging in an activity with an iPad. After the icepack is removed a warm washcloth will be placed on your children's foot. The children will be asked to answer a few questions about their discomfort and anxiety levels which will be recorded with pencil and paper.

**Confidentiality:** The researcher will take all necessary precautions to protect you and your child's confidentiality rights as a participant in this study. All participants will be assigned an identification number and these will be used instead of your name on all study-related documents and electronic files. Your identification will not be revealed to anyone besides the researcher involved in this study.

**Storage of Data:** Paper data will be stored in a locked filing cabinet in the researcher's home for three years and will then be shredded. The data also will be entered into a software program and stored on the researcher's password-protected computer for three years and then deleted. Only members of the research team will have access to the data.

**Risks or Discomforts:** I anticipate that your child will feel some discomfort while the icepack is on their foot during the sessions. Your child will not be allowed to keep the icepack on their foot for more than 4 minutes. Your child has the right to remove the icepack at any time and for any reason. You will be responsible for the costs of any care that is provided [note: Ball State students may have some or all of these services provided to them at no cost]. It is understood that in the unlikely event that treatment is necessary as a result of your participation in this research project that Ball State University, its agents and employees will assume whatever responsibility is required by law.

**Voluntary Participation:** Your child's participation in this study is completely voluntary and he or she is free to withdraw from the study at any time for any reason without penalty or prejudice from the researcher. Withdrawing and/or not participating in this study will not effect your child's standing at the Child Study Center. Please feel free to ask any questions at any time before, during, or after the icepack distraction sessions.

**IRB Contact Information:** For one's rights as a research subject, you may contact the following: For questions about your rights as a research subject, please contact Director, Office of Research Integrity, Ball State University, Muncie, IN 47306, (765) 285-5070 or at [irb@bsu.edu](mailto:irb@bsu.edu).

**Consent to Participate:** If you agree for your child to participate in the study, sign, seal in an envelope and hand back your consent form to Kresha Warnock, Co-Director of the Ball State University Child Study Center. This form will be stored in a secure location and you will be given a copy for your own records.

I, (print name) \_\_\_\_\_, agree and give consent for my child (print name) \_\_\_\_\_, to participate in this research project titled *Effectiveness of an iPad as a Distraction for Children During Painful Procedures*. I have had the study explained to me and my questions have been answered to my satisfaction. I have read the description of this project and give my consent for my child to participate. I understand that I will receive a copy of this consent form to keep for my own future reference. I understand that, in addition to this form, my child must formally give assent to participate. To the best of my knowledge, my child meets the inclusion/exclusion criteria for participation (described on the previous page) in this study.

Parent/Guardian Signature

Today's Date

Email Address: \_\_\_\_\_

**Investigator:**  
Molly A. Greco, CCLS  
Ball State University Graduate Student  
(317) 979-5538; [magreco@bsu.edu](mailto:magreco@bsu.edu)

**Advisor:**  
Jill K. Walls, Associate Professor  
Family and Consumer Sciences  
Ball State University, Muncie, IN 47306  
(765) 285-5941; [jkwalls2@bsu.edu](mailto:jkwalls2@bsu.edu)

C-3: Letter of Assent

**Child Verbal Assent Form**  
*Ball State University*

Hi! My name is Molly and I am a student at Ball State University. I am trying to learn about how playing with an iPad can make hospital visits less scary for children because a lot of children are scared when they have to go to the hospital. I would like to invite you to be in my study.

As a part of this study, you will play with an iPad while an icepack is on your foot. Then you will have a warm washcloth placed on your foot to warm it back up. You may remove the icepack at any time and for any reason. Do you understand what will happen if you agree to be part of this study?

Indicate child's response: \_\_\_\_\_

Would you like to be a part of this study?

Indicate child's response: \_\_\_\_\_

**APPENDIX D**

**PROTOCOL MATERIALS**

D-1: Script with Questions

## D-1: Script with Questions

### Items Needed

- iPad
- Timer
- Ice Pack
- Likert Scale
- Warm Wash Cloth
- Legal Pad

### Script

*In a minute, an ice pack will be placed on your foot. After a while, you will notice that your foot will start to feel uncomfortable or hurt. I want to see how long you can keep the icepack on your foot. I want you to try to keep the icepack on your foot as long as you can, even after it starts to hurt. But, when the icepack becomes too uncomfortable or hurts too much, you should remove the icepack from your foot.*

### Assent Questions

- What are we going to do during the ice pack session?
- When should you remove the ice pack?
- Would you like to participate in the study?

### Scale Questions

- How scared are you about the ice pack session?
- Now that you know you get to play with an iPad, how scared are you about the ice pack session?

### Other Questions

- Did you like using the iPad during the ice pack session?
- If you had to do the ice pack session again, would you want to use the iPad?