An Art-Light Mosaic Light Distraction for the Pediatric Healthcare Environment

Anna Rae Dutro

Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
In
Architecture + Design

Lisa Tucker, PhD, Committee Chair

James R. Jones

Elizabeth Grant

Mintai Kim

October 19, 2016
Blacksburg, VA

positive distraction, healthcare environment, healthcare design, child immunization, pediatric distress

An Art-Light Mosaic Light Distraction for the Pediatric Healthcare Environment

Anna Rae Dutro

ABSTRACT ACADEMIC

In his classic book, Experiencing Architecture, Rasmussen (1959) noted that architects inspired by addressing problems in built environments created buildings with a special spirit: a distinctive stamp. Recent problems in healthcare facilities, specifically those related to reducing stress and anxiety, have inspired designers to create positive, uplifting distractions to redirect a patient's attention from a sterile environment and/or noxious event. In doing so, healthcare facilities have become special environments with a caring spirit.

This study examined a specific aspect of creating a caring environment: determining whether or not a positive distraction, a child's art-light mosaic movie developed by the researcher, would lower pain and distress in children 4, 5, and 6 years old during an immunization procedure. The researcher conducted a randomized controlled study in two locations using a child's self-report pain scale, heart rate, parent/guardian report, and nurse report measures. After collecting and analyzing data from 76 well-participants receiving one to five immunizations, the researcher found no statistically significant difference between the conditions for any of the measures. Thus, the null hypothesis, the art-light mosaic image would not assist in lowering pain and distress in pediatric patients, 4 to 6 years old, during an immunization procedure, was not rejected. From these results, the researcher recommended future studies incorporate training the parent and child on how to use the distraction, combine the distraction with a topical analgesic, provide a clear understanding of pain and distress from the child's point of view, and develop more sensitive self-report measures of pain for children.

An Art-Light Mosaic Light Distraction for the Pediatric Healthcare Environment

Anna Rae Dutro

ABSTRACT PUBLIC

In his classic book, Experiencing Architecture, Rasmussen (1959) noted that architects inspired by addressing problems in built environments created buildings with a special spirit. Recent problems in places that provide healthcare, specifically those related to reducing stress and anxiety, have inspired designers to create positive, uplifting distractions to redirect a patient's attention from an unfriendly environment and/or unpleasant event. In doing so, healthcare facilities have become special places with a caring spirit.

This study investigated one area in creating a caring environment: determining whether or not a positive distraction, a child's art-light mosaic movie developed by the researcher, would lower pain and distress in children 4, 5, and 6 years old receiving a vaccination. The researcher conducted a study in two locations using proven measures to determine the child's anxiey. After collecting and analyzing information from 76 well-children receiving one to five vaccinations, the researcher found no difference between the children's anxiety watching or not watching the positive distraction during a vaccination. Therefore the researcher stated the positive distraction, an art-light mosaic image, would not help lower pain and distress in children, 4 to 6 years old, during a vaccination. From these results, the researcher recommended future studies include training the parent and child on how to use the distraction, combine the distraction with a cream designed to rub on the skin to relieve pain, provide a clear understanding of pain and distress from the child's point of view, and develop better measures to determine pain in children.

Acknowledgements

As I reflect on my doctoral work, I realize that no one achieves this goal without special people who are willing to give their time, knowledge, and guidance to empower you to succeed. Therefore, I would like to express my gratitude to the people who helped make this dream a reality. Thank you, Dr. Tucker, for your creative teaching and kind guidance. Thank you Dr. Grant, Dr. Jones, and Dr. Kim for your insight through the research process and dissertation writing which broadened my horizons and enabled me to broaden the horizons of the students I teach.

I would also like to thank James Livingston for guiding me through the development of the art-light movie, Dr. Andi Clements for supporting my clinical research with children, and Dr. Karen Shaw for editing my writing without changing my voice.

Finally, I would like to thank my three closest friends who were the load-bearing walls that supported the foundation of my doctoral pursuit: my husband, Lynn Dutro, for allowing me to soar with the necessary freedom while watching me with a protective eye; my sister, Ann McCraven, for carrying the load of executrix without complaint and always coaching, “You can do this, Sis;” and Carolyn Shaw for always listening, always encouraging, and always being there. Without the three of you, this would not have happened.

Table of Contents

1. Introduction

1.1 Purpose of the study 1

1.2 The built healthcare environment is more than a facility 1

1.3 Problem statement

1.3.1 Identify perceptual and procedural pain in children during immunizations. 3

1.3.2 Identify how perceptual and procedural pain in children during immunizations relates to environmental psychology. 4

1.4 Location of Study 5

1.5 Research Hypothesis 5

1.6 Institutional Review Board Approval. 5

1.7 Definition of Terms

1.7.1 Art-light mosaic image. 6

1.7.2 LEDs 6

1.8 Delimitations and Limitations 6

2. Literature Review

2.1 Designers Address the Problem of Creating Healing Healthcare Environments

2.1.1 The Center for Health Design. 8

2.1.2 Concern for quality healthcare 9

2.2 Designers Face the Challenge

2.2.1 Designers build with knowledge 11

2.2.2 The Center for Health Design Report of Hospital Design by Ulrich 13

2.3 Pain and Stress as It Relates to Medical Procedures

2.3.1 Pain definition 15

2.3.2 Perceptive and procedural pain, needle-related 15

2.3.3 Negative stress - how it relates to pain 16

2.4 Needle-related pain in children 18

2.5 Positive Distractions

2.5.1 Definition of positive distractions 20

2.5.2 Relationship of art to positive distractions 21

2.5.3 Influence of color on patients in the healthcare environment 22

2.5.4 The capacity of positive distractions 23

2.5.5 Attributes of positive distractions 23

2.5.6 Distraction adoption 25

2.6 Environmental psychology research 26

2.7 Methodology of Studies

2.7.1 Oxford quality scale 29

2.7.2 Non-biased random selection 30

2.8 Validated Pain and Distress Measures for Children

2.8.1 Understanding of pain and distress differences in children and adults 30

2.8.2 Psychological measures of pain and distress in children.

2.8.2.1 Behavioral measures 31

2.8.2.2 Child's self-report measures 32

2.8.3 Physiological measures of pain and distress in children 33

2.9 Studies of Positive Distractions

2.9.1 Distraction types during painful medical procedures for children 38

2.9.2 Distractions types during immunizations 39

2.10 Results of Distraction Studies

2.10.1 Statistical analysis of the studies 42

2.10.2 Outcomes of the studies 42

2.11 Limitations of the Studies.

2.11.1 Pain measurements in the studies 47

2.11.2 Methodological rigor in studies 47

2.12 Recommendation for Further Studies

2.12.1 Methodology of studies 49

2.12.2 Psychological measures in the studies 50

3. Design of the Art-Light Movie to use as a Positive Distraction

3.1 An Overview of the Art-Light Research 53

3.2 Preliminary Study Using an LED Art-Light as a Positive Distraction

3.2.1 Development of the LED light troffer with a lenticular lens 55

3.2.2 Installation in a pediatric clinic, research, and results 55

3.2.3 Follow-up interview with nurses 56

3.3 Design of the Child Art Pictures

3.3.1 Selection of visual display unit 56

3.3.2 Position of visual display unit 58

3.3.3 Development of six child-art pictures 59

3.4 Development of Art-Light Movie Composition

3.4.1 Adobe Illustrator to Autodesk Maya to Adobe Premier Pro 60

3.4.2 Adobe Illustrator to Adobe Photoshop 61

3.4.3 Adobe Photoshop to Adobe After Effects 62

3.5 Pilot Study 1

3.5.1 Design of the highest ranked pictures study 64

3.5.2 Results of the highest ranked pictures 65

3.6 Composition of Art-Light Movie in Adobe After Effects

3.6.1 Layer turn-on time sequence in Adobe After Effects 67

3.6.2 Movie creation from Adobe After Effects composition 67

3.7 Pilot Study 2

3.7.1 Study of best turn-on time rate for movie 69

3.7.2 Results of best turn-on time rate study 71

4. Methodology of Study

4.1 Study Locations 73

4.2 Participant Characteristics 73

4.3 Sampling Procedures

4.3.1 Johnson City Community Health Clinic 73

4.3.2 Washington County Health Department 74

4.3.3 Ethical issues addressed 75

4.4. A randomized control study research design 76

4.5 Sample Size and Power

4.5.1 Intended sample size 77

4.5.2 Actual sample size 77

4.6 Measures

4.6.1 Definitions of all measures.

4.6.1.1 Psychological measures.

4.6.1.1.1 Children's Self-Report of pain 78

4.6.1.1.2 Parent/Guardian Survey Instrument 80

4.6.1.1.3 Nurse Survey Instrument 80

4.6.1.2 Physiological measures 81

4.6.1.3 Demographical measures 81

4.7 Methods to collect data

4.7.1 Installation of monitors 82

4.7.2 Informed consent documents.

4.7.2.1 Nurse informed consent document 82

4.7.2.2 Parent/Guardian informed consent document 83

4.7.3 Assignment of participants to conditions 83

4.7.4 Obtain physiological data 84

4.7.5 Obtain psychological data after immunization 85

4.8 Data analysis and results

4.8.1 Quantitative Data Analysis 85

4.8.2 Content Analysis 92

5. Conclusion

5.1 Null Hypothesis cannot be rejected 93

5.2 Comparisons with previous research 93

5.3 Discussion of results

5.3.1 Statistical power 95

5.3.2 Appropriate blinding 96

5.3.3 The number of nurses administering the immunizations 96

5.3.4 Prior invasive procedures 97

5.3.5 Number of immunizations 97

5.3.6 Difference in immunizations 98

5.4 Observations from results.

5.4.1 Developmental level of the child 99

5.4.2 Strength of the distraction 100

6. Recommendations for future studies

6.1 Incorporate more training to reduce distress and pain 101

6.2 Combine distraction with topical analgesic 103

6.3 Research to better understand children 103

6.4 Further insight into this study 104

References 107

Appendix A: Environmental Psychology Theories 117

Appendix B: Informed consent document – pilot study 1 118

Appendix C: Child verbal script to ask permission 120

Appendix D: 3-frame, 7-frame, and 11-frame turn-on time after 12 seconds 121

Appendix E: Pilot study 2 data analysis 122

Appendix F: Informed consent document – pilot study 2 127

Appendix G: Parent/ guardian survey instrument – intervention 129

Appendix H: Parent/ guardian survey instrument – control 131

Appendix I: Patient information_ nurse report 133

Appendix J: Informed consent document – nurse 134

Appendix K: Informed consent document – parent/guardian 136

Appendix L: Data analysis correlations 145

Appendix M: JJCHC and WCHD research data analysis 161

Lists of Tables and Figures

Tables

Table 2.1 Vaccines in Widespread Use, 1985-2020 19

Table 2.2 Behavioral instruments used to measure children's pain and distress 31

Table 2.3 Self-report pain measures to determine a child's pain 33

Table 2.4 Pain and Distress measurements in studies using distractions during immunizations 35

Table 2.5 Physiological and psychological pain measurements used in studies using distractions during venipuncture 38

Table 2.6 Methodology of studies using distraction during immunizations 40

Table 2.7 The results of studies using distractions during immunizations 43

Table 3.1 Pilot Study 1 Sample demographics 65

Table 3.2 Multivariate linear regression analysis: Pilot Study 2 data 71

Table 3.3 Descriptives: Pilot Study 2 Number of times child looked away from each Frame turn-on rate 72

Table 4.1 Study: Sample demographics of 75 participants 78

Table 4.2 Heart-rate by time and condition 87

Table 4.3 Dependent variable: rating on the Wong Baker Pain Scale 88

Table 4.4 Dependent variable: rating on the Wong-Baker Pain Scale 89

Table 4.5 Dependent variable: Total first four items on Parent Survey (higher = more distress) 90

Table 4.6 Dependent variable: Total first four items on Nurse Survey (higher = more distress) 91

Table 5.1 Number of shots 97

Table 5.2 Dependent Variable: Rating on the Wong Baker Scale 100

Table A-1 Environmental Psychology Theories 117

Figures

Figure 1.1 Johnson City Community Health Center (JCCHC) in Johnson City, TN 5

Figure 3.1 Flowchart outlining the path taken for the study of the art-light positive distraction 54

Figure 3.2 Installation of the LED light bars in the fluorescent troffer 55

Figure 3.3 LED backlit image installed in the ETSU Pediatric Clinic in Johnson City, TN 56

Figure 3.4 Photoshop puppy layered file in Adobe After Effects 61

Figure 3.5 Left: Illustrator background layer. Right: Art-image layer with background layer deleted 62

Figure 3.6 Left: Puppy grid. Right: Puppy grid with Adobe After Effects adjustment layers 63

Figure 3.7 Adobe After Effects screen showing added adjustment layers 63

Figure 3.8 The scores and rank of the art light images as scored by the 15 child participants 66

Figure 3.9 The art light images and their rankings 66

Figure 3.10 Adobe After Effects Screen Display for Puppy movie keyframe layers 68

Figure 3.11 Adobe Media Encoder Queue for Puppy movie 69

Figure 4.1 View from the examination bed in the pediatric examination room F108 in JCCHC 76

Figure 4.2 Top: Wong-Baker FACES pain measurement scale for children Bottom: Bieri et al. Faces Pain Scale-Revised 78

Figure 4.3 The glasses rating scale with glass 0 for no pain and glass 5 with a whole lot of pain 79

Figure 4.4 WelchAllyn Ref # 85MXVE pulse oximeter 81

Figure 4.5 Heart-rate spike for the three conditions 88

Figure 4.6 Wong-Baker Pain Scale for the three ratings 89

Figure 4.7 Parent Survey for the three ratings 90

Figure 4.8 Nurse Survey for the three ratings 91

1. Introduction

1.1 Purpose of the Study

This researcher sought to determine if certain interactive elements incorporated into the built healthcare environment lessen patient pain and distress. Focusing specifically on improving the experience of pediatric patients during immunizations, the researcher developed a child's art-light mosaic movie to be viewed on a computer monitor. The monitor was then installed in a pediatric examination room to assist in lowering pain and distress in children 4, 5, and 6 years old during an immunization procedure. From January 2014 to July 2014, the researcher collected data on 76 participants at two locations. The results from this study endorsed the Center for Health Design's request to designers to contribute to the healthcare design body of knowledge: specifically, the effect of design on a patient's outcome.

1.2 The built healthcare environment is more than a facility.

Architectural theorists have long debated how and to what degree utility and aesthetics affect human interaction with the built environment. In his classic book, *Experiencing Architecture,* Rasmussen (1959) stated "Architecture is not produced simply by adding plans and sections to elevations. It is something else and something more. It is impossible to explain what it is – its limits are by no means well defined" (p.10). In exploring that something else and something more, Rasmussen also noted that while architects work with form and color as other artists do, their work also encompasses utility. In fact, Rasmussen maintained that the experience of an architectural space emerges from the inseparable interaction of both its aesthetic and its utility. In contrast, Roger Scruton, author of *The Aesthetics of Architecture,* believed that a building is only experienced visually. He stated, "There is no way of using the idea of function to cast light on the nature of architecture" yet he maintained that the aesthetics of the building could

be developed in spite of the functionality. Similarly, Susanne Langer suggested that the way people interact with the space, the actual functions, was the affliction of architecture. The functionality of the space placed limitations on the architect's artistic vision. Slater, however, countered both Scruton and Langer stating "the function of buildings is integral to the understanding of them, even though, at the same time, our aesthetic experience of buildings is a species of imaginative attention" (Slater, 1984, p. 253). Thus, the fundamental difference in these theoretical visions hinges upon the role assigned to aesthetics in architecture. Scruton and Langer viewed architecture as art one "looked at" while Rasmussen and Slater described it as an art one "lived with".

Conceiving of architecture as artistic living space shifts the focus to what Rasmussen (1959) identified as the architect's primary task: designing living space for ordinary people in such a way that brings "order and relation into [their] human surroundings" (p. 34). Rasmussen further noted that "the best buildings have been produced when the architect has been inspired by something in the problem which will give the building a distinctive stamp. Such buildings are created in a special spirit and they convey that spirit to others" (p.32). Although architects like Altar Aalto understood the principles Rasmussen described and applied them to their designs, producing architecture in tune with the people living in it, others were creating designs more reflective of the sterility that came to characterize much of mid-twentieth century architecture. This sterility also informed the design of healthcare facilities when architects focused on the function and neglected the building's form. The results produced intimidating, sometimes frightening, experiences for the visiting patients and family. In short, buildings should be "formed around the life to be lived in them" (p. 152). Aalto created modern architecture in tune with the people who lived in it and avoided the sterility that characterized the mid-twentieth

century designs. Such experiences foregrounded the importance of the "special spirit" Rasmussen described in his work and inspired architects and designers to form the Center for Health Design to address the problem.

Thus, inspired by the need to create healthcare environments that benefit the users, specifically by reducing stress and anxiety, designers have the opportunity to create settings with a special spirit, one that communicates "I care." One means to achieve this goal is to redirect the patient's attention from the setting's function to a positive, uplifting distraction. By doing so, the designer becomes "the perfect host who provides every comfort for his guests so that living with him is a happy experience (Rasmussen, 1959, p. 10).

1.3 Problem Statement

1.3.1 Identify perceptual and procedural pain in children during immunizations.

Pain, anxiety, and distress are associated with medical procedures for young children and adolescents. Along with the actual pain of the procedure, called *perceptual pain*, pediatric patients may develop *procedural pain*. The latter refers to the long-term inability to accept and tolerate pain that may result if a child fails to receive adequate pain relief during an earlier medical procedure. For pediatric patients, both well and chronically ill, medical procedures involving needle punctures generate significant fear and are, therefore, highly likely to produce procedural pain. Unsurprisingly, immunizations constitute the most studied needle-related procedural pain in young children (Chambers, Taddio, Uman, & McMurty, 2009; DeMore & Cohen, 2005; Fernald & Corry, 1981; Fowler-Kerry & Lander, 1987; French, Painter, & Coury, 1994; Sparks, 2001; Uman, Chambers, McGrath, & Kisely, 2010). Studies of immunizations for young children incorporate understanding the amount of pain children experience during the procedure, helping the child cope with the pain, and lowering the perceptual pain. One technique

medical caregivers use to assist in lowering the perceptual pain during immunizations is a positive distraction. A positive distraction is an environmental feature or condition that research reveals can help to alleviate stress in an individual.

1.3.2 Identify how perceptual and procedural pain in children during immunizations relates to environmental psychology.

The need for evidence based design to determine what elements in the built environment assist in lowering a patient's stress and anxiety became apparent as designers focused on medical procedures rather than the patient, and created patient rooms, nurses' stations, triage areas, and examination rooms for the benefit of the medical caregiver. This narrow focus produced sterile and frightening environments. Health designers, awakened to the trend toward unfriendly medical environments, broadened their focus to incorporate the well-being of the patients as well as the medical care giver. Roger Ulrich, one of the leading Interior Designers to shed light on problems in modern medical design, stated medical patients are in a stressed condition from illnesses and medical procedures. Elements in the built environment can increase or decrease the patient's stress. In a 2004 meta-analysis study, researchers identified the effects of hospital design on stress outcomes for patients, families, and healthcare providers and suggested providing patients with positive distractions to assist in lowering stress and anxiety (Ulrich, R., Quan, X., Zimring, C., Joseph, A., & Choudhary, R., 2004).

1.4 Location of Study

The art-light mosaic image was installed on a wall of a pediatric examination room in the Johnson City Community Health Center (JCCHC) in Johnson City, Tennessee and in the Washington County Health Department in Johnson City, Tennessee. The JCCHC is owned by East Tennessee State University (ETSU) and operated in conjunction with ETSU's Colleges of Nursing, Clinical & Rehabilitative Health Sciences (physical therapy and speech), and Allied Health Sciences (nutrition) . The clinic serves the uninsured, the underinsured, TennCare enrollees, the medically indigent individuals, and the growing Latino population. The Washington County Health Department provides quality healthcare for the residents of Washington County and surrounding communities.

Figure 1.1: Johnson City Community Health Center (JCCHC) in Johnson City, TN
Used with permission by the photographer, Beth Duncan. Contractor for the clinic was Merit Construction

1.5 Research Hypothesis

The null hypothesis H_0: $\mu_0 = \mu_1$ The null hypothesis, H_0, stated the art-light mosaic image would not assist in lowering pain and distress in pediatric patients, 4 to 6 years old, during an immunization procedure.

H_1: $\mu_0 > \mu_1$ The alternative hypothesis, H_1, stated an art-light mosaic image would create a positive distraction that would assist in lowering the pain and distress in pediatric patients, 4-to 6-years-old, during an immunization procedure.

1.6 Institutional Review Board Approval.

Before starting the study at the Johnson City Community Health Clinic, the researcher obtained permission from Patricia M. Vanhook, the Associate Dean of the Nursing Graduate

Program at East Tennessee State University, the Virginia Tech Institutional Review Board (IRB), and the East Tennessee State University IRB to conduct the study. After the study began, the researcher obtained permission from the Washington County Health Department manager and the Tennessee Board of Health IRB to conduct the study at the Washington County Health Department with approval from the Virginia Tech IRB and East Tennessee State University IRB.

1.7 Definition of Terms

1.7.1 Art-light mosaic image. The art-light mosaic image was a 22-inch digital monitor installed on the wall of the examination room in view of the pediatric patient sitting on the examination table or sitting in his or her parent or guardian's lap. The monitor displayed a movie of a 3-D light image comprised of light cells. The researcher used Adobe Illustrator, Photoshop, and After Effects software programs to create a random sequence of each light cell being switched on one cell at a time. When all the light cells were on, the colored cells created a picture of a child's drawing. The randomization of the switching on of each light cell created anticipation in the child to see what the patterns of light cells would create.

1.7.2 LEDs. The researcher developed the light cells in the digital monitor described above to mimic LEDs**,** light emitting diodes that create different colors of light depending on the amount of electrical current received by the LED.

1.8 Delimitations and Limitations

The sample of this study was limited to the Johnson City Community Health Clinic which serves the Tri-Cities of Tennessee and areas of western North Carolina and the Washington County Health Department which serves the communities of Washington County and surrounding areas. A sample from this area of the United States did not represent the entire U.S. population of children 4 to 6 years old receiving immunizations.

Other factors not possible to control for were the different personalities of the attending medical caregivers and the physical differences in the examination rooms, i.e. noise, ambient light, distance to door, or visual access.

2. Literature Review

2.1 Designers Address the Problem of Creating Healing Healthcare Environments

2.1.1 The Center for Health Design.

In 1993, a small group of healthcare designers formed a coalition to promote awareness that the design of healthcare environments can improve patient outcomes. As the first step toward their goal, the founding members identified the need to bridge the gap between research and design by identifying the field research that was based on the best methodology and encouraging designers to incorporate this research. Twenty years later, the coalition, known as the Center for Health Design, is supported by a team of research professionals, design practitioners, healthcare administrators, industry partners, volunteers, educators, and students dedicated to the development of evidenced-based design. The Center compiles peer-reviewed articles and industry best practices to establish an evidenced-based design body of knowledge. Key support in distributing this body of knowledge comes from the AIA Academy of Architecture for Health; The American Society for Healthcare Engineering; American Society of Interior Designers; the Robert Wood Johnson Foundation; the National Association of Children's Hospital and Related Institutions; the California HealthCare Foundation; the Kresge Foundation; Gresham, Smith and Partners; Healthier Hospital Initiative; and more. In other words, many renowned organizations recognize the need to identify and incorporate design principles to assist designers in planning a healthcare environment that conveys to the people who use it, "We care" (Center for Health Design, 2016).

In their quest to encourage designers to identify and incorporate these design principles, the Center for Health Design used the compiled evidence-based design research to identify areas that constrained research and then developed tools to assist designers in researching and planning

health promoting environments. The first tool developed, "Healthcare Environments Terms and Outcome Measures: An Evidence-Based Glossary" reviewed research publications and established standard terms and measurements in seven key areas of evidenced- based design research to create a centralized approach to research and research findings, increase communications between stakeholders, assist in making informed decisions based on research, and conduct "systematic integrative reviews of multiple studies" (Quan, Joseph, Malone, and Debajyoti, 2011, p. 65). The seven key areas included healthcare-associated infections, patient falls, patient waiting, patient satisfaction, medical errors, staff satisfaction, and staff efficiency.

The next three tools used post-occupancy evaluations to collect data on the effectiveness of meeting strategic design goals in clinics and community health centers and to develop checklists that designers can use to incorporate evidenced-based design in patient, medical/surgical, intensive care unit, and maternity rooms. The final tool, a research repository, was developed with funds provided by the AIA Academy of Architecture for Health to be used by designers to submit and access evidenced-designed based research in healthcare settings (Joseph, 2012). The Center for Health Design encouraged designers to utilize these tools to build and publish a body of knowledge available to all stakeholders for the purpose of identifying the necessary elements to increase positive patient outcomes in the built healthcare environment.

2.1.2 Concern for quality healthcare.

Conjoint with the Center for Health education is the increasing concern for quality healthcare. Andel, Davidow, Hollander, and Moreno (2012) reported "approximately 200,000 Americans die from preventable medical errors" which include facility-related conditions (p. 1). Health insurance companies approach quality care by stating $2.7 trillion dollars, one-sixth of the United States economy are spent annually on healthcare, yet the system is not delivering

quality care. Medical costs continue to increase due to the higher cost of drugs, more complex medical technology, unhealthy lifestyles, and a current fee system that pays for services rather than the value of the services (Rising health, 2015). Private health insurance companies, Medicaid, Medicare, the Veteran's Administration, and the American Institute of Architects are calling for accountability to promote quality in healthcare expenditures.

To raise the bar in healthcare, private healthcare companies use health plans to call providers and individuals to account. Companies now require fixed payments for healthcare services and a justification of scheduled medical procedures while encouraging individuals to maintain a healthy lifestyle. In 2013, the Center for Medicare and Medicaid Services issued a letter calling for states' accountability to maintain the federal upper payment limit on Medicaid payments to healthcare facilities stating these "rates are consistent with efficiency, economy and quality of care" (U.S. Department of Health and Human Services, 2015, p.1). In anticipation of fixed rates, the initial costs of building must be low and efficiency of operations and sustainability high which challenges designers to provide cost-effective buildings and efficient work spaces while incorporating energy efficient lighting and indoor air quality. In another area of accountability, Medicare (2015), a United States federal health insurance program for people 65 years old or older, certain younger people with disabilities, and people with end-stage renal disease, created accountable care organizations to encourage doctors and care providers to work together to provide complete healthcare information for each patient. Now designers work with the healthcare information delivery system in medical environments and assist in providing patient privacy using the mandates issued in the Health Insurance Portability and Accountability Act of 1996 (HIPAA). Another call for accountability came from the Veterans Health Administration, America's largest combined healthcare system, to provide quality care and

overcome the reputation (deserved or undeserved) of mediocre patient care (Perlin, Kolodner, & Roswell, 2004). The American Institute of Architects addressed these calls from private and government healthcare providers for quality care and accountability by researching how to control costs of new and remodeled healthcare construction, how to design for sustainability in the maintenance of the facilities, and how to discern the effect of the built healthcare environment on the patients, families, and medical caregivers.

2.2 Designers Face the Challenge

2.2.1 Designers build with knowledge.

As stated earlier, the focus to achieve quality healthcare challenged architects and designers to incorporate healthcare quality in their medical facility designs that endures and benefits all stakeholders. The costs are high and allow no room for error in designing a facility that satisfies the physical and psychological needs of patients and medical caregivers. The American Institute of Architects (AIA) and Interior Designers state that healthcare designers should not guess at how to design spaces that will work best, but should use researched design knowledge as a guide to design facilities that establish a smooth work flow, maintain a safe environment, contain sustainable elements, incorporate energy efficiency, and create non-threatening interiors.

The use of computer modeling software greatly contributes to designing a facility that successfully meets all those outcomes. Integrated Project Delivery (IPD) documents published by the AIA endorse the use of BIM to integrate project knowledge. The IPD is a methodology developed by the American Institute of Architects (AIA) and the AIA California Council to guide all participants in the design and building process to cooperate in a holistic integration of design, construction, and operations and to support accountability in quality health care.

Architects utilize BIM (Building Information Modeling) a process that generates and manages information in computer modeling to create a digital representation of a facility's building process connecting architects, engineers, and contractors to make the building design accessible at all points of the design process. BIM's modeling capacity streamlines transfers of information between designers and builders resulting in fewer design and construction errors. In the built healthcare environment, fewer errors lower initial medical costs by reducing downtime, change orders, expensive mistakes, and overhead costs (Lott, 2008). BIM also plays a major role in designing for energy efficiency by simulating and analyzing energy consumption. Building maintenance costs are lowered when energy efficiency is increased which results in reduced overall medical expenses. Incorporating BIM in healthcare design provides one way to control the cost of construction and improve the efficiency of buildings.

Architects and interior designers developed another strategy, Evidenced-Based Design (EBD), to enable designers to build healthcare facilities that improve patient outcomes. Started in 1993, The Center for Health Design (CHD) led the way by developing programs in research, education, and the advocacy of evidence-based design for the improvement of healthcare through the built healthcare environment. The CHD developed one major program, the Pebble Project, to encourage its members (architects, healthcare providers, designers, and industry partners) to contribute to the existing body of knowledge in well-researched healthcare design, conduct pre and post-occupancy evaluations, conduct rigorous research in healthcare design areas that do not have current research, and publish the results. The CHD maintains a Knowledge Repository on the Internet that includes published research papers to encourage study and research. In a move to strengthen their cause, CHD developed an accreditation program, Evidenced-Based Design Accreditation and Certification (EDAC), to recognize individuals who understand and apply

evidenced-based design principles in healthcare design. EDAC reflects CHD's advocacy of healthier healthcare environments (*"A view"*, 2015).

2.2.2 The Center for Health Design Report of Hospital Design by Ulrich.

In a 2004 report made to the Center of Health Design (CHD) to identify the role of the physical environment in the hospital of the 21st century, Ulrich encouraged designers to "rethink hospital design, and especially to consider how improved hospital design can help reduce staff stress and fatigue, increase effectiveness in delivering care, improve patient safety, reduce patient and family stress, and improve outcomes and overall healthcare quality" (Ulrich et al., 2004, p. 2). In this 2004 report funded by the Robert Wood Johnson Foundation, Ulrich, et al. (2004) conducted a meta-analysis study that combined the results of independent studies in an effort to increase the sample number and thereby increase the statistical power of the results (Crombie & Davies, 2009). The study explored existing research to reveal the effects of hospital design on the safety and stress outcomes for patients, families and healthcare providers. Researchers from Texas A&M and Georgia Tech reviewed several thousand articles and narrowed the field to six hundred that used the most rigorous study techniques. Based on these six hundred articles Ulrich et al. (2004) identified seven areas where designers could begin to make an impact in designing better hospital environments:

1. Provide single-bed rooms in almost all situations. Adaptable-acuity single-bedrooms should be widely adopted. Single rooms have been shown to lower hospital-induced nosocomial infections, reduce room transfers and associated medical errors, greatly lessen noise, improve patient confidentiality and privacy, facilitate social support by families, improve staff communication to patients, and increase patients' overall satisfaction with health care.

2. New hospitals should be much quieter to reduce stress and improve sleep and other outcomes. Noise levels will be substantially lowered by the following combination of environmental interventions: providing single-bed rooms, installing high-performance sound- absorbing ceilings, and eliminating noise sources (for example, using noiseless paging).

3. Provide patients stress-reducing views of nature and other positive distractions**.**

4. Develop wayfinding systems that allow users, and particularly outpatients and visitors, to find their way efficiently and with little stress.

5. Improve ventilation through the use of improved filters, attention to appropriate pressurization, and special vigilance during construction.

6. Improve lighting, especially access to natural lighting and full-spectrum lighting.

7. Design ward layouts and nurses stations to reduce staff walking and fatigue, increase patient care time, and support staff activities such as medication supply, communication, charting, and respite from stress (p. 27).

Number three of these findings reinforces research conducted on the influence of positive distractions on children in clinic waiting areas (Pati & Nanda, 2011). It, like the meta-analysis, indicated that providing patients with views of nature and other positive distractions seemed to reduce stress. Ulrich et al. defined positive distractions as environmental features or conditions that have been found by research to mitigate stress in an individual. Positive distractions may include animals, laughter, certain art, and nature.

High noise levels, mechanical equipment noise during the night that prevents sleep, inadequate light, and lack of nature views contribute to the patient's stress load and could be eliminated with proper design (Ulrich et al., 1991). In his quest to eliminate stressors in the built

healthcare environment, Ulrich became an advocate for the use of nature and positive distractions to assist in lowering anxiety and stress in patients during medical appointments and procedures.

2.3 Pain and Stress as It Relates to Medical Procedures

2.3.1 Pain definition. In order to construct successful positive distractions, designers must understand the complex nature of pain. The International Association Study of Pain (IASP) described pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Uman et al., 2010, p. 2). Craig stated that pain is a "complex interaction between the pain stimulus, psychological, and social factors" (Chambers et al., 2009, p. S78). McGrath, a foremost researcher and writer about pain in children, described pain as a very personal experience containing physiological, behavioral, emotional, developmental, and sociocultural components (Uman et al., 2010).

2.3.2 Perceptive and procedural pain, needle-related. Jean Piaget, a Swiss psychologist, pioneered a systematic study of children's cognitive development and concluded that young children do not process information as do adults. Piaget divided children's cognitive development into three stages and identified ages 2 to 7 years old as pre-operational. In the pre-operational stage, children have an egocentric focus and cannot use logic or combine ideas. Applying Piaget's findings, McGrath and Craig (1989) stated children assess their perceptive pain, the actual pain of the procedure, according to their cognitive development. Thus, children 2 to 7 years old focus on the physical factors of pain and trust their senses to give them information. When confronted with an immunization, they do not believe their parent or caregivers counsel that the needle will keep them from becoming ill, but focus only on the pain

of the event. Their lack of ability to think logically also deters them from distinguishing between the levels of pain or how they feel about the pain, and impedes their ability to communicate what they are experiencing. Without an ability to communicate, it is difficult to understand and treat their pain. McGrath (1996) also notes that "untreated pain may sensitize the brain to more easily experience pain in the future" (p. 63).

A child's memory of pain from needle sticks can influence the child's perception of later medical procedures creating distorted memories of prior events. Berberich and Landman (2009) observed a tendency toward this anxiety in their study of 4- to 5-year-olds anticipating an injection. Children pre-school age and older greeted the doctor with, "Do I have to have a shot?" (p. e204). Questions like this one clearly demonstrate needle-related anxiety and support the findings of earlier studies. Fowler-Kerry and Lander (1987) discovered a bad experience with injections may increase anxiety and thereby worsen the experience with later injections. DeMore and Cohen (2005) came to a similar conclusion, stating that inadequate pain relief during a previous medical procedure may increase a child's anxiety and interfere with the current procedure (Uman et al., 2010). Younger children are more vulnerable to a bad medical procedure experience as they typically report more pain than older children (Kleiber & Harper, 1999). Complicating the fear of the procedure itself, children may also blame the doctor or nurse for the pain they experience. That association could exacerbate the fear of future medical-related procedures (Nilsson et al., 2007). Further, the child's fear related to needle sticks can also influence the parent or guardian of a pediatric patient to delay medical treatments (DeMore & Cohen, 2005; Fowler-Kerry & Lander, 1987). Sparks (2001) links the low immunization rate of U.S. children to the fear of injections.

2.3.3 Negative stress - how it relates to pain. Stress is a part of everyday life; in fact,

positive stress, or eustress, equips a person with the drive to accomplish goals or simply to complete daily tasks. When left unchecked, however, stress negatively affects the psychological and physiological well-being of an individual. In other words, when the mind and body can no longer cope with the overload of stimuli, stress becomes distress. Gifford (1997) defines the psychological aspect of stress as cognitive appraisal: an individual continuously surveys the environment processing what is seen and felt and attributing meaning to the received information. That information is categorized based on a multiplicity of characteristics, such as beautiful, safe, interesting, intriguing, alarming, dangerous, or threatening. If the cognitive appraisal results in fear or anxiety, it triggers the *fight-or-flight* response, which in turn triggers the production of adrenaline and cortisone in the body. Selye (1976) explained this physiological process in the three stages of the general adaptation syndrome: alarm reaction, resistance, and exhaustion. In the alarm reaction stage, alarm signs appear when the body is exposed to a stressor causing the body's physical resistance to be lowered. If the body can adapt to the stressor the alarm signs disappear and the resistance is raised. In extreme cases, if the stressor is not removed, the stage of resistance continues until the "adaptation energy is exhausted," the signs of the alarm reaction reappear, and the body dies. Children, more than adults, have low resistance and excessive reactions to any stressors (p. 6). Although normal stressors in each child or adult's day are not terminal, they may affect the individual's health and well-being.

All of this has bearing on pain perception and the development of procedural pain. If a child's cognitive appraisal of a medical procedure results in fear and anxiety and triggers a fight-or-flight response, that response itself can, as Sparks (2001) noted, factor into pain perception. According to the Gate Pain Theory, fear and anxiety can cause the pain perception to increase. When a child does not receive pain relief from a medical procedure, anxiety can increase

creating a vicious cycle of increased pain, anxiety, and distress. It is these very complex and emotional experiences that the researcher needs to measure to determine the efficacy of interventions on a child's pain and distress during a medical procedure.

2.4 Needle-related pain in children.

In a meta-analysis study of needle-related pain and distress in children, Uman, et al. (2010) stated the most commonly studied needle procedures in children were the injections and immunizations that leading pediatric doctors and disease experts recommend to maintain the health of United States communities. The Centers for Disease Control's Advisory Committee on Immunization Practices (ACIP), comprised of fifteen medical and public health experts selected by the Secretary of the U.S. Department of Health and Human Services, establishes the pediatric immunization schedule (Centers for Disease Control and Prevention, 2014). The schedule is then approved by the Advisory Committee on Immunization Practices, the American Academy of Pediatrics, and the American Academy of Family Physicians. The 2015 schedule requires over twenty immunizations be administered to a child before the age of 6-years. As many as three immunizations can be administered to the child during one medical visit (Centers for Disease Control and Prevention, 2015). This is a nine-fold increase of required immunizations since the 1950s. The Institute of Medicine (2000), a division of the National Academies of Sciences, Engineering, and Medicine, predicted that the number of vaccines available to the public could triple by the year 2020 as shown in Table 1.

Table 2.1

Vaccines in Widespread Use, 1985-2020

Reprinted with permission from *Calling the Shots: Immunization Finance Policies and Practices, 2000* by the National Academy of Sciences, Courtesy of the National Academies Press, Washington, D.C.

1985	2000	2020[a]
Adult influenza	Adult influenza	Adult influenza[c]
Adult pneumococcal polysaccharide	Adult pneumococcal polysaccharide	Adult pneumococcal polysaccharide
Diphtheria, pertussis, tetanus, and components	Diphtheria, tetanus, acellular pertussis, and components [b]	DTaP[c]
Measles, mumps, and rubella	MMR[b]	Measles, mumps, rubella, and varicella[c]
Oral poliovirus	Inactivated poliovirus[b]	Eradication of polio expected
	H. influenzae type b[b]	Hib[c]
	Hepatitis A[b]	Hepatitis A[c]
	Hepatitis B[b]	Hepatitis B[c]
	Varicella[b]	Varicella with MMR
	Pediatric conjugate of pneumococcal polysaccharide	Pediatric conjugate of pneumococcal polysaccharide[c]
	Borrelia burgdorferi	*Borrelia burgdorferi*
	Meningococcal polysaccharide A,C,Y,W-135	Conjugated meningococcal polysaccharide A,B,C,Y,W-135[c]
		Adult tetanus, diphtheria, acellular pertussis, and components[c]
		Chlamydia
		Coccidioides immites
		Cytomegalovirus
		Enterotoxigenic *E.coli*
		Epstein-Barr
		Helicobacter pylori[c]
		Hepatitis C[c]
		Herpes simplex
		Histoplasma capsulatum
		Human papillomavirus[c]
		Child influenza[c]
		Insulin-dependent disbetes mellitus (therapeutic)
		Melanoma (therapeutic)
		Multiple sclerosis (therapeutic)
		Mycobacterium tuberculosis

Table 2.1 continued
Vaccines in Widespread Use, 1985-2020

	Neisseria gonorrhea
	Neisseria meningitidis B
	Parainfluenza[c]
	Respiratory syncytial virus[c]
	Rheumatoid arthritis (therapeutic)
	Rotavirus[c]
	Shigella
	Streptococcus, Group A[c]
	Streptococcus, Group B

[a]Priority candidate vaccines, drawn from IOM, 1999b.
[b]Vaccines covered by Vaccines for Children (VFC) as of February 2000.
[c]Vaccines likely to be recommended for universal use (including VFC coverage for childhood vaccines).

The Institute of Medicine, formed in 1970 to provide reliable evidence of public health issues to assist government and private health sectors to make health decisions for the nation, reported the immunization infrastructure must be kept strong to support the fight to suppress disease. Encouraging parents or guardians to stay current with their child's shot schedule plays a key role in this fight. Reducing immunization pain in children may support the parent or guardian's desire for scheduled immunizations and provide a benefit for the children, parents or guardians, medical caretakers, and the public health of the nation (DeMore & Cohen, 2005). In intervention studies, distraction emerged as an effective way to assist in reducing the perceptual pain and distress in young children during medical procedures (Chambers et al., 2009; Cohen et al., 1997; Sparks, 2001; Uman et al., 2010).

2.5 Positive Distractions

2.5.1 Definition of positive distractions. In their report to the Center for Health Design, Ulrich et al. (2004) defined a positive distraction as an environmental feature or condition that, through research, shows the ability to reduce distress. Barlow identified positive distractions as a

group of treatment procedures or cognitive-behavioral therapies used to "identify and modify faulty thought processes, attitudes, attributions, and problem behaviors. Cognitive-behavioral therapy interventions for pain management are aimed at assisting the child to develop and apply coping skills in order to manage the pain and distress" (Uman et al., 2010, p. 3). These interventions identify and alter negative thinking styles about the medical procedure to develop a more positive attitude that encourages children to adapt and cope with the procedure (Uman et at., 2010). Cognitive-behavioral interventions or positive distractions redirect a child's attention away from a noxious event toward a more pleasant stimulus alleviating distress and perceptual pain (Felt et al., 2000; Hathorn & Nanda, 2008; Jaaniste, Hayes & von Baeyer, 2007; Kleiber & Harper, 1999; Nilsson et al., 2007; Sparks, 2001). Cohen, Blount, and Panopoulos (1997) identified positive distractions as a center of focus in studies determining the efficacy of mitigating the perceptual pain and distress in young children during a medical procedure.

2.5.2 Relationship of art to positive distractions. In 1860, Florence Nightingale wrote in her book *Notes on Nursing* that a patient needs beauty in his or her surroundings because beauty has positive influences on the health of the body (Nightingale, 1860). Over a century later researchers reported there is evidence to support the concept that art is a very important part of the healthcare environment and can assist in the healing process (Hathorn & Nanda, 2008). Art has also been used in healthcare as a positive distraction to mitigate distress in patients. However, researchers have found that all art is not edifying for the patients, families, and medical caregivers in the healthcare environment. Art that is ambiguous, complex, and chaotic can provoke feelings of unrest and uncertainty. Ulrich et al. (1991) found that the greater the distress experienced by the patient the less complexity they wanted in the art. Ulrich et al. stated this supports Sheldon Cohen's perspective that a very complex stimulation places high demands

on an individual's information processing and hampers a recovery from stress. Thus, when the external stimulation is low such as nature and nature art, there is a more rapid recovery from distress. Researchers found that a great majority of patients have a positive response to stress recovery when viewing nature art (Hathorn & Nanda, 2008; Ulrich et al., 2004).

In studies of children, research has supported using pictures of childlike art nature figures created in bright primary colors as a positive distraction. Eisen (2006) and Hathorn and Nanda (2008) studied the art preferences of children in schools and hospitals and concluded the majority of children in both settings highly preferred nature art as compared to abstract art. In Eisen's study, a total of 129 subjects, ages 5 to 7, 8 to 10, 11 to 13, and 14 to 17, viewed six art images on a lap top computer. With each picture, Eisen asked the children if they liked it and how it made them feel, recorded the responses of the children, and ranked the pictures according to the children's preferences. The results revealed the children preferred nature art as compared to abstract art. In Hathorn and Nanda's study, the researchers found children ages 5 to 7 ranked child art (art created by children) highly. Further, the boys did not differ widely from girls in their choices of art. Both preferred nature images with bright colors, water features, non-threatening wildlife, and images that did not suggest solitude. Though children preferred the bright, primary colors, there was no evidence to show that choice of color had an effect on patients in the healthcare environment.

2.5.3 Influence of color on patients in the healthcare environment. Other studies have corroborated Hathorn and Nanda's conclusions regarding color. In a study of literature on the use and effect of color in the healthcare environment, Tofle, Schwarz, Yoon, and Max-Royale (2004) found no "significant evidence-based body of knowledge" to support the effect of color selection in the healthcare environment. In fact, the literature review revealed no guidelines that supported

how color affected people in healthcare settings. Rather, it suggested that color alone did not create the character of the space and constituted only one part of the healthcare environment. It must be considered in conjunction with the location, the configuration of the space, the natural and artificial lighting, the stakeholders, and the use of the space to create a sense of place. As a result, Tofle et al. concluded that an attempt to establish universal guidelines for color selection would produce a weak and ineffective result: "There are no direct linkages between particular colors and health outcomes of people." They did, however, find "demonstrable perceptual impressions of color applications that can affect the experience and performance of people in particular environments" and concluded that studies on color in the healthcare environment need to focus on "specific and concrete problems rather than abstract and universal questions" (p. 5).

2.5.4 The capacity of positive distractions. One specific area of study in the healthcare environment focused on the use of positive distractions. McGrath (1990) identified positive distractions as the most common cognitive interventions and explained that an effective positive distraction absorbs the child's attention and turns the child's thoughts from the pain to the distraction. The child's diverted attention blocks his or her perception of pain by "activating endogenous opioid and nonopioid pain suppressing systems." In other words, the body itself responds to the distraction by producing endorphins that reduce the sensation of pain and affect the emotions much like opium or one of its derivatives would. Thus, the distraction can activate pain suppression. McGrath (1990) states "the more focused the child is by the distraction, the more their pain will be reduced." The process of the child focusing on the distraction does not help the child to ignore the pain, but actually lessens the pain (p. 159).

2.5.5 Attributes of positive distractions. Jaaniste et al. (2007, p. 2790) suggested when a child focuses on the positive distraction, it leaves fewer attention resources to focus on the

pain. Jaaniste et al. used Kaheman & Treisman "fixed capacity" model of attentional processing to support this concept. In 1984 Kaheman & Treisman suggested individuals have a limited number of attentional resources with some amount of control over the distribution of these resources. Cassidy et al. (2002, p. 109) suggested distraction competes with the pain by taking resources needed "to process physical, emotional, and evaluative components of pain perception." In a meta-analysis study on the use of distraction with children during an acute pain experience, Vessey, Carlson, and McGill (1994) suggested for a distraction to be effective, the child needs to have some degree of cognitive control over pain perception. This allows the child to allocate high attentional capacity to the distractor and leaves less attentional capacity to give to the pain. Thus, if a distraction intervention coaxes high attention capacity from the child, the distraction is more likely to be effective. An effective distractor needs to provoke curiosity in the child and to encourage the child to use visual, auditory, tactile, and/or kinesthetic senses when engaged. These findings reinforce McGrath's (1990) conclusions: the more intriguing the distraction, the more attention the child will give it.

The efficacy of distraction interventions for children during a medical procedure are well supported in research. In three meta-analyses studies on distraction for immunization and other needle-related procedural pain in children, the overall consensus was that a variety of cognitive-behavioral interventions, the majority of which are distractions, successfully reduced pain or distress during needle-related procedures (Chambers et al., 2009; DeMore & Cohen, 2005; Uman et al., 2010).

In a systematic review of studies using a distraction to lessen needle-related perceptual pain, two important characteristics for successful distraction techniques emerged from the data. The pain stimulus must be low and the attention to the distraction must be high for the child's

attention to be redirected from the noxious event (Chambers et al, 2009). McGrath (1990) suggested distractions that intrigue a child should be concrete objects as opposed to abstract and external events. In their study on stress recovery using exposure to the natural elements as the distraction, Ulrich et al. (1991) identified five characteristics necessary for a distraction to redirect attention and assist in alleviating distress; a distraction must evoke "a positive initial response, comprised of liking and moderate to high interest; motivate and sustain prolonged attention/intake; produce higher levels of positive feelings; reduce stress related feelings such as fear and anger; and suppress stressful thoughts" (p. 224).

2.5.6 Distraction adoption. Many of the positive distractions studied were capable of fulfilling these criteria, but were not time-efficient, easy to use, cost-effective, or easily adopted by patients and medical caregivers (DeMore & Cohen, 2005). Bowen and Dammeyer (1999) stated that though some distraction studies reported a statistically significant decrease in pain and distress in treatments groups as compared with the control group; physicians, nurses, and parents were reluctant to use the interventions. Bowen and Dammeyer suggested this reluctance may have stemmed from the interventions appearing awkward and unnecessary, as well as their requiring training in order to implement. A positive distraction, therefore, needs both to show a significant reduction in the child's distress and perceptual pain and to be embraced by the medical caregivers to be genuinely effective.

In order to be readily adopted, a distraction must hold a child's attention during a painful medical procedure, such as an immunization, while not interfering either with the procedure itself or the caregiver's other responsibilities. For example, the caregiver must employ good time management. Providing the caregiver with a distraction that would require more than the normal amount of time with each patient would diminish its benefits. In studies using music, cartoons,

and party blowers, the instruction nurses provided to the children and to the children's parents prior to the immunization added to the total time the nurse devoted to each patient. Blount et al. (1992) stated in their study that the training time was ten to fifteen minutes for the parent and child to understand how to use the paper blower during the immunization. Krauss (1997) asked the parent and child to view a video showing a child coping with the immunization by blowing a party blower and Cohen et al. (1997) instructed the nurses to have the child select a cartoon to watch during the procedure. Sparks (2001) used bubble blowing. This created the potential for interference as the nurse administered the immunization and for spillage on the surfaces in the room. All of these methods provided a distraction for the child but also added responsibilities for the caregiver and required additional contact time with the patient. In light of this, studies to determine the efficacy of the distraction should include measurements from the children, parents, and medical caregivers to determine pain and distress reduction, ease of use, and acceptance of the distraction.

2.6 Environmental psychology research.

Designers use research tools developed by environmental psychologists to understand transactions between individuals and the environment, to help solve problems that exist in the physical realm, and to create more user friendly environments. Although the science of psychology has long studied a wide range of human behaviors, it was not until the mid-twentieth century that certain psychologists begin to identify the need to understand the effects of the physical realm on individuals. Gifford (1997) identified Eglon Brunswik as one of the first psychologists to state that the physical environment can affect an individual whether or not the physical stimulus is noticed or understood. Recognizing this, Brunswik called for further research into how environmental stimuli can affect human behavior. In his study, environmental

psychologist Gifford (1997), focused on the transactional relationship between the individual and the environment, concluding that when individuals encounter their environment, they either shape that environment to meet their needs or change their behavior to cope with the environmental demands. The results of these changes, in their surroundings or in themselves, shape individual experiences in the built environment. Anticipating how individuals will react often proves difficult due to the complexity of individuals and the abundance of influences in the physical realm. As a result, environmental psychologists use research to identify patterns in how individuals interact with their physical surroundings, and from these patterns develop theories to give order and meaning to these observations. Practicing designers incorporate this research into their spaces to create friendly and inviting environments. Soon architecture (the design and construction of the built environment) and engineering (the use of ergonomics and product design) joined with psychology to research all phases of design development: concepts, specification, and occupancy evaluation (Bechtel & Ts'erts'man, 2002).

Today, when psychologists, architects, and engineers add environmental research to their discipline, they quickly recognize the complexity of the task before them: they must understand how personal preferences, culture, and age interact with the multiplicity of stimuli in the environment. They approach this quest by accepting the fact that no individual study will reveal the information they are seeking. Researchers combine the individual studies into multi-analyses not to provide specific answers to design problems, but to guide designers in researching solutions to problems in the built environment (Gifford, 1997).

From the results of multiple studies, environmental psychologists developed several major theories that have provided just such guidance: integral, stimulation, control, and behavior settings. The interaction theory, the simplest form of the integral theory, identifies the individual

and the environment as separate entities and studies the interactions between them. The stimulation theory defines individuals' reactions to stimuli in the real world. The stimuli can be as simple as light, sound, heat, and cold or as complex as a building, people, outdoor settings, or painful medical procedures. Adaptation-level, arousal, overload, and restricted-environmental theories are contained within the stimulation theory. The adaptation-level theory states that individuals have the ability to adapt to a certain level of stimuli. However, after the threshold of adaptation of stimuli is reached, there is a change in the individual's perception or behavior. The threshold of adaptation differs with each individual, stimulus, and stimulus load. The arousal theory identifies how the physiological make-up of individuals relates to stimuli; the overload theory addresses the results of too much stimulation, and the restrictive environmental theory identifies individual reactions to environments that have little or no stimuli. The amount and the control of stimuli can have negative or positive effects on the individual. Thus, the third major theory, control, identifies these effects from different points of view: how much control a person has, thinks he or she has, or would like to have over the stimuli encountered in the environment. The fourth major theory, behavior-setting, seeks to explain activities that take place in designated spaces such as hospitals, grocery stores, classrooms, and gyms. For example, the structure for teaching in a junior high classroom mandates one teacher in front of the room facing students seated in their desks. Theorists would study the uniformity in each role in the classroom, such as teacher and student, rather than the variations in individual behaviors. They would also seek to explain the relationship between each given role and the interaction of the roles with the environment (Gifford, 1996) (see Appendix A).

Developing theories to explain interactions between individuals and stimulation in the environment requires large scale studies to define behavior patterns. One method to increase

sample numbers in studies combines statistical results from independent studies to increase the statistical power of the results. Researchers approach this method, called meta-analysis, with caution. The validity of the meta-analysis depends upon the methods used in combining the studies. In 2009, Crombie and Davies suggested five important areas to address to obtain a valid meta-analysis; the quality of studies used, heterogeneity, a comprehensive collection of studies to avoid bias, addressing publication bias, and the calculations used to combine the effect sizes.

Researchers have developed methods to assess the validity of the requirements identified to create a reliable meta-analysis. One method, scales developed by Chambers et al. (2009) and Jadad et al.(1996), addressed quality assessment of research studies. A second method, Cochraine's Q, determined the heterogeneity (how combinable the studies are). A third method used a full review of published quality studies that included studies which showed no effect results to avoid bias. A fourth method used funnel plots to identify publication bias, the result of studies not being published because no effects were found. Funnel plots plotted the effect size against the sample size resulting in a symmetrical (non-biased) or asymmetrical (biased) data distribution (Crombie & Davies, 2009). These methods of identifying quality were important in healthcare research because meta-analysis was used most often in evaluating the effectiveness of healthcare interventions.

2.7 Methodology of Studies

2.7.1 Oxford quality scale. Chambers et al. (2009), DeMore and Cohen (2005), and Uman et al. (2010) conducted meta-analyses of studies to determine the efficacy of interventions to help alleviate the pain and distress in young children during routine immunizations and other needle-related perceptual pain. In one meta-analysis conducted for the Cochrane Collaboration, Uman et al. coded the studies for inclusion using the Oxford Quality Scale developed by Jadad

and his colleagues to assess medical research trial validity (Jadad et al., 1996). All three of the meta-analyses identified the qualities necessary for studies to be included in the analyses as; the study must be a randomized controlled trial or quasi-randomized, the pain and distress measurements used must be validated, and the study must include all measured outcomes and analyses.

2.7.2 Non-biased random selection. Anjali Joseph, Vice President and Director of Research for the Center for Health Design (CHD) stated the CHD does not have published research rigor guidelines but uses other published guidelines in their literature reviews such as the variations of the Cochrane guidelines published by the Cochrane Collaboration, an international network dedicated to reporting the current relevant and valid evidence-based health care research (Personal communication, March 4, 2013). To identify valid research, the Cochrane Collaboration published a handbook that included the Collaboration's tool for assessing the risk of selection bias. The tool identified the need for a random sequence allocation of subjects for each participant in the study. The allocation must be concealed so the participants do not have foreknowledge of the treatment they will be assigned to (Cochrane Handbook for Systematic Reviews of Interventions, 2011).

2.8 Validated Pain and Distress Measures for Children

2.8.1 Understanding of pain and distress differences in children and adults. Through research, psychologists developed behavioral, physiological, and self-report instruments to measure the complexity of pain and distress perception, but the majority of these instruments were developed for adults. Psychologists realized a child's understanding of procedures and pain usually differ from an adult's (Ulman et al., 2010), so research began to focus on understanding pain and distress in children which led to the development of a large number of very diverse

behavioral, physiological, and self-report measures of pain and distress.

2.8.2 Psychological measures of pain and distress in children.

2.8.2.1 Behavioral measures. Broome, Lillis, and Smith (1989) explained that children have verbal and non-verbal responses to the threat of pain, perceived pain, and distress. These responses include torso and leg movements, crying, verbal complaints, trying to escape, and facial expressions. Researchers coded these behavior responses to create instruments that may determine the anxiety and pain perception of the child. An observer would note the type and number of responses during the medical procedure or from a videotape of the procedure and use the instrument to assess the child's pain and distress. Researchers developed and used the following behavior instruments to assess the child's pain and distress (see Table 2).

Table 2.2

Behavioral instruments used to measure children's pain and distress

Name	Definition
BAADS	Behavioral Approach-Avoidance and Distress Scale – 5 pt. scale to assess the level of distress and coping style (Blount et al., 1992)
CHEOPS	Children's Hospital Of Eastern Ontario Pain Scales rated no pain = 0, severe pain = 3
FLACC	Faces Legs Activity Cry Consolability Scale
OSBD	Observational Scale of Behavioral Distress - 9 coded categories (Blount et al., 1992)
CAMPIS	Child-Adult Medical Procedure Interaction Scale, a 35-code observational scale (Blount et al., 1992)
CAMPIS- R	revised from CAMPIS into a six codes that include child coping, distress, and neutral behaviors (Blount et al., 1992)
CFCS	Child Facial Coding System, 13 facial expressions shown to be reliable measures of pain (Cassidy et al., 2002)
CMFS	Child Medical Fear Scale, 17 item questionnaire of medical procedures. Each question is rated "not at all afraid" = 1, "a little afraid" = 2, "a lot afraid" = 3 (Sparks, 2001)
Child Medial Distress Scale	12 item behavioral rating instrument that measures observable distress behaviors (Krauss, 1997)

Table 2.2 continued

Behavioral instruments used to measure children's pain and distress

MBPS	analyzes the infant's facial expression using scores of 0,1,2,3 with 0 indicating the least distress to 3 indicating the most distress (Cramer-Berness & Friedman, 2005)
VAS	Visual Analog Scale 10 cm depicting "no anxiety" = 1, "worst anxiety imaginable" = 2 (Cassidy et al., 2002)

The assumption made in the development and validation of behavioral instruments was the cries and flailing indicated the amount of pain and distress the child experienced during a medical treatment. Broome et al. (1989), Kleiber & Harper (1999), Sparks (2001), and Vessey et al. (1994) stated the child's inborn nature may dictate how the child reacts to pain and distress. Passive temperaments may not display distress behaviors but can be experiencing pain equal to or greater than that of the child who actively displays distress. Children displaying a large number of behavioral responses often rate their pain lower than children displaying more passive behaviors during the same medical procedure. Researchers evaluated younger children experiencing different painful stimuli, including immunizations, and concluded the behavioral responses only minimally correlated or negatively correlated with the children's self-reports of pain (Kleiber & Harper, 1999; Sparks, 2001; Uman et al., 2010; Vessey et al., 1994). Beyer, McGrath and Berde found the intensity of children's perceived pain did not match the behavioral responses to the pain and concluded the relationship between pain perception and pain behaviors is more complex than previously considered (cited in Kleiber & Harper, 1999).

2.8.2.2 Child's self-report measures. Sparks (2001) and McGrath (1996) stated the "gold-standard" of psychological pain measurement is self-report. Broome et al. (1989, p.156) defined self-report "as the child's verbal assessment of the degree of pain experienced." In a meta-analysis of studies conducted using distractions to mitigate needle-related pain and distress

in children, Uman et al. (2010, p. 11) stated all measures of pain, including self-report, are indirect measures for children due to the complexity of pain, yet self-report measures "are weighed most heavily in patient outcomes." As long as the patient experiences reductions in pain, then the outcome can be considered effective. The following self-report measures were the most frequently used by researchers in studies to determine a child's pain during needle related procedures (see Table 3).

Table 2.3

Self-report pain measures to determine a child's pain

Name	Definition
FACES	five face drawings from frowning to smiling and rated from "most pain possible" to "no pain at all" (Cohen et al., 1997)
FPS	Faces pain scale, seven faces depicting neutral or "no pain" = 1, "most extreme pain" = 2 (Cassidy et al., 2002)
Wong-Baker FACES	VAS of 6 face drawings from very happy to sad, crying face (Wong & Baker, 1988)
Oucher	younger children use a scale of 6 photographs of a child ranging from "no hurt" to "the biggest hurt ever" -older children use a scale from 0 to 100 (Sparks, 2001)

2.8.3 Physiological measures of pain and distress in children. Broome et al. (1989) described a physiological response as a change in the physical well-being of patients in response to their pain perception. Measuring the change in the physiological response can indicate the degree of the intervention's effectiveness. The majority of physiological measures are used in studies with adults. Ulrich et al. (1991) used physiological measurements to assess the efficacy of nature versus urban scenes to assist stress recovery in adults. In this study, researchers attached electrodes to the adult participant to monitor heart period, pulse transit time, spontaneous skin conductance response, and frontalis muscle tension for the study. In studies with children, attaching electrodes may excite, frighten, and increase their anxiety. As a result,

researchers look for child pain and distress measures that are noninvasive and easily accepted by the child. Salivary cortisone, heart rate, respiratory rate, blood pressure, and oxygen saturation are physiological measures practical for use with children during a medical procedure as they require monitoring instruments but no invasive measures (Uman et al., 2010). Salivary cortisol assay, collecting oral saliva, generally increases with pain and stress, but cortisol may not be specific to pain. Heart rate and blood pressure generally increases with pain. Respiratory rate, however, may increase or decrease. Transcutaneous oxygen tension, the level of oxygen in the peripheral blood supply, generally decreases with pain and distress. Transcutaneous carbon dioxide tension may increase or decrease with pain and distress. Researchers differ on the validity of these physiological pain measures. McGrath (1996) suggested there is sufficient data on heart rate, vagal tone (the impulses from the vagus cranial nerve that inhibits the heartbeat), transcutaneous oxygen, sweating and the stress response to validate the use of these measurements in some studies to determine short and sharp pain.

Studies focused on the use of interventions during needle-related medical procedures employed a variety of psychological and physiological pain and distress measurements. Eighty intervention studies reviewed in three meta-analyses revealed that all studies used psychological measurements while only four used physiological. Table 4 identifies the pain measurements used in studies selected to identify rigorous methodological characteristics for pain intervention for children receiving immunizations (Chambers et al., 2009). Table 5 identifies the use of physiological pain-predicting metrics, specifically heartrate, as well as psychological measurements in intervention studies of children receiving venipuncture.

Table 2.4

Pain and Distress measurements in studies using distractions during immunizations

Author, Year Intervention groups	Pain measurements	Distress and fear measurements
Blount et al.(1992) 1 group trained to blow party blower 1 group control	The Child-Adult Medical Procedure Interaction Scale (CAMPIS) - raters scored from videotape FACES – child self-report of pain	Observational Scale of Behavioral Distress (OSBD), BAADS raters scored from videotapes VAS (Visual Analogue Scale) – Parent rated child's fear prior to procedure, procedural hurt, how did parent think they would help, how did the parent help, how distressed was the child during procedure FACES – child assessment of fear before the procedure VAS – Nurse assessment of child's anxiety
Bowen and Dammeyer (1999) 1 group blowing party blower 1 group blowing pinwheel 1 group control	Wong-Baker FACES – child self-report of pain	Questionnaire – parental assessment of child's anxiety using 5-pt Likert rating scale Questionnaire – nurse assessment of child's anxiety using 5-pt Likert rating scale
Berberich and Landman (2009)	Faces Pain Scale-Revised (FPS-R) parent and child scores	Face-legs-activity-crying-consolibility (FLACC)
Cassidy et al. (2002) 1 group watch musical cartoon movie 1 group control	Children's Hospital of Eastern Ontario Pain Scale (CHEOPS), CFCS- Blinded raters scored from videotape –pre-needle, needle, post needle FPS – child's self-reported pain	VAS - Parent rated own and child's anxiety

Table 2.4 continued

Pain and Distress measurements in studies using distractions during immunizations

Cohen et al. (1999)	VAS Child report – expected distress and pain, distress, pain Heart rate – baseline, pre-procedural, post-procedural, delayed for 3 to 5 minutes	CAMPIS-R (Child-Adult Medical Procedure Interaction Scale-Revised) child coping and distress, nurse coping VAS Nurse report of child distress, pain and nurse distress
Cohen et al. (1997) 1 group nurse coach to watch cartoon movie 1 group nurse coach + train parent to watch cartoon movie 1 group standard care	FACES – child's self-reported pain	CAMPIS- R (revised) child coping and distress, parent and staff coping (coaching) and distress. Raters scored from videotape 5-pt Likert rating scale – parents reported how upset they were, the parent's perception of their child's distress 5-pt Likert rating scale – nurses rated their own anxiety and perception of child's distress
Cramer-Berness and Friedman (2005) 1 group distraction stimulus by parents 1 group supportive care 1 group standard care	MBPS – observations of child's pain made pre-needle, needle, post-needle by 3 undergraduate coders blinded to hypothesis but not blinded to interventions	VAS – parental assessment of how much the child was upset Trait Anxiety Questionnaire- to ensure the parents across the groups did not differ in their global anxiety
Felt et al. (2000) 1 group parental distraction 1 group standard care	Blinded raters scored from videotapes –pre-needle, needle, post needle using researcher developed behavioral assessments	Salivary Cortisol assay

Table 2.4 continued
Pain and Distress measurements in studies using distractions during immunizations

French et al. (1994) 1 group blowing out air like blowing bubbles 1 group control	VAS – parent and nurse evaluation of the child, child's self-reported pain	VAS – parent scored their own anxiety about shots for themselves, their own anxiety about the child's shot that day, and the parent's prediction of their child's reaction to the shot OSBD – researchers evaluated videotapes of the procedure
Fowler-Kerry and Lander (1987) 1 group suggestion 1 group music distraction 1 group music distraction + suggestion 2 groups control	Researcher developed pain management scale – 4 pt VAS child self-report	
Krauss (1997) 1 group videotape presentation 1 group control		Child Medial Distress Scale – experimenter, parent and nurse to rate the child's distress
Megel et al. (1998) 1 group music intervention 1 group control	Heart rate Blood pressure Oucher – self-reported pain	Observational Scale of Behavioral Distress (OSBD)
Sparks (2001) 1 group touch (gentle massage 1 group blowing bubbles 1 group standard care	Oucher – self-reported pain	CMFS – self-reported fear

Table 2.5

Physiological and psychological pain measurements used in studies using distractions during venipuncture

Chen (1999)	Physician's report using VAS Child questionnaire Child systolic and diastolic blood pressure ratings Child heart rate Child salivary cortisol	Memory interview Child self-report of anxiety and pain using VAS Procedure Behavior Check List (PBCL)
Harrison (1991)	Child self-report of pain and fear using VAS Radial pulse rates Parent questionnaires	
Posner (1998)	Child self-report of anxiety and pain Parent and nurse ratings of child distress Child heart rate	Behavioral child distress scores

2.9 Studies of Positive Distractions

2.9.1 Distraction types during painful medical procedures for children. The number of interventions developed and studied to help children and adolescents ages 0 to 18 years old cope with medical perceptual pain emphasizes the importance of positive distractions in the healthcare environment. The use of distractions to mitigate perceptual pain and distress in young children is not limited to immunizations. Researchers studied the use of distractions during venipuncture, intravenous insertion, allergy testing, wound dressing, lumbar punctures, bone marrow aspirations, and dental procedures. Vessey et al. (1994) studied the use of a kaleidoscope as a distraction during venipuncture and later Carlson, Broome, and Vessey (2000) studied the use of a kaleidoscope as a distraction during venipuncture and intravenous insertions. Bellieni et al. (2006) studied watching videos during venipuncture as an intervention in one group of children, having parents talk to their children about anything but the medical procedure in

another intervention group, and one control group with no videos and no instructions to the parents. Jeffs (2007) studied the use of children watching videos as a distraction during allergy testing. Nilsson et al. (2007) used lollipops as an intervention during wound dressings: one group of children received lollipops, while the control group received none. Fernald and Corry (1981) studied the use of empathetic reassurance as an intervention with children undergoing a venipuncture procedure: one group of children received empathetic reassurance from the attending nurse as an intervention, while the control group received only brief instructions from the attending nurse. Olmsted, Zeltzer, and LeBaron (1982) studied the use of hypnosis in young cancer patients undergoing lumbar punctures and bone morrow aspirations and Aitken, Wilson, Coury, and Moursi (2002) studied the use of music as a distraction for children during a dental procedure.

2.9.2 Distractions types during immunizations. A number of researchers have focused specifically on the use of distractions to mitigate perceptual pain and distress in young children receiving immunizations. Bowen and Dammeyer (1999) and Blount et al. (1992) studied the use of party blowers and pinwheels as distractions. One group of children had party blowers, one group had pinwheels, and one group, the control group, had no distraction. French et al. (1994) studied using breathing exercises as a distraction by coaching one group of children to blow out air during the immunization and compared the results with one control group of children who were given no instruction. Sparks (2001) researched one group of children with instructions to blow bubbles at the time of the injection, one group of children with the attending nurse applying a light stroking around the injection site, and one control group with no interventions. Cassidy et al. (2002) studied the use of watching videos and age-appropriate cartoons as distractions. Cohen et al. (1997) studied the use of watching videos in one group, the use of watching videos with

parent coaching in another, and no interventions in one control group. Berberich and Landman (2009) used preparation information before the immunization, a topical ethyl chloride spray, and a tool which vibrated the area around the injection site in one group of children and a control group with no preparation information and no vibration distraction. To prepare children for an immunization, Krauss (1997) developed and presented a video to one group showing a child receiving an immunization from a nurse while the control group received standard care with no video preparation. Fowler-Kerry and Lander (1987) studied the use of music as a distraction using five groups of children. One group received the suggestion that a researcher was going to help them, one group received music intervention, one group received music plus distraction, one control group wore headphones with no music and one control group received standard care. Megel, Houser, and Gleaves (1998) also studied music using lullabies as a distraction in one group and no intervention in one control group. (see Table 6)

Table 2.6

Methodology of studies using distraction during immunizations

Author, Year	Location	Immunization	Intervention (Independent Variable)	Population enrolled	Random assignment
Berberich and Landman (2009)	Pediatric Medical Group	DPT MMR Polio	verbal suggestion topical spray arm gripper vibrating instrument	N=41 4 to 6 years old	Randomly assigned
Blount et al. (1992)	County Health Department USA	N/A*	party blower	N=60 3 to 7 years old	Not available

Table 2.6 continued
Methodology of studies using distraction during immunizations

Bowen and Dammeyer (1999)	County sponsored immunization clinic USA	N/A	party blower pinwheel	N=80 3 to 6 years old	Quasi-experimental Random assignments could not be achieved
Cassidy et al. (2002)	Two urban pediatric practices Canada	DPTP	watch TV of an age appropriate musical cartoon	N=62 5 years old	Randomly assigned Method not available
Cohen et al. (1997)	County Health Center USA	DTP MMR	watch TV of an age appropriate cartoon	N=92 4 to 6 years old	Quasi-experimental Alternately assigned
Cramer-Berness and Friedman (2005)	Health Care Clinic USA	N/A	parental distraction parental supported care	N=123 2 months to 2 years old	Randomly assigned Method not available
Felt et al. (2000)	Urban pediatric practice	N/A	parental distraction	N=102 2 months to 2 years old	Quasi-experimental Enrolled sequentially
French et al. (1994)	Public Health Department USA	DPT	blowing out air like blowing bubbles	N=149 4 to 7 years old	Randomly assigned
Fowler-Kerry and Lander (1987)	Community Health Clinic Canada	DPT	music distraction music distraction + suggestion	N=200 4 years 6 months to 6 years 2 months	Randomly assigned Method not available
Krauss (1997)	County Health Department USA	DPT MMR	videotape of coping model blowing party blower	N=50 4 to 7 years old	Randomly assigned 50 pcs of paper numbered 1 or 2 drawn from jar

Table 2.6 continued
Methodology of studies using distraction during immunizations

Sparks (2001)	2 school based immunization clinics 1 public health center USA	DTP	blowing bubbles gentle massage	N=105 4 to 6 years old	Quasi-experimental

* N/A - not available

2.10 Results of Distraction Studies

2.10.1 Statistical analysis of the studies. In the research studies listed in Table 6, Bowen and Dammeyer (1999), Cohen et al. (1997), Fowler-Kerry and Lander (1987), Felt et al. (2000), and Sparks (2001) used ANOVA (Analysis of Variance) to interpret the continuous data. Sparks used ANCOVA (Analysis of Covariance) to hold the fear ratings constant to determine the effect of distraction on pain. Fowler- Kerry and Lander used ANCOVA to compare the groups with the ages. Cramer-Berness and Friedman (2005), French et al. (1994), and Krauss (1997) used t-tests to compare the paired data. Bowen and Dammeyer used Kruskal-Wallis to interpret nonparametric or ordinal data. Cassidy et al. (2002), Cramer-Berness and Friedman, French et al., and Felt et al. used chi-square for ordinal or categorical data. Cassidy et al. used the Mann-Whitney U test to determine group differences. Blount et al. (1992) did not disclose the statistical method used to interpret the data.

2.10.2 Outcomes of the studies. The results of the data interpretation of studies selected to identify rigorous methodological characteristics for pain intervention for children receiving immunizations are listed in Table 7. Ten studies found statistical differences showing less child distress in the distraction condition as observed by the researcher, nurses, or parents (Blount et al., 1992; Bowen & Dammeyer, 1999; Cohen, Blount, Cohen, Schaen, & Zaff, 1999; Cohen et

al., 1997; Cramer-Berness et al., 2005; Felt et al., 2000; French et al. 1994; Krauss, 1997; Megel, 1998; Sparks, 2001). Two studies found statistical differences reporting less pain in the distraction condition using a child self-report pain scale (Bowen & Dammeyer, 1999; Fowler-Kerry & Lander, 1987). Only one study using a physiological pain measure, salivary cortisol assessment, reported less pain in the distraction condition for infants (Felt et al., 2000).

No significant statistical differences between the conditions of the child's distress were found in seven studies using observed behavior measures (Blount et al., 1992; Bowen & Dammeyer, 1999; Cassidy et al., 2002; Cohen et al., 1997; Cohen et al., 1999; French et al, 1994; Krauss, 1997;). Five of the studies reported no significant statistical difference between the conditions for the child's self-report of pain (Blount et al., Cassidy et al., Cohen et al., 1997; French et al.; Megel). Two of the studies using physiological measures, heart-rate and blood pressure, found no significant statistical differences between the groups. These results suggested that distraction may be effective in reducing children's distress during a needle-related medical procedure as rated by behavior observation. However, when using the child's self-report of pain, the distraction may not be effective. (see Table 7).

Table 2.7

The results of studies using distractions during immunizations

Author, Year Intervention groups	Results
Berberich and Landman (2009)	Significant group difference • child and parent Faces Pain Scale-Revised scores • face-legs-activity-crying-consolability method. Scores rated by co-investigator
Blount et al.(1992) 1 group trained to blow party blower 1 group control	Significant group difference • for trained parents' engaged in more coaching commands to their child, CAMPIS distress behaviors used • trained children lower in child distress behavior, CAMPIS-R

Table 2.7 continued
The results of studies using distractions during immunizations

	• and BAADS scores used • in required restraint for the child, 31% of trained children requiring restraint and 56% of control group requiring restraint • higher level of nurses' coaching in trained child group • trained parents rated themselves and their children less distressed during the injection than they would normally be No significant group difference • for parental nonprocedural talk and humor to the child • in child coping behavior, BAADS Approach- Avoidance score used • in child distress behavior, Observational Scale of Behavioral Distress (OSBD) Total Distress scores used • in nurses' nonprocedural talk and humor to the child or in distress promoting behaviors • parental report of their children's pre-injection fear or pain during the procedure • parent's measures on their pre or post- immunization measures of their ability to help their child cope • child self-reported pain or fear ratings • staffs' ratings of either the child's distress or cooperation level
Bowen and Dammeyer (1999) 1 group blowing party blower 1 group blowing pinwheel 1 group control	Significant group difference • child self-report ratings of distress significantly higher in control and pinwheel group than in party blower group No significant group differences • parental rating of their child's level of distress • nurses' rating of the child behavior and distress • parent and nurses' rating of how well the pinwheel or party blower worked for the children
Cassidy et al. (2002) 1 group watch musical cartoon movie 1 group control	No significant group differences • for any pain or distraction measures using Faces Pain Scale, Child Facial Coding System, and Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) • Greater time looking at cartoon related to lower levels of pain • Only correlations with objective pain measures were statistically significant

Table 2.7 continued

The results of studies using distractions during immunizations

Cohen et al. (1999)	Significant group difference • CAMPIS-R child coping in the distraction condition than in either the pharmacologic or typical condition • CAMPIS-R less distress in distraction condition than in the pharmacologic • CAMPIS_R nurse coping promoting in distraction than in pharmacologic or typical No significant group differences • between conditions for child or nurse reports of distress or pain • heart rate measures between conditions
Cohen et al. (1997) 1 group nurse coach to watch cartoon movie 1 group nurse coach + train parent to watch cartoon movie 1 group standard care	Significant group difference • more coping behaviors in intervention groups than in control group • more behavioral distress in standard care than in intervention groups • children in control group required more constraint • children in control group reported more experienced pain in self-report • parent's ratings of child distress was higher in control group • nurses' ratings of child distress was higher in control group • nurses displayed more coping promoting behavior when interacting with intervention groups • nurses engaged in more distress promoting behavior in the control group • parents showed a higher percentage of intervals in which coping promoting behaviors occurred in interventions groups • parents in control group displayed more distress promoting behavior • parents reported more distress in control group • nurses experienced higher levels of distress during the medical procedure in the control group No significant group difference between the treatments groups • in parent or nurse distress, distress coping behavior • in parental coping promoting behavior • in child's reported pain or distress

Table 2.7 continued

The results of studies using distractions during immunizations

Cramer-Berness et al. (2005) 1 group distraction stimulus by parents 1 group supportive care 1 group standard care	Significant group difference • infant distress between standard care and supportive care in the post-needle recovery phase • parental behavioral interventions in distraction group in all phases, pre-needle, needle, and post-needle
Felt et al. (2000) 1 group parental distraction 1 group standard care	Significant decrease • in salivary cortisol levels for parental distraction group at 15, 30, and 60 minutes after immunization • in infant distress time at immunization in parental distraction group Significant increase • in parental distraction group using a behavioral technique with their infants before immunization Significant group difference • in infant comfort, intervention rated more comfortable by parental distraction group
French et al. (1994) 1 group blowing out air like blowing bubbles 1 group control	Significant group difference • fewer child pain behaviors in intervention group No significant group difference • parent's own anxiety about shots for themselves, anxiety about the child's shot, prediction of the child's reaction to the shot • child's reported pain using the Visual Analog Scale (VAS) • Nurse or parent VAS scores • Significant correlation of the parents, nurses, and children's assessment of pain using the VAS
Fowler-Kerry and Lander (1987) 1 group suggestion 1 group music distraction 1 group music distraction + suggestion 2 groups control	Significant group difference • pain responses lower in music distraction group using a 4-point VAS No significant group difference • the main effect of suggestion nor the suggestion x distraction interaction
Krauss (1997) 1 group videotape presentation 1 group control	Significant group difference • in distress rated by the researcher No significant group differences • in distress rated by the nurses or parents

Table 2.7 continued

The results of studies using distractions during immunizations

Megel et al. (1998)	Significant group differences • Total OSBD scores significantly less for intervention group No significant difference • between intervention and control groups for heart rate, blood pressure, or Oucher scores
Sparks (2001) 1 group touch (gentle massage 1 group blowing bubbles 1 group standard care	Significant group differences • reduced pain perception for both distractions, touch and blowing bubbles • total OSBD scores significantly less for intervention group

2.11 Limitations of the Studies.

2.11.1 Pain measurements in the studies. The assumption underlying the outcome of these studies is that pain response is an outcome not a dynamic process (Broome, 1989). Pain is a complex phenomenon affecting the physiological, behavioral, and psychological make-up of a child. Anxiety and stress can exacerbate pain, creating intricate relationships between pain, anxiety, and stress (Cassidy et al., 2002). The outcome measures may not accurately reflect the child's pain and distress because of the dynamics of these relationships. Another assumption is that the distractor is reproducible. Inconsistencies in the distraction interventions, (i.e. the nurse's personality, the parent's distress, the characteristics of the clinic, the time of day), compounded by the variations of the child's personality, create unique situations that may not be reproducible (Kleiber & Harper, 1999). Some distractions require an adult to teach or to coach the child. However, some adults may teach and coach better than others which may add strength to the distractor. If a child remembers the setting from a previous painful procedure, the distress may increase dramatically which may weaken the strength of the distraction. Differences in personalities and surroundings require a strong distractor to override the variations.

2.11.2 Methodological rigor in studies. The meta-analysis of studies to determine the

efficacy of distractions to mitigate pain and distress in children during painful medical procedures identified four characteristics of a rigorous methodological study: (a) the study should be a random-control or quasi-randomized design, (b) the instruments to measure pain and distress should be validated through previous research (c) the study should be double-blinded and (d) all withdrawals should be recorded. Three of these characteristics were included in the Oxford Quality Scale developed by Jadad and his colleagues: the use of validated pain and distress measures was not. In a meta-analysis study, Chambers et al. (2009) found that overall the studies lacked these characteristics of methodological rigor in the design, the execution of the study, and the reporting of results. The researchers stated eighteen out of the twenty studies in their meta-analysis rated a high risk of bias in the reporting methods, citing the lack of true randomization, blinding, and the incomplete reporting of outcome data as problematic. They also noted that studies with reported randomization did not identify the randomization process. Bowen and Dammeyer (1999) and Uman et al. (2010) concurred and reported the failure to describe both the randomization process and the drop-outs or participant withdrawals reduced the studies' effectiveness.

Another limitation identified in the studies was the lack of sensitive and reliable pain measures (Cassidy et al., 2002). In a meta-analysis, Broome et al. (1989) stated that inconsistent findings and investigator-developed pain and distress scales used without validity testing undercut the reliability of the various studies' conclusions. DeMore and Cohen (2005) also reported that the wide range of self-report measures of pain and distress, observer ratings of behavior, and physiological pain measures lacked correlation and confounded data results in the studies. French et al. (1994) found self-report pain measurements using the Visual Analog Scale (VAS), difficult for the children to use.

Another concern addressed the ability to draw samples that represent the population. Sparks (2001) reported that using a convenience sample of only healthy children in one suburban area did not represent a large population of children receiving immunizations. Using small sample sizes did not provide enough power in the statistical analysis to detect between-group differences, thus raising the risk of reporting a Type 1 or Type 2 error[1]. Another revealed flaw was the inaccurate reporting of the intervention administration. DeMore and Cohen noted the studies in their meta-analysis did not identify in what stage the distraction measure was taken. This omission is significant because research has revealed that a distraction has different effects depending on whether it is introduced in the pre-injection, injection, or post-injection stage. Other studies did not control for confounding variables, for example, the number of caregivers administering the injections; or the relationship between a child's temperament and perceived pain (Kleiber & Harper, 1999).

2.12 Recommendation for Further Studies

2.12.1 Methodology of studies. DeMore and Cohen (2005) stated researchers need to learn from their past mistakes and in future avoid the faulty methodological rigor found in prior research. Similarly, the researchers who conducted meta-analyses identified the need for more methodological rigor as a vital consideration in further studies (Chambers et al., 2009; DeMore & Cohen, 2005; Uman et al., 2010). Uman et al. listed six check points for future studies to ensure accurate reporting in individual studies and meta-analyses:

1. Report means and standard deviations for all outcomes measures.

2. Development of a set of "standard" outcome measures for pain and distress.

[1] A Type I error, known as a false positive, is the error of rejecting a null hypothesis when it is actually true. A Type II error, known as a false negative, is the error of not rejecting a null hypothesis when the alternative hypothesis is true. A Type II occurs when there is not adequate power to detect a statistically significant difference. (University of Texas (2011).

3. Development of a set of standard age ranges for studies.

4. Report the method of randomization.

5. Report withdrawals/drop-outs and reasons for dropouts.

6. Development of manualized interventions (pp 15-16).

Researchers typically report only means and standard deviations with significant statistical outcomes. However, a meta-analysis needs all means and standard deviations for a study to be included to ensure accurate comparisons between studies. It was recommended that researchers quantify how accurately the distraction is administered by the parents and caregivers and record the level of the child's attention on the distraction. In their meta-analysis report, DeMore and Cohen stated studies did not provide enough specific information for caregivers to be able to replicate the use of the distraction in clinical practice and recommended developing a manual for the distraction that would provide the exact identification of the distraction, the length of time and how it was administered.

2.12.2 Psychological measures in the studies. Recommendations for refinement and /or new directions in research emerged from these meta-analyses. Previously conducted studies involving children have examined using psychological interventions like distractions or hypnosis or using pharmacological interventions like analgesic cream or vibrating the area of the skin where the shot would be administered. Chambers et al. (2009) and Broome et al. (1989) recommended further studies using a combination of psychological and pharmacological methods. Chambers et al. also recommended studying how providing psychological interventions for younger children may benefit them in future medical procedures.

Determining the effect of a distraction on a child requires standard outcome measures, a

difficult achievement considering the complexity of children's temperaments, anxiety levels, and cognitive abilities. Children of different ages and developmental stages process and express pain and anxiety in diverse ways, so measures that work best for children of one age may not work well for a different age level or developmental stage. Researchers recommended more studies to identify how pain and distress measures relate to the age and development of children (Blount et al., 1992; Cassidy et al., 2002; Chambers et al., 2009; Cohen et al., 1997; DeMore & Cohen, 2005; Fowler-Kerry & Lander, 1987). Researchers also noted some nurses and parents displayed distress when the child demonstrated anxiety during a medical procedure and recommended further research to determine what affect mitigating a child's pain and distress has on the behavior of the medical caregivers and the attending parent or guardian, and how their distress relates to the child's level of distress (Blount et al., 1992; Cohen et al., 1997; DeMore & Cohen, 2005).

After conducting research using a kaleidoscope as a distraction for children receiving needle related procedures during a visit to an emergency room, Carlson et al. (2000) suggested further research to examine the strength of various distractions. Carlson et al. noted the children and parents appreciated the kaleidoscope as a distraction but data analysis showed no significant statistical differences between conditions. The researchers were surprised by the study's results and noted other studies using a kaleidoscope as a distraction during needle procedures showed significant statistical differences. The researchers concluded a stronger distraction was needed to counteract the higher stress influences of a sick child visit to an emergency room versus a well child check in a physician's clinic. They also recommended that the distractions be easy to use, time efficient, and cost effective (DeMore & Cohen, 2005). Chambers et al. (2009) concluded that previous studies lacked specifics on the development and use of the interventions. Future

studies should include this information with enough detail to ensure the replication of a validated distraction in healthcare practice.

3. Design of the Art-Light Movie to use as a Positive Distraction

3.1 An Overview of the Art-Light Research

The art-light research began as a preliminary study using an LED art-light as a positive distraction to help lower pain and anxiety in children during medical procedures in a pediatric clinic and developed into a study using an art-light movie as a positive distraction. The research required permission from three participating study locations, approval from three Institutional Review Boards, development of child art pictures and movies, Spanish translations of parental/guardian informed consent documents, two pilot studies, and data collection in two medical clinics. The following flowchart outlines the path taken from conception to end of the study that sought to explain the effectiveness of using an art-light movie as a positive distraction for children 4 to 6 years old receiving routine immunizations.

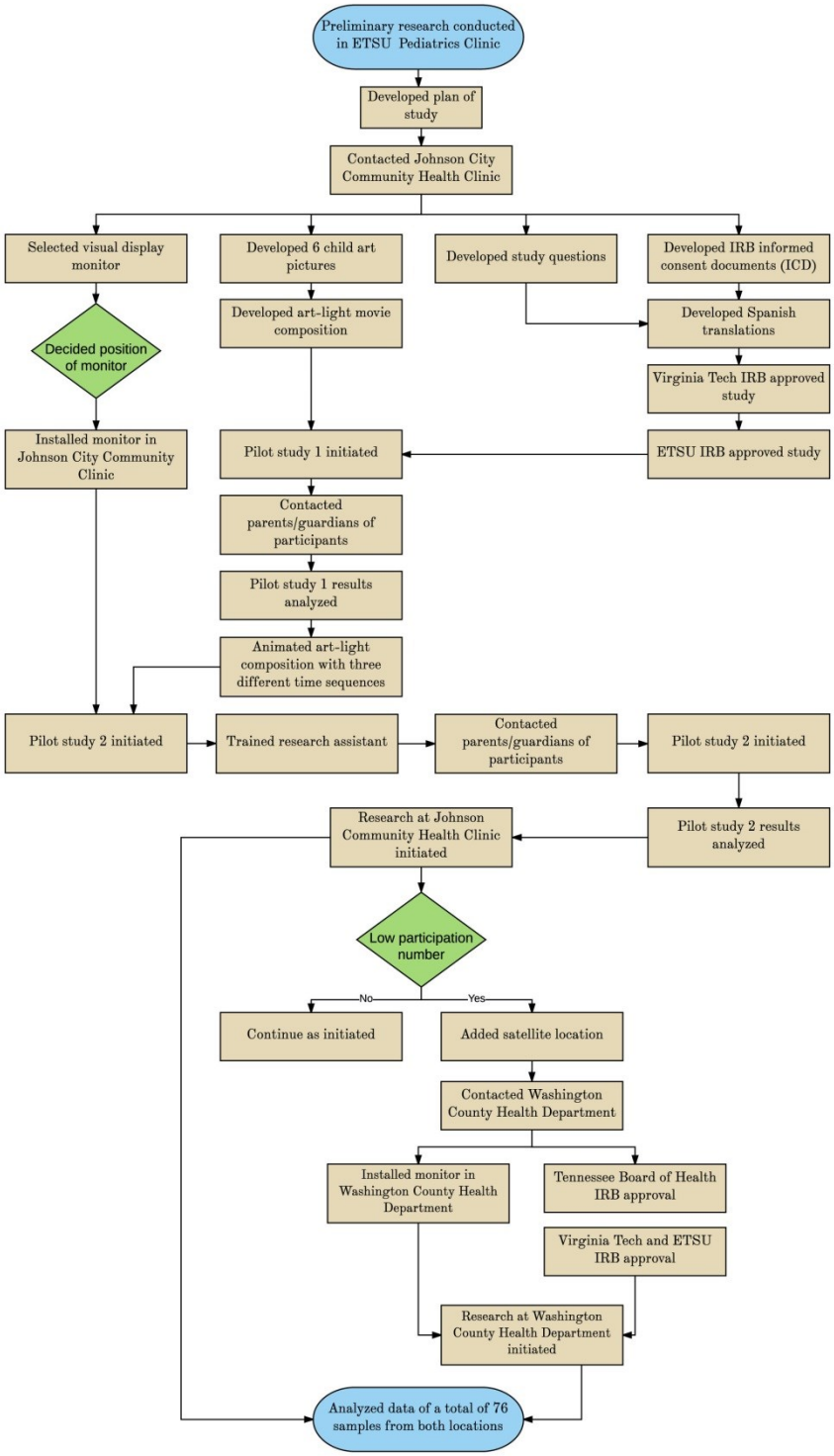


Figure 3.1: Flowchart outlining the path taken for the study of the art-light positive distraction

3.2 Preliminary Study Using an LED Art-Light as a Positive Distraction

3.2.1 Development of the LED light troffer with a lenticular lens. For a pilot study, the researcher built an art light image consisting of a fluorescent light troffer with all fluorescent hardware removed. After removing the fluorescent hardware, the researcher installed LED light bars in the light troffer. An art image was printed on 3-D lenticular lens, a plastic sheet molded into parallel rib-like rows or lenses. The picture was interlaced by creating layers in Adobe Photoshop and interpolating the layers into strips using Image Contour™. Each lens had a cylindrical shape that lined up with the strips in the interlaced picture. Once completed, the picture was inserted in the light troffer's lens space. The LED power supply, AC in and DC out, was installed in the plenum outside the troffer. The light controller was placed in the troffer and set to the desired light color change. As a result of the differential between each layer of the picture, the finished project produced a three-dimensional image when viewed from behind the lens.

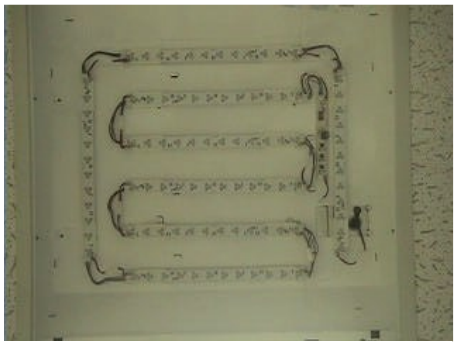


Figure 3.2: Installation of the LED light bars in the fluorescent troffer

3.2.2 Installation in a pediatric clinic, research, and results. The researcher installed the art-light image in the East Tennessee State University Pediatric Clinic in Johnson City, Tennessee in May 2007 and used survey instruments to collect sample data from patients, parents or guardians, and physicians in a randomized, balanced controlled study designed to determine if patients experienced less stress in the room with the backlit image as compared to three different exam rooms. The four different conditions consisted of one room containing the

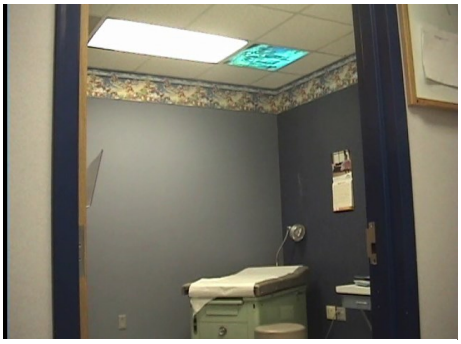


Figure 3.3: LED backlit image installed in the ETSU Pediatric Clinic in Johnson City, TN

art-light image, one room with a light troffer with lenticular lens and no LED backlighting, one room with a black square installed in the ceiling over the patient examination table, and one control room with no changes. The art-light room condition effect indicated a significant trend toward reducing patient anxiety level. Treatment means showed a significant statistical difference between the black ceiling square and the non-backlit image. The data results from regression analysis indicated that patients in the room with the black square showed the greatest amount of anxiety, patients in the non-backlit light image room and backlit light image room showed the lowest level of anxiety, while patients in the standard examination room ranked third in their level of anxiety.

3.2.3 Follow-up interview with nurses. In a follow-up meeting on January 15, 2013, the researcher met with nine nurses working in the ETSU Pediatric Physician's Clinic to assess the nurses' appraisal of the efficacy of the LED backlit image in lowering stress in their pediatric patients. The nurses commented, "We love it. It definitely works well. The older children ask for the room with the light because they remember it from their last visit. When the returning patients are placed in the room without the color change (the non-backlit light image), they get upset because we can't turn on the light change." When the researcher asked what problems they encountered with the light, the nurses replied, "We don't have one in every room." (Personal communication, 2013.)

3.3 Design of the Child Art Pictures

3.3.1 Selection of visual display unit. Wanting to create a stronger distraction, the

researcher planned to create an electronically controlled LED light consisting of individually lit squares forming a child art picture. The researcher then consulted with the President of Solid State Lighting Services, Morgan Patterson, PhD LC IES, and the AFG Chair of Excellence at ETSU, Andrew Czuchry, PhD, to determine the next step in the light development. They advised the researcher to develop the art-light image concept on an LED monitor (Personal communications, April 11, 2013). Patterson and Czuchry stated the researcher could create the same LED light image on a LED monitor with added features not available in the RGB LED light source. The advantages of using a LED monitor would include, an infinite color range for the art images versus only three colors in the LED light, the ability to change the switch-on time intervals of each cell in the image quickly, the ability to program new images on the LED monitor quickly, and the ease of installation.

After making the decision to use an LED monitor for the distraction, the researcher made inquiries into a visual display unit and selected a size large enough to attract a child's attention from a distance of three to four feet. After extensive investigation, the researcher chose a 22-inch digital picture frame, model BIG22USB14. Built and sold by BigeFrame located in Nashville, Tennessee, this model is capable of playing an HD 1080p video in a continuous loop from a USB drive using a widescreen format. The term HD stands for high definition and 1080p refers to the resolution of the picture or video formatting. High definition format (720p, 1080p, and 1080i) uses a higher picture resolution than the standard definition format of analog television (576i). The resolution number defines the number of pixels or dots used to capture the information in the picture or video. The larger the number of pixels or dots displayed in the image, the higher the quality of the image. In the standard format, the video and monitor are 576 pixels high and 720 pixels wide. The high definition format creates videos 720 pixels high x 1280 pixels wide and

1080 pixels high x 1920 pixels wide to correspond with 720p, 1080p, and 1080i monitors. The letters “p.” progressive scan, and “I.” interlaced scan, define how images are displayed on monitors. In progressive scan, the signal is converted into vertical columns that are displayed sequentially. In interlaced scan, the odd numbers of vertical columns are displayed first and then the even number of columns fill in the picture. This procedure happens very rapidly so the viewer cannot detect the process. However, interlaced scan creates a ghosting effect in fast-paced action videos so progressive scan became the dominant technology (Newton, 2015). Another necessary feature of the monitor, the continuous loop, allows the movie to repeat until manually turned off. This feature ensures the art-light movie will play through the entire immunization procedure.

3.3.2 Position of visual display unit. The researcher further refined the initial study by repositioning the art-light distraction, placing it on the wall instead of the ceiling (as it was in the ETSU Pediatrics Clinic). The decision to make this change developed during an interview with the pediatric nurse at the Johnson City Community Health Clinic on January 30, 2013. The researcher found the attending nurse positioned children 4 to 6 years old on their mother’s lap during the immunization procedure. This supported the conclusions from the researcher’s pilot study that positioning the art-light image on the wall may create the optimum interaction with the patient.

> The assumption was made by the researcher that the pediatric patients would lie down on the table for the examination. The majority of patients in this clinic were not required to lie down with their face oriented toward the ceiling for physician examinations. Although many patients did lie back on the examination table just to view the light, the patient faced the room’s wall during the majority of time spent in the examination room. Future

> research in a pediatric outpatient clinic may obtain different results by installing the backlit light image on the wall directly in front of the examination table (Dutro, 2007, p.63).

Andrea D Clements, professor of psychology at ETSU in Johnson City, Tennessee confirmed the wall placement and stated that keeping the study procedure consistent with the nurse's procedure creates a better study (Personal communications, Mar 15, 2013).

3.3.3 Development of six child-art pictures. In the development of six child-art pictures, the researcher sought an understanding of the art children liked best. A literature review of studies of child art preferences showed children in schools and hospitals highly valued child art, scenes of nature, non-threatening wildlife, and bright colors (Eisen, 2006; Hawthorn & Nanda, 2008). Guided by these preferences, the researcher developed six images of child art nature scenes using Adobe Illustrator CS5.1. The researcher created a grid of 1 inch squares, 18 inches wide by 10 inches high to fit the wide scale format of the digital monitor. Creating child art pictures using the grid of squares proved to be cumbersome, so the researcher turned to the ancient art of the Chinese tangram for inspiration. The Chinese tangram (a geometrical puzzle) used five triangles, one square, and one rhombus to create animal silhouettes. Inspired by the triangles in tangram shapes, the researcher drew diagonal lines from the opposite corners of each square in the Illustrator grid creating a triangle grid which allowed more freedom to create nature images.

Though the findings by Tofle et al. (2004) stated there is no clear evidence that color can affect the experience and performance of people in certain environments, the researcher used the same color palette and color distribution for each image. The background triangles were filled with the color blue (Illustrator Red28, Green117, Blue188) and the bright colored triangles

creating the child art pictures were filled with yellow (Illustrator Red0, Green148, Blue68), red (Illustrator Red148, Green30, Blue54), green (Illustrator Red0, Green148, Blue68), and a rich brown (Illustrator Red87, Green41, Blue41). This color palette was evenly distributed in each picture to eliminate bias that could result from differences in the children's color preferences. Even with the triangle grid and rich color palette, some animal images were easier to create than others. After trying nine different animal figures, the researcher selected a puppy, swan, duck, butterfly, squirrel, and fish to develop into the art images.

3.4 Development of Art-Light Movie Composition

3.4.1 Adobe Illustrator to Autodesk Maya to Adobe Premier Pro. The next step in the development of a strong positive distraction required creating a movie from the Illustrator child art picture. The movie would show the picture being built one triangle at a time to capture the children's curiosity as they sought to discover what the picture would reveal. Finding the right method to create the movie took research and development. The researcher first used Maya, a computer modeling software from Autodesk to construct the movie. Using the picture built from triangles in Illustrator as a guide, the researcher keyframed each triangle of the child art picture into a grid of triangles constructed in Maya. Each triangle was keyframed one-half second apart to change from a background blue to the color needed to create the picture. The Maya file with the keyframed color changes was imported into Adobe Premier Pro and exported as a H.264 media file (mp4 movie file). The H.264 formatting program, the highest quality and most popular codec available, compressed transmitted data and decompressed received data, thus allowing for faster transmission of a video.

The transition from the picture built in Illustrator to keyframing the grid in Maya proved cumbersome and time consuming, however. As a result, the researcher opted for a different

construction method: saving the original Illustrator file as an Adobe Photoshop file (.psd) and importing the .psd file into Adobe After Effects CC to create a mp4 video file. This proved to be a simpler and faster method without a loss in quality.

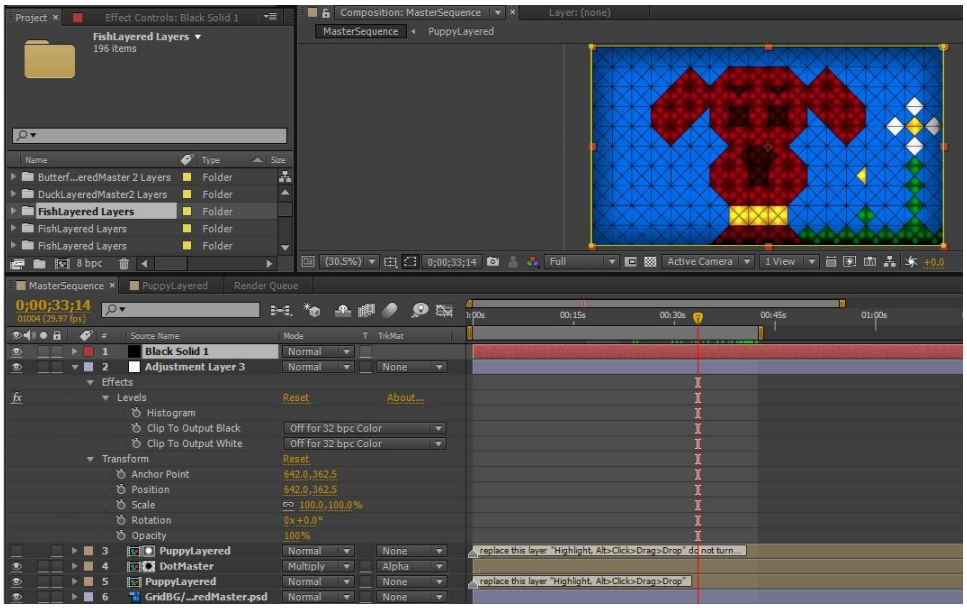


Figure 3.4: Photoshop puppy layered file in Adobe After Effects

3.4.2 Adobe Illustrator to Adobe Photoshop.

To make the transition from the Illustrator layers into After Effects, the researcher created a background layer in Illustrator that consisted of layers of blue triangles. (In Illustrator each created object or shape is placed on an individual layer.) The background layer was duplicated and the original layer locked. The researcher created the art images on the duplicated layer by changing blue triangles to bright yellow, red, green, brown and deleting any remaining blue triangles. Next, the yellow, red, green, and brown layers were released from the duplicated layer and the duplicated layer deleted. After this, the researcher exported the Illustrator file in a Photoshop format (.psd) and saved the image as 1280 x 720 pixels, HDTV 720, 72 ppi, RGB, write layers. This pixel size corresponded with the monitor's wide screen format.

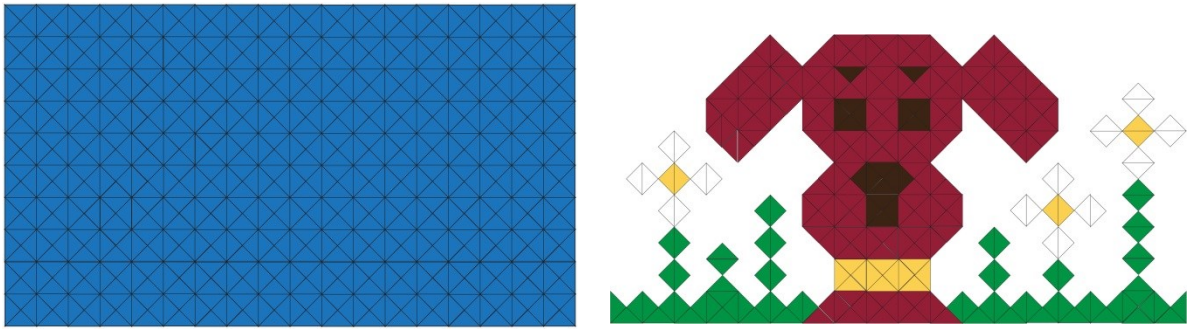


Figure 3.5: Left: Illustrator background layer.

Right: Art-image layer with background layer deleted

3.4.3 Adobe Photoshop to Adobe After Effects. When the Photoshop file was opened in Adobe After Effects, the child art picture appeared flat and lifeless, not vivid enough to hold a child's attention. Using the child's toy, Lite-Brite, as an inspiration, a composition with adjustment layers (named Master Sequence) was created in Adobe After Effects CC to give the picture the effect of a light being turned on behind each triangle as the color changed from the background blue to another color. To create this effect, the top adjustment layer, BlackSolid1, used a solid black triangle with an inverted mask to add contrast, creating a sense of depth to the picture. The next layer, Adjustment Layer3, adjusted the levels and gamma of the image. (Gamma is the exponent of the power function that expresses the relationship of light intensity to signal intensity for a display device as seen as the light and dark value of the image.) The next two layers, PuppyLayered and Dot Master, worked together to mask the light dots from the blue background triangles. Using an alpha channel, the blue triangles masked the light dots on the dot master layer revealing the light dots under each switched on yellow, red, green, or brown triangle in the puppy picture. The second PuppyLayered contained the triangle layers set on a time sequence to turn on at different frame intervals. The last layer, GridB-G through redMaster.psd,

contained the blue triangle background used in each image.

To create the remaining pictures, the researcher replaced the PuppyLayed file in the completed Master Sequence composition with the .psd files of the swan, duck, butterfly, squirrel, and fish. A jpeg file was created from each of the six child art images in the composition and printed individually on 8.5”x11” HP photo paper to use in the Pilot Study 1.

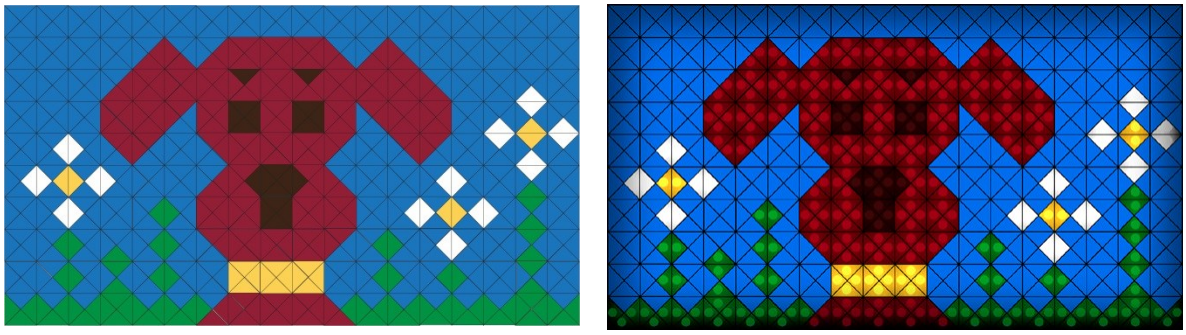


Figure 3.6: Left: Puppy grid. Right: Puppy grid with Adobe After Effects adjustment layers

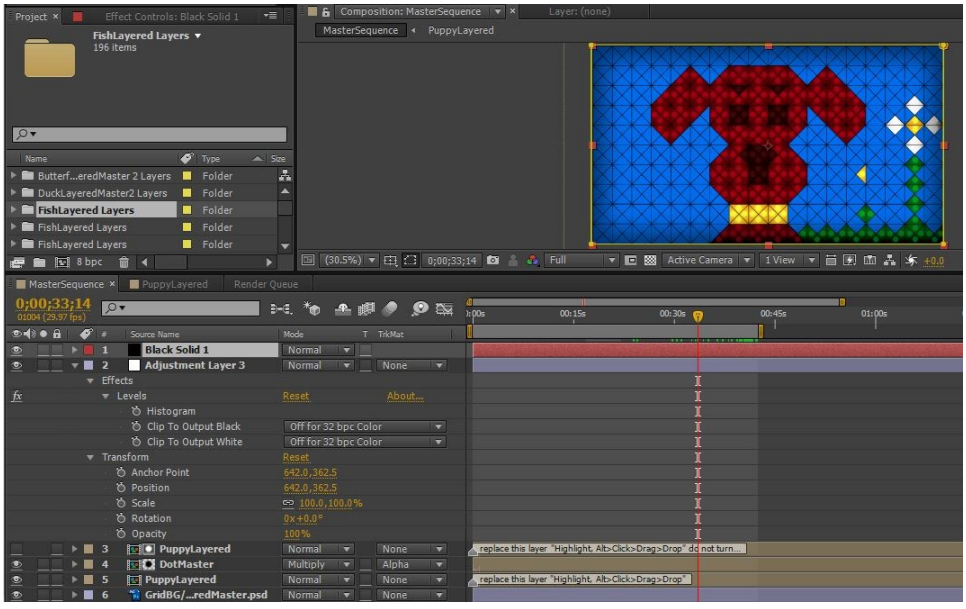


Figure 3.7: Adobe After Effects screen showing added adjustment layers

3.5 Pilot Study 1

3.5.1 Design of the highest ranked pictures study. After creating the six child-art images and obtaining East Tennessee State University and Virginia Tech Institutional Review Board approval for pilot studies 1 and 2, the researcher conducted a pilot study with fifteen – 4- to 6-year-old children to find their three favorites images from the six images constructed by the researcher. The researcher selected the 4 to 6 age range to correspond to the age of the future research subjects, children 4 to 6 years old receiving an immunization. The rationale for the pilot study assumed a stronger preference for a particular picture would strengthen its potential as a distraction. In Eisen's (2006) study to determine art preferences in school and hospitalized children, fifteen children from four different age groups, ages 5 to 7 and above, viewed six art images. With each picture, Eisen asked the children if they liked it and how it made them feel. Eisen recorded the responses of the children and ranked the pictures according to the children's preferences.

Using Eisen's study on children's art preferences as a model to find the children's three favorite images, the researcher obtained a convenience sample of fifteen participants by asking parents if they would allow their 4-to 6-year-old children to participate in this study. If the parent gave written consent (see Appendix B), the researcher met the child and parent or guardian in the Welcome Center of First Presbyterian Church in Johnson City, Tennessee. The researcher asked the child if he or she would like to participate in this study. If the child gave verbal consent, the researcher took the child to a children's classroom where the six art pictures were displayed on a preschool-sized table (see Appendix C). Asking the child to sit down in the front of the pictures, the researcher asked which picture was his or her very favorite. After the child pointed to the favorite, the researcher removed the favorite picture, rearranged the remaining pictures, and

asked the child to choose his or her next favorite picture. The researcher continued to take away the chosen picture and rearrange the picture placement until all pictures were chosen. If the child did not feel comfortable going into the classroom alone with the researcher, the parent or guardian was asked to accompany and sit behind the child in the classroom. The child would then know the parent or guardian was close by but could not look to them for guidance in which picture to choose. Table 8 shows the percentage of sex, age, and race of the children in this study.

Table 3.1

Pilot Study 1 Sample demographics

Sex	Male	53%
	Female	47%
Age	4 years old	33%
	5 years old	40%
	6 years old	27%
Race	White	87%
	Latino	13%

3.5.2 Results of the highest ranked pictures. The researcher recorded and added the scores from each child's choices in an Excel worksheet. The first picture chosen scored 1, the second picture chosen scored 2, etc. The picture with the lowest number was assigned the rank of one; the picture with the second lowest number, the rank of two; etc. Figure 3 shows the scores and rank of the pictures and Figure 4 shows the ranked pictures.

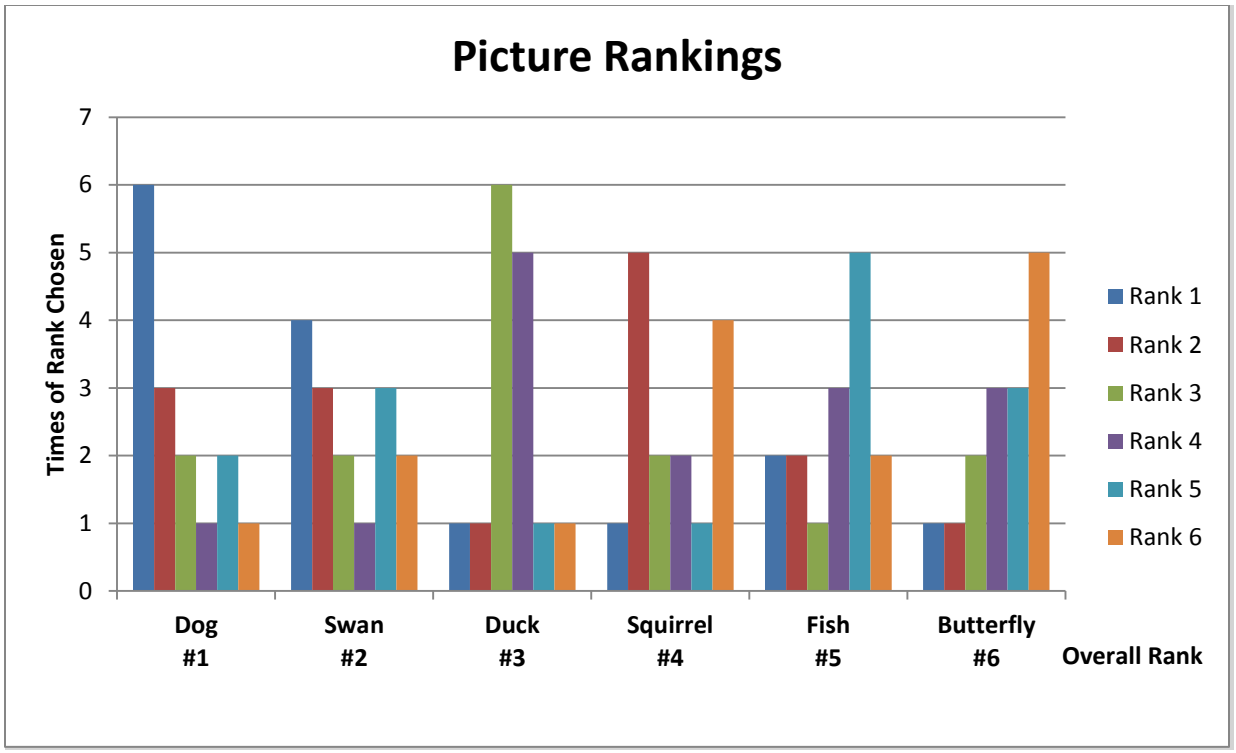


Figure 3.8: The scores and rank of the art light images as scored by the 15 child participants.

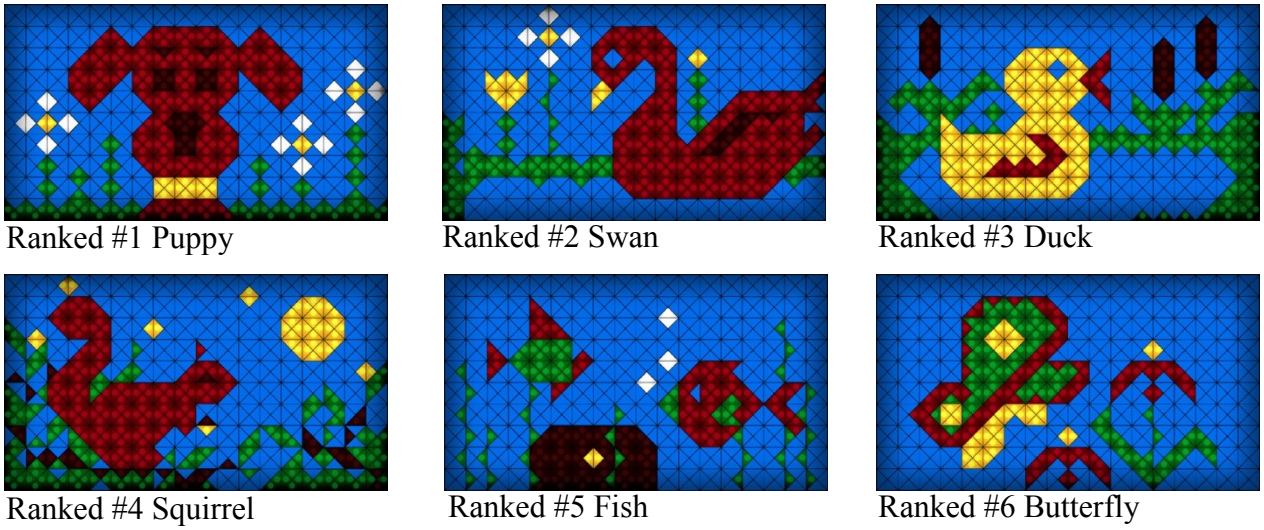


Figure 3.9: The art light images and their rankings

3.6 Composition of Art-Light Movie in Adobe After Effects.

3.6.1 Layer turn-on time sequence in Adobe After Effects. The researcher used the three favorite child art images determined in the first pilot study (the puppy, swan, and duck) to create movies that built the art images one triangle at a time. The researcher chose Adobe After Effects CC software to create the movies because of the program's ability to open the Adobe Photoshop.psd files in layers, to easily create the layering time-on sequence, and to export the layering sequence in a movie format.

After importing the Photoshop file into Adobe After Effects, the composition time rate for each movie was set at 30 frames/second with a five minute duration time. The best time to hold the child's attention for each frame turn-on time was unknown. A second pilot study was necessary to determine the best frame turn-on time to create the strongest possible distraction for the child. Nine movies were created for the analysis in the second pilot study of the best frame turn-on rate. The nine movies included three different frame turn-on times for each of the three favorite child art images. To create the 3 frame turn-on time, each layer in each of the individual image files was set on a time sequence to turn on every 3 frames. Using the brackets keys the layers were trimmed to 3 frames in length. Holding the shift key, the trimmed layers were selected one at a time in the best sequential order to build the picture. Next, the selected layers were sequenced using 'Animation/Keyframe/ Assistant/Sequence'. This process was repeated with each child art picture changing the layer sequence time to 7 frames, then 11 frames. Each frame time change was saved as a new composition. This method created three puppy movies with 3, 7, and 11 frame turn-on times; three swan movies with a 3, 7, and 11 frame turn on times, and three duck movies with 3, 7, and 11 frame turn-on times (see Appendix D).

3.6.2 Movie creation from Adobe After Effects composition. After keying in the frame

turn-on times, the researcher created an MPEG4 (mp4) movie, the most commonly used format to store video and audio images, from each Master Sequence composition (3, 7, 11) frame of each of the three child art pictures. Adobe recommended the Adobe Media Encoder for rendering files into video format. This program is Adobe's stand-alone application or companion to Adobe After Effects that transcodes and renders the built composition into any video format (codec). The codec H.264, preset of HD720p29.97 (pixel size and frames per second), and a target bitrate (data rate) of 20 was selected for each exported movie. The H.264 codec was chosen for its efficiency in compressing the file. The bit rate (how much data the codec stores each second) of 20 mbps (million bits per second) was a high quality format considering the slow action needed for the movie.

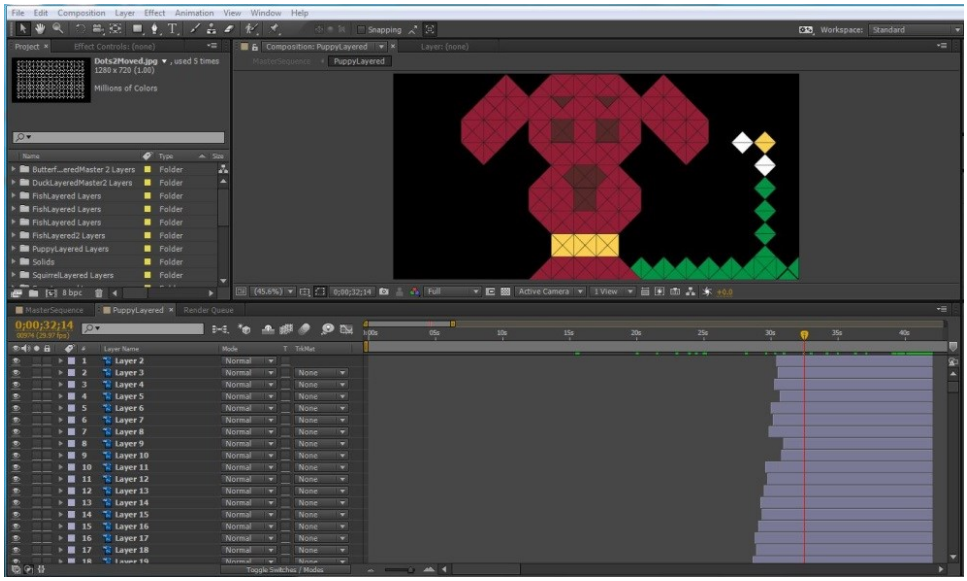


Figure 3.10: Adobe After Effects Screen Display for Puppy movie keyframe layers

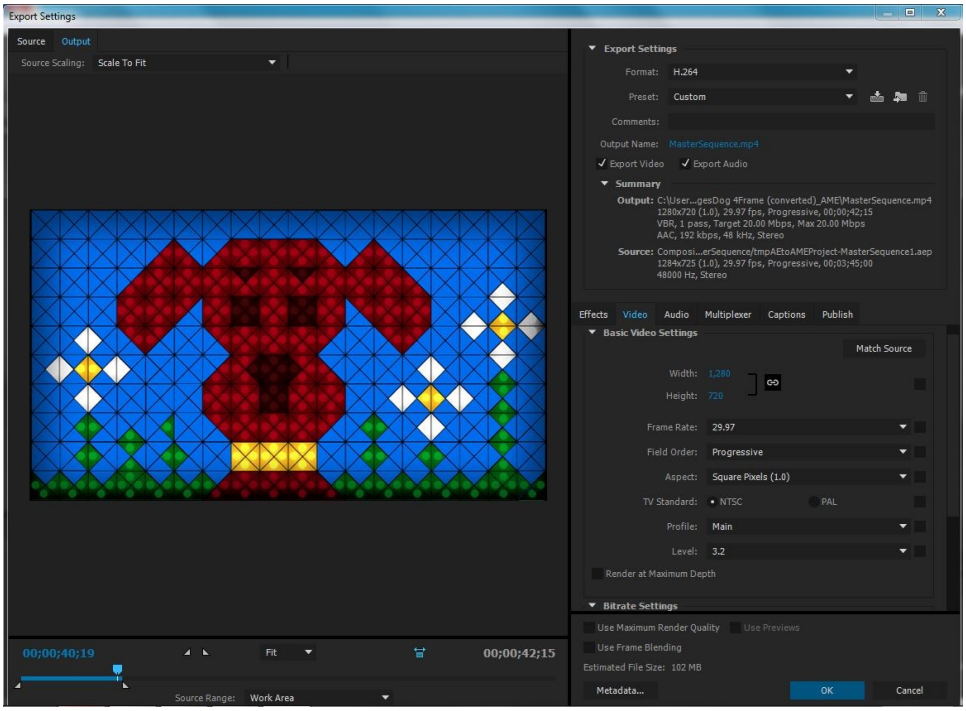


Figure 3.11: Adobe Media Encoder Queue for Puppy movie

3.7 Pilot Study 2

3.7.1 Study of best turn-on time rate for movie. Once the movies were completed, the researcher conducted a second pilot study to determine which of the 3, 7, or 11 frame-change times would best hold a child's attention and thereby create the strongest distraction. If the interval between the switch-on time for each cell was too long, the child would lose interest. A similar result would occur if the interval was too short. The children were monitored in a counter-balanced study to determine the frame-change rate of the movie that resulted in their looking away the fewest times. Researchers use counter-balanced studies to obtain unbiased data that is not influenced by the order in which the test components are presented. Therefore, using a counter balanced design eliminated any effect from the order in which the child viewed the movies (Pollatsek & Well, 1995). With this in mind, the researcher created three movies, each of which varied the order in which both the art picture and the frame rates were presented. Each

picture occurred first, second, and third; each rate occurred first, second, and third; and each picture occurred with each rate.

Video 1: Puppy (3-frame), Swan (7-frame), Duck (11-frame)

Video 2: Swan (11-frame), Duck (3-frame), Puppy (7-frame)

Video 3: Duck (7-frame), Puppy (11-frame), Swan (3-frame)

Five children viewed the first video, five the second, and another five the third.

To create a stronger study not biased by the researcher, an ETSU psychology work study student experienced in assisting researchers with studies of children collected the data from the viewings. The researcher met with Clements and the ETSU student research assistant at JCCHC to train the student in the research's protocol. Using the continuous duration observation study established by Rapp, Carroll, Stangeland, Swanson, and Higgins (2011), the assistant noted how long one 5-year-old child and one 6-year-old child watched, diverted their eyes, or turned their head away from the movie during this training session. Rapp et al. (2011) found the continuous time sampling observation methods produced the most accurate data results (as opposed to partial and momentary time sampling). The data were recorded on a D.A.T.A. phone app. It was noted during the training session that three seconds of blue background needed to be added to the beginning of Videos 1, 2, and 3 and the research assistant would need to be added to the IRB protocol. After making these changes, the researcher contacted the parents of fifteen children 4- to 6-years-old to ask if their child would like to participate in the study. If the parent agreed, the researcher scheduled the parent to meet the research assistant at the clinic. The assistant greeted the child, asked the parents to sign the consent form, and asked the child if he or she would like to participate in this study (see Appendices I & J). If the child agreed, the assistant then led the child to the examination room where the monitor was installed. The assistant seated the child in

front of the movie, instructed the child to watch the movie, and turned the movie on. The assistant observed each child watching the videos, recorded the observation data on the phone app, and sent the data to Clements. Data from the first three participants were not coded correctly and, therefore, were not used in the calculations. Fortunately, the data from the remaining twelve participants clearly and reliably showed a significant statistical difference in response to the frame turn-on rate.

3.7.2 Results of best turn-on time rate study. After the data were collected, the researcher needed to discover which frame turn-on rate and which picture best held the child's attention. In order to accomplish this, the researcher employed multiple regression, a technique that reveals how multiple independent variables influence variation in a dependent variable. In this case, multiple regression in SSPS 21 (Statistical Package for the Social Science) was used to identify the best predictors (Independent variables: picture being shown, frame turn-on rate, picture order) of "the number of times the child looked away per minute" (dependent variable). The predictors were entered simultaneously, which estimated the direct effects of the predictors on the dependent variable (see Appendix E). The full model was significant (F=2.95, p=.047). Only frame turn-on rate was significantly related to the number of times per minute the children looked away (see Table 9).

Table 3.2

Multivariate linear regression analysis: Pilot Study 2 data

	B	*Beta*	*P*
Picture being shown	-.178	-.159	.318
Frame turn-on rate	.119	.426	.010
Picture order	-.111	-.099	.531

Dependent variable: number of times the child looked away from the picture

After finding a statistically significant relationship between the frame turn-on rates, one-way ANOVA was used to determine which frame turn-on rate resulted in the fewest "looks away". The ANOVA was significant ($F = 3.67$, $p = .04$). Tukey, a multiple comparison follow-up technique, was used to determine which frame turn-on rate resulted in the fewest looks away. The follow-up revealed that the look away rate for 3 frame turn-on rates was significantly lower than for 11 frame turn-on. However, the 7 frame turn-on did not reveal a statistically significant difference from the 3 or 11. The 3 frame turn-on rate was chosen because it had the lowest look away rate, suggesting that it best held the children's attention (see Table 10).

Table 3.3

Descriptives: Pilot Study 2 Number of times child looked away from each Frame turn-on rate

	N	Mean	Std. Deviation	Minimum	Maximum
3 Frame turn-on rate	12	0.595	0.5	.000	1.983
7 Frame turn-on rate	12	1.045	0.712	.242	2.169
11 Frame turn-on rate	12	1.549	1.218	.496	4.578

4. Methodology of Study

4.1 Study Locations.

The participants in this study were enrolled from the patients attending the Johnson City Community Health Clinic (JCCHC) and Washington County Health Department (WCHD). After obtaining managerial and IRB approval, the researcher identified the control and intervention examination rooms and installed the monitors in the intervention rooms.

4.2 Participant Characteristics

The participants in this study consisted of children receiving routine medical care at the Johnson City Community Health Clinic and the Washington County Health Department in Johnson City, Tennessee. The inclusion criteria required that each child be between the ages of 4 and 6 years-old. No contact was made with the child or the parents or guardians prior to the scheduled immunization. Children identified as not well by the medical caregiver were not included in this study. Close to 50% of the children were White, 43.3% were Latino, and 9.3% were Black or Asian.

4.3 Sampling Procedures

4.3.1 Johnson City Community Health Clinic. Participants were enrolled in the study at the time of their medical appointment. The researcher obtained HIPPA training to get permission to view the Johnson City Community Health Clinic's pediatric patient's schedule. However, no prior contact was made with the participants' parents or guardians to enroll the children in the study. The researcher waited until the parents checked in at the front desk, then drew a number to determine which examination room to assign to the child. If the patient load was light and the room was available, the nurse used the room identified by the drawn number. If the patient load was heavy, the nurse assigned the patient to the first available room.

After the nurse recorded the child's demographics, the child and parents or guardians entered the examination room and waited for the nurse practitioner and nursing students. After the nurse practitioner examined and explained the necessary immunizations, the researcher approached the parent or guardian, explained the study, gave the parent or guardian the informed consent form, and requested permission to ask his or her child to participate. If the parent said yes, the researcher asked the child if he or she would be willing to participate (see Appendixes C and F). If the parents did not speak English well, an interpreter on staff was asked to translate. If a Spanish interpreter was used, a Spanish translation of the informed consent document was presented. Only three parents or guardians declined to participate and only one child declined. One parent, after granting permission, withdrew from the study before the immunization.

4.3.2 Washington County Health Department. The researcher began collecting data in the Johnson City Community Health Clinic (JCCHC) in Johnson City, Tennessee. Three months after starting the study, only twenty-four samples were obtained. Several factors influenced the low number: the practice of administering all the immunizations needed for a three-year period to 4-year-olds reduced the available pool of patients; many of the scheduled patients did not show; and the clinic was closed for two weeks due to snow and ice. The researcher tried to increase the number of the patients by asking United Healthcare to encourage the 3-to 6-year-olds behind on their immunizations to attend the JCCHC, handing out flyers advertising JCCHC at the schools registering for kindergarten, and calling to remind parents of their child's appointments. The number of eligible participants did not increase so the researcher requested modifications to the study, specifically adding a satellite location, the Washington County Health Department (WCHD) to the study and decreasing the number of participants to seventy-five. The Virginia Tech PhD committee granted approval. The researcher followed the same enrollment

procedure at WCHD as at JCCHC with the exception of relying on the staff to know the patient's well-child check or immunization schedule. Only one parent declined participation, and all the children asked agreed to participate.

4.3.3 Ethical issues addressed. At the time of enrollment, the researcher followed the Institutional Review Board (IRB) procedure to ensure the rights of the parents, guardians, and children were protected. The researcher presented the parent or guardian of the pediatric patient an IRB approved informed consent document stating that if they chose not to participate in this study their decision would not affect the quality of the medical treatment for their child. The researcher explained the study to the parent or guardian and asked permission to record his or her child's heart rate using a pulse oximeter. The researcher asked the child if they would participate, showed the child the pulse oximeter, and asked if he or she would allow the sensor to be placed on his or her finger. The researcher then showed the Wong-Baker pain measurement scale to the child and the questionnaire to the parent or guardian and asked if they would complete it at the end of the medical visit.

At the time of this research, approximately 90% the JCCHC pediatric clientele consisted of Latinos. An interpreter for the Spanish speaking population was on staff at all times to ensure good communications with the Latino patients. The Latino parents or guardians who used this clinic trusted the director JoAnn Marrs because she has shown the Latino people her commitment to their well-being (Andrew Clark, PhD, personal communication, February 18, 2013). When Dr. Marrs endorsed the research, the parents or guardians had the security to accept or decline their child's participation in the study without concern of losing the best healthcare for their child. The WCHD treated a lower percentage of Latinos and did not maintain a Spanish interpreter on staff. When the nurses needed a Spanish interpreter, they contacted one via phone.

Although the WCHD had access to Spanish translators via telephone, no translators were needed.

4.4. A randomized control study research design. To ensure quality in testing the hypothesis, the researcher conducted a randomized controlled study using three examination rooms located in the Johnson City Community Health Clinic (JCCHC) and three examinations rooms in the Washington County Health Department (WCHD). The three rooms in the JCCHC were identical in size, furnishings, layout, and wall colors. However, the rooms were different in their proximity to the nurse's station. The researcher installed a 22-inch digital picture frame monitor on the wall directly across from the patient examination bed in both exam room F106 and exam room F108. In room F106, the attending nurse started the art-light movie immediately before administering the immunization. In room F108, the monitor displayed the static picture and remained on throughout the medical examination and the administered immunization. No change was made, and no positive distraction was provided in F109, the control room. Similarly, the three examination rooms used at the WCHD, 182, 183, and 184, were identical in furnishings and lay-out. However, room 184 had a window, while rooms 183 and 182 did not. The researcher installed a 22-inch digital picture frame monitor in room 184 with the window and in room 183 without the window. Room 182 served as the control room. The monitors were positioned on the wall where the child could view the movie or picture sitting on his or her mother's lap. As in the JCCHC, the static picture remained on throughout the medical examination and the administered immunization and the attending nurse started the movie immediately before administering the immunization.

Figure 4.1: View from the examination bed in the pediatric examination room F108 in JCCHC

4.5 Sample Size and Power

4.5.1 Intended sample size. To estimate the number of participants needed, the researcher met with Jon Smith, PhD, statistician and Director of Business Research at ETSU, and Andrew Clark, PhD, nutritional biochemist at ETSU, to determine the power analysis.

Using a study on children's responses to immunizations, Megel et al. (1998) found a nine beat per minute rise in the heart rate of children in the intervention group and a sixteen beat per minute rise in the heart rate of the children in the control group. From this data, it was decided to look for a difference of 5 beats per minute in the analysis. Using a standard deviation of 8.6, an alpha of .05, a power of .80, and a difference of 5; one hundred twenty children, forty in each condition group, were needed to detect a significant statistical difference in the heart rate between groups.

4.5.2 Actual sample size. After three months of research at the JCCHC and obtaining only 24 samples the researcher added a satellite location, WCHD. In an interview with the nurses at the new site, it was estimated that fifty participants would be possible during the summer months. The researcher received permission from the PhD committee to stop collecting data after obtaining seventy-five participants. The total number of participants from both locations was seventy-six, 56% males and 44% females. The average age of the participants was 4.5 years old and the percentage of races studied was 49.3% White, 41.3% Latino, and 9.3% Black or mixed race (see Table 11).

Table 4.1

Study: Sample demographics of 75 participants

		Percent	Frequency
Sex	Male	56.0%	42
	Female	44.0%	33
Age	4 years old	62.7%	47
	5 years old	29.3%	22
	6 years old	8.0%	6
Race	White	49.3%	37
	Latino	43.3%	31
	Other	9.3%	7

4.6 Measures

4.6.1 Definitions of all measures.

4.6.1.1 Psychological measures.

4.6.1.1.1 Children's Self-Report of pain. The large variance in human personalities creates a large variance in understanding human subject reactions to stimuli. Researchers in psychology search for the best tools to determine the truth in their studies of human nature. In studies on the assessment of pain in children during a medical procedure, Finley (2001) stated children are very complex and obtaining pain measurements from them is very challenging. He identified a self-report measurement of pain as the gold standard of measuring pain. The self-

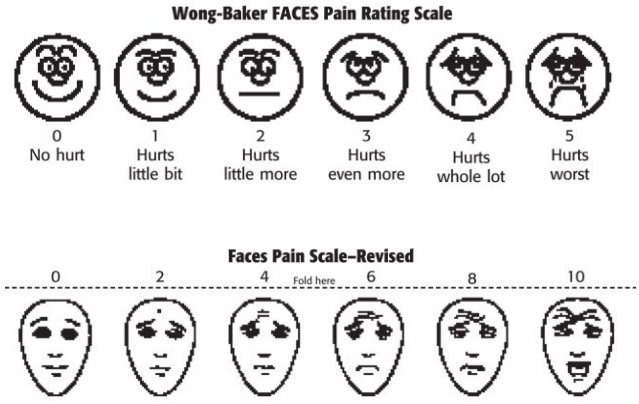


Figure 4.2. Top: Wong-Baker FACES pain measurement scale for children
Bottom: Bieri et al. Faces Pain Scale-Revised

report of pain measurement tools are different for adolescents, adults, and children. Adolescents and adults understand the concept of a linear scale starting at 0 for ‘‘no pain” and going to 10 for “worst pain imaginable”. It is difficult for children 4-to 6- years-old to understand how to map their pain on a linear scale because abstract thinking has not developed by this age (Bieri, Reeve, Champion, Addicoat, & Ziegler, 1990). Thus, researchers developed picture scales to assist medical caregivers in obtaining an assessment of a child’s pain during and after medical procedures. The FACES scale is one of the pain assessment picture scales for children developed through validated research.

In a study on a comparison of assessment scales for pain in children, Wong & Baker (1988) found that children, ages 3 to 18, preferred the FACES scale over the simple descriptive, numeric, and glasses rating scales (see Figure 12) . One year later Bieri et al. (1990) revised the FACES pain scale with more realistic faces. The researchers suggested the more realistic faces corresponded with actual pain expressions.

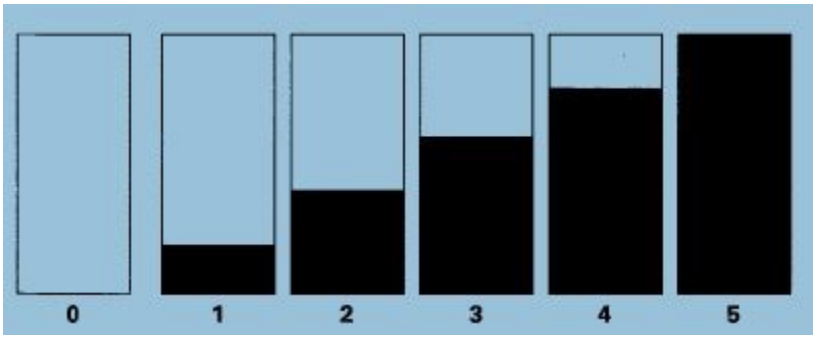


Figure 4.3: The glasses rating scale with glass 0 for no pain and glass 5 with a whole lot of pain

After assessing the validated self-report pain measures, the researcher chose to use the Wong-Baker scale because the JCCHC nurse currently used this scale as a pain measurement in children. Andrea Clements, psychology professor at ETSU, concurred with this decision stating that the children would probably respond better to the cartoon faces. (Personal communication,

March 8, 2013).

4.6.1.1.2 Parent/Guardian Survey Instrument. In a three-group study on reducing children's immunization distress using a pinwheel or party blower as a distraction, all the parents were asked to assess the child's distress by answering four questions: "(a) How upset was your child after getting the shot?, (b) Compared to other painful things that have happened to your child, how painful was this shot?, (c) How hard was your child crying during the shot?, and (d) How strongly did you have to hold your child?" The parents in the intervention room were asked a fifth question, "How much did the pinwheel or noise maker distract your child?" (Bowen & Dammeyer, 1999, p. 298). The questions were rated on a six-point Likert scale from 1 = not at all to 6 = very much (or very strongly for the question about holding the child). Using the six-point Likert scale forced the parent or guardian to choose one side or the other and kept them from remaining neutral in their answers. Andrea Clements, psychology professor at ETSU, suggested using these questions and the Likert scale because they comprised a validated test instrument. She also recommended adding a fifth question, "In the past when your child had a shot, did your child have any bad experiences because of the shot? If yes, please explain on the back of this paper what the bad experience was."

The researcher developed the parent/guardian questionnaire in English using the questions and Likert scale measurements listed in the paragraph above (Appendixes G and H). Ardis Nelson, director of Language and Culture Resource Center and Spanish professor at East Tennessee State University, translated the questionnaires into Spanish. The parents and guardians of the pediatric patients were asked to answer the researcher's questionnaire in their choice of English or Spanish.

4.6.1.1.3 Nurse Survey Instrument. The researcher developed a questionnaire in

English using the questions administered to the nurses in the Bowen and Dammeyer (1999) study. The four questions on the nurse's survey were "(a) How upset was this child after getting the shot?, (b) How hard was this child crying during the shot?, (c) Compared to other children, what was this child's pain reaction like?, and (d) How afraid was this child during the shot?" The researcher added a fifth question to the nurse's survey for the intervention room, "How much did the art-light picture distract this child?" The questions were rated on a six-point Likert scale from 1 = not at all to 6 = very much.

4.6.1.2 Physiological measures. The Johnson City Community Health Clinic nurse used the pulse-oximeter (Welch-Allyn REF #85MXVE built by Masimo) located in the clinic's examination room to monitor the child's heart rate. The nurse practitioner placed the fingertip monitor on the child after the well-child check-up and recorded the child's heart rate on a digital read-out mounted on the examination room's wall immediately before the immunization, immediately after the immunization, and five minutes after the immunization. In the study at the satellite location, Washington County Health Department, the nurses used a portable instrument, the Fingertip Pulse Oximeter by Drive Medical Design & Manufacturing.

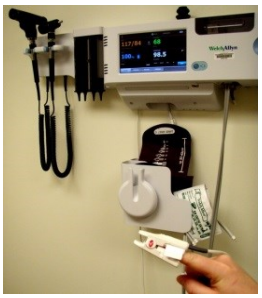


Figure 4.4: WelchAllyn Ref # 85MXVE pulse oximeter

4.6.1.3 Demographical measures. After the immunization, the nurse recorded the following information on the Patient Information form provided by the researcher: the child's sex, age, weight, and height, the length of time in the examination room, and any medications prescribed for the child to take (see Appendix I). No information that could reveal the child's identity was recorded.

4.7 Methods to collect data

4.7.1 Installation of monitors. In keeping with the findings from the initial pilot study and interviews with the JCCHC nurses, the researcher had the monitors mounted on the wall directly in front of the exam table which gave the child a direct view of the monitor. The researcher met with East Tennessee State University's electrician at the Johnson City Community Health Clinic for the installation of the two monitors. There were no existing electrical outlets on the wall where the monitor would be installed, so the electrician brought power from a line located above the suspended ceiling, through the wall, and installed a junction box to hard wire the monitors. This method of installation eliminated the visibility of electrical cords and provided a cleaner look for the examination room.

After obtaining permission to add a satellite location, the researcher met with the Washington County Health Department (WCHD) nurses and learned that for an immunization the parent or guardian sat in the chair next to the nurses' desk and the child sat in the parent's lap facing the wall behind the parent. Based on this information, the researcher decided to mount the monitors on the wall behind the parent giving the child a direct view of the monitor. The WCHD maintenance employee installed the monitors using an existing duplex outlet mounted eighteen inches above finished floor and located directed beneath the monitor position.

4.7.2 Informed consent documents.

4.7.2.1 Nurse informed consent document. Before the data collection started, the researcher met with each nurse, explained the study procedure without revealing the hypothesis of the study, and asked if he or she would participate. All of the nurses agreed and signed an IRB approved informed consent document prepared by the researcher. However, one nurse at the Johnson City Community Health Clinic expressed concern that the study would add to her work

load. After the researcher explained the importance of the study, the nurse agreed to participate (see Appendix J).

4.7.2.2 Parent/Guardian informed consent document. At the time of the request for the enrollment in the study, the researcher presented the parents or guardians with an IRB approved Informed Consent Document (ICD) in English or Spanish. The ICD explained the study's rationale including the benefits and potential harm to the participant, and assured the parents or guardians that not participating would have no effect on the quality of their medical care. The ICD also listed IRB and researcher contact information if the parents or guardians wanted further information concerning the study. (see Appendix K).

4.7.3 Assignment of participants to conditions. To create a random sequence allocation at the Johnson City Community Health Clinic, forty pieces of paper were numbered 1 to identify the control room, forty pieces of paper were numbered 2 for the movie room, and forty pieces of paper were numbered 3 for the static picture room. All the numbered pieces of paper were folded, placed in the bag and shuffled. The researcher drew one number from the bag when the patient signed in at the front desk and asked the nurses to assign the patient to the room corresponding with the number drawn. This method concealed the allocation of the condition from the nurse and patient until the time the child was assigned to the exam room and provided a random or chance process that protected the study against selection bias. However, when the patient load was high, the patient was assigned to the first available room.

The original allocation plan to obtain 40 participants in each of the three conditions at JCCHC changed when the study started at the WCHD. Clements recommended a random assignment of intervention rooms at both locations keeping the control rooms the same. Following this plan at WCHD, the researcher drew a number to determine the assigned room

after notification of a check-in. After two drawings it became clear that the room assignment was outside the control of the researcher. However, the room assignment created a random selection and eliminated bias. The researcher then alternated the interventions within the rooms showing the movie for the first patient assigned to room 183 or 184, the picture for the second patient, the movie for the third, etc. The researcher repeated the same procedure at JCCHC.

4.7.4 Obtain physiological data. The child's health was determined during the well-child check-up by the nurse practitioner at the Johnson City Community Health Clinic and the attending nurse at the Washington County Health Department prior to the administration of the immunization. If the child was not well, he or she was withdrawn from the study.

After the healthy child was enrolled in the study, the nurse prepared the immunizations, entered the exam room, and asked the child if she or he would allow the nurse to put the pulse oximeter on the child's finger. The nurse read the heart rate immediately before and after the immunization, and then returned to the nurses' station to record the immunizations on the patient's chart. The nurse returned to the room five minutes later, recorded the child's heart rate, and talked with the parents. When the nurse returned to the station, he or she filled out the nurse survey instrument and patient information nurse report which included heart rate information (see Appendices C, D, and E). The sequence of recording the heart rate was the same for the control, movie, and picture room at both locations. The differences in the procedure occurred in the movie and picture rooms. In the picture room, the picture was on when the child entered the room and the nurse coaxed the child to look at the picture immediately before the immunization. In the movie room the nurse used the remote to start the movie and coaxed the child to watch the movie immediately prior to the immunization.

One difference in the heart rate data collection between the two locations involved the

pulse oximeter. The nurses at the Johnson City Health Community Clinic used the pulse oximeter located on the exam room wall to record heart rate during a well child check. The Washington County Health Department nurses checked the child's heart rate manually by placing their fingers on the child's wrist. The researcher requested the nurses use a pulse oximeter for the purpose of the study. However, several of the nurses did not feel competent with the pulse oximeter and asked the researcher to help them. Before the immunization, the researcher showed the child how the pulse oximeter worked, placed it on the child's finger, the nurse and the researcher read the output, and then the researcher left the room.

4.7.5 Obtain psychological data after immunization. After the nurse administered the immunization and recorded the second heart rate, the researcher entered the exam room and gave the parent or guardian the questionnaire to answer. The researcher then explained the Wong-Baker faces scale to the child and asked the child to point to the face on the scale that showed how much the shots had hurt. Next, the researcher went to the nurses' station and waited for the nurse to complete the Nurse Survey Instrument and Patient Information Nurse Report.

4.8 Data analysis and results

4.8.1 Quantitative Data Analysis. All research data were recorded on an Excel worksheet and analyzed using IBM SPSS, predictive analytic software. The data were checked for errors and strange values. A check was made for any data that seemed to be missing and frequencies were run on all variables. One child who had a recorded initial heart rate of 163 and a heartrate of 90 immediately after the shot was identified as an outlier and was omitted from the analysis.

Bivariate correlations were calculated to find any statistically significant correlations to include in the analysis. Correlations were run between all the demographics, physical measures,

and situational variables (Location, Room number, Race, Sex, Age, Weight_pounds, Height_inches, Time in room_minutes, Medications, Daycare, Number of shots, Attending nurse) with the outcomes (Heart-rate before, Heart-rate immediately after, Heart-rate five minutes after, Heart-rate immediately after to five minutes after, Heart-rate before to five minutes after, Wong-Baker Scale, Nurse, Nurse question (Q)_1, NurseQ_2, NurseQ_3, NurseQ_4, NurseQ_5, ParentQ_1, ParentQ_2, ParentQ_3, ParentQ_4, ParentQ_5c6i, ParentQ_5i, ParentTot, NurseTot) to see which ones to include as covariates (see Appendix L). Only the age, weight, height, nurse, and number of shots were significantly correlated with any outcome variable or variables. Only the age, nurse, and number of shots were used as covariates because age, height, and weight are inter-correlated. Using the age was sufficient to capture the variance attributable to this factor.

Four mixed between-within subjects of ANCOVA were conducted to determine the effect of the three conditions (the between subjects factor) on the three times the heart-rate were recorded (the within subjects factor). The four mixed ANCOVAs were conducted 1) with no covariates, 2) with age as a covariate, 3) with age and Nurse, then 4) with age, Nurse, and number of shots. Age was the only significant covariate, so only that model is being reported. Heart-rate did differ significantly across time (the three times the heart-rate was recorded), but heart-rate did not differ significantly over time by condition. Mean heart-rate rose immediately after the shot(s) for all the groups, then declined, but did not differ significantly across conditions (see Appendix M for all analyses).

The Testing of Assumptions was conducted as follows:

1) Box's Test of Equality of Covariance Matrices was not significant. It can be accepted the groups do not differ from one another.

2) Levene's Test was not significant for any of the repeated measures ANOVA analysis. The assumption of equality of variances can be accepted.

3) Mauchly's Test of Sphericity was not significant for any of the repeated measures ANOVA analyses. It can be accepted that the variances of differences are not significantly different, but roughly equal.

The analysis showed the effect of time the heartrate was taken (before shot, immediately after, and 5 minutes after) was significant (p=.003) and time by age was significant (p=.022). However, condition by time was not (p=.346). There was no statistically significant effect on heart rate over time, F(2, 140)= 1.13, p = .346, Partial Eta Squared = .031.

Table 4.2
Heart-rate by time and condition

Condition	Time	Mean	Std. Error
Control	before shot	102.869[a]	3.361
	immediately after	114.452[a]	4.554
	5 minutes after	96.243[a]	3.574
Movie	before shot	99.989[a]	3.328
	immediately after	111.999[a]	4.510
	5 minutes after	101.539[a]	3.540
Picture	before shot	95.285[a]	3.534
	immediately after	110.641[a]	4.789
	5 minutes after	102.126[a]	3.758

[a] Covariates appearing in the model are evaluated at the following values: Age=4.459

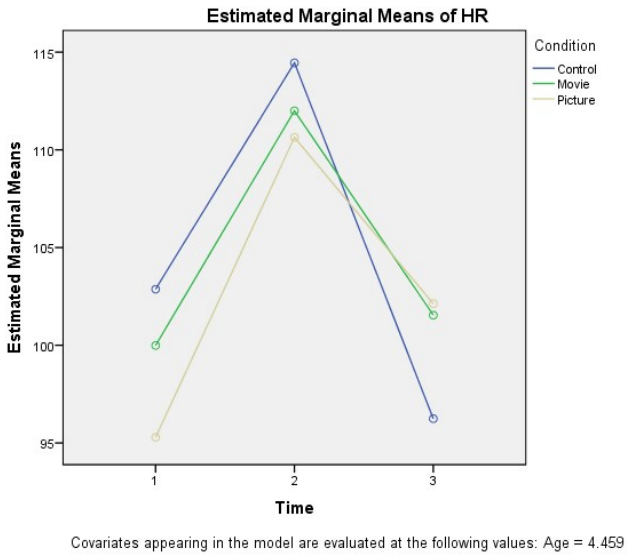


Figure 4.5: Heart-rate spike for the three conditions

Using ANCOVA an evaluation was made whether there was a difference in Wong-Baker scores across conditions using age, nurse, and number of shots as covariates. There was a significant difference in Wong-Baker by the child's age ($F(1,64) = 1$, $p<.001$, Partial Eta Squared = .189), and number of shots ($F(1,64) = 4.274$, $p = .043$, eta = .063); but not for nurse ($F(1,64) = 0.736$, eta = .011) or condition ($F(2,64) = 0.176$, $p = .839$, eta = .005 (see Tables 13 and 14).

Table 4.3
Dependent variable: rating on the Wong Baker Pain Scale

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Parial Eta Squared
Corrected Model	49.934[a]	5	9.987	3.208	.012	.200
Intercept	103,928	1	103.928	33.389	.000	.343
Age	46.507	1	46.507	14.941	.000	.189
Nurse	2.291	1	2.291	.736	.394	.011
Number of shots	13.304	1	13.304	4.274	.043	.063
Condition	1.097	2	.548	.176	.839	.005
Error	199.209	64	3.113			
Total	1142.000	70				
Corrected total	249.143	69				

a. R squared = .200 (Adjusted R Squared = .138

Table 4.4

Dependent variable: rating on the Wong-Baker Pain Scale

			95% Confidence Interval	
Condition	Mean	Std. Error	Lower Bound	Upper Bound
Control	3.650[a]	.369	2.913	4.387
Movie	3.408[a]	.348	2.714	4.103
Picture	3.687[a]	.389	2.911	4.463

a. Covariates appearing in the model are evaluated at the following values: Age = 4.386, Nurse = 6.04, Number of shots = 3.00

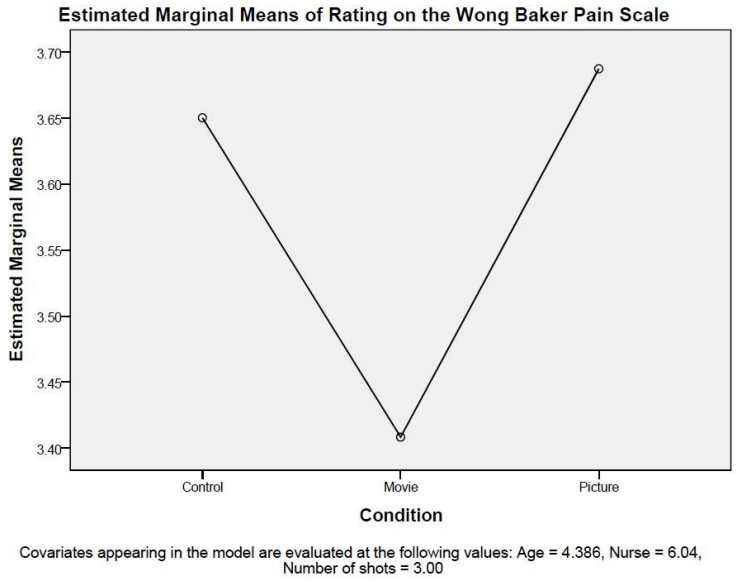


Figure 4.6: Wong-Baker Pain Scale for the three ratings

Using ANCOVA, the researcher evaluated whether there was a difference in Parent Survey scores across conditions using age, nurse, and number of shots as covariates. The analysis revealed a significant difference in Parent Survey by age (F(1,69) = 8.306, p = .005, Partial Eta Squared = .107). Mean parent total scores did not differ significantly by number of shots (F(1,69) = 3.793, p = .056, eta = .052); nurse (F(1,69) = 0.423, p = .518, eta = .006) or condition (F(2,69) = 1.685, p = .193, eta = .047) (see Table 15).

Table 4.5

Dependent variable: Total first four items on Parent Survey (higher = more distress)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Parial Eta Squared
Corrected Model	696.798[a]	5	139.360	5.274	.000	.276
Intercept	518.135	1	518.135	19.607	.000	.221
Age	219.507	1	219.507	8.306	.005	.107
Nurse	11.182	1	11.182	.423	.518	.006
Number of shots	100.227	1	100.227	3.793	.056	.052
Condition	89.040	2	44.520	1.685	.193	.047
Error	1823.388	69	26.426			
Total	18101.000	75				
Corrected total	2520.187	74				

a. R squared = .276 (Adjusted R Squared = .224

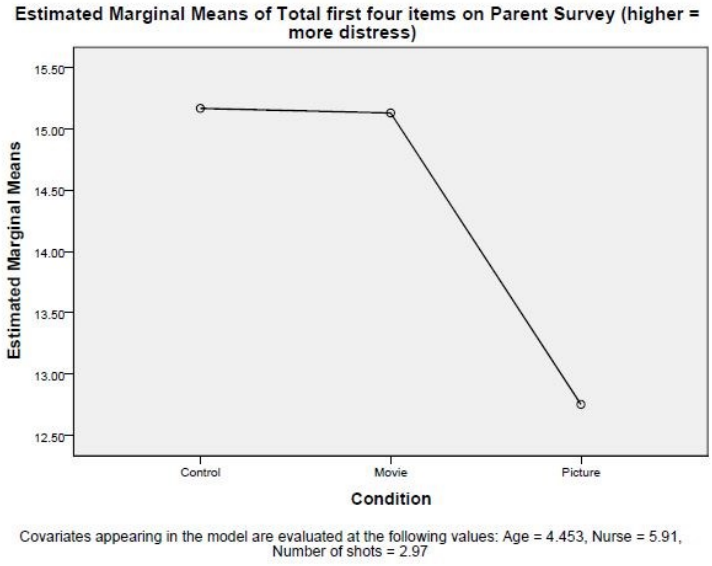


Figure 4.7: Parent Survey for the three ratings

Using ANCOVA, the researcher made an evaluation whether there was a difference in Nurse Survey scores across conditions using age, nurse, and number of shots as covariates. There was a significant difference in Nurse Survey by age (F(1,68) = 11.337, p = .001, Partial Eta

Squared = .143). Mean nurse total scores did not differ significantly by number of shots F((1,68) = 0.483, p = .489, eta = .007); nurse (F(1,68) = 0.028, p = .867, eta = .000) or condition (F(2,68) = 0.073, p = .930, eta = .002) (see Table 16).

Table 4.6
Dependent variable: Total first four items on Nurse Survey (higher = more distress)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	434.577[a]	5	86.915	3.275	.010	.194
Intercept	599.858	1	599.858	22.601	.000	.249
Age	300.897	1	300.897	11.337	.001	.143
Nurse	.754	1	.754	.028	.867	.000
Number of shots	12.828	1	12.828	.483	.489	.007
Condition	3.870	2	1.935	.073	.930	.002
Error	1804.829	68	26.542			
Total	12234.000	74				
Corrected total	2239.405	73				

a. R squared = .194 (Adjusted R Squared = .135

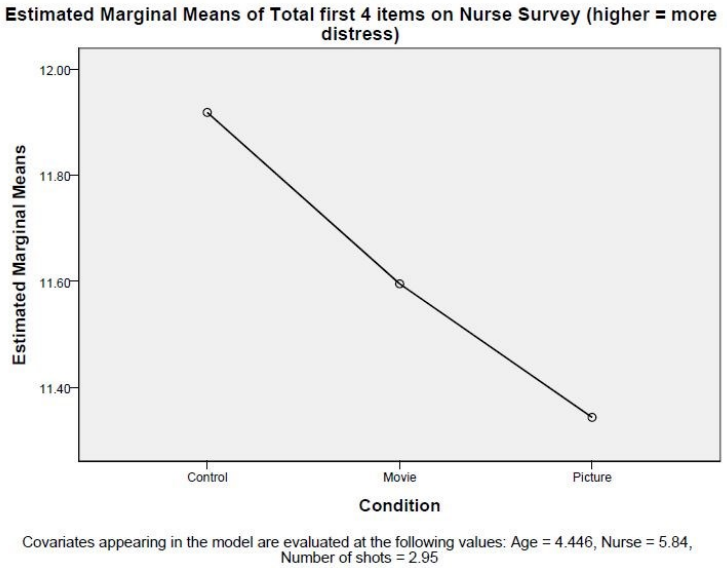


Figure 4.8: Nurse Survey for the three ratings

4.8.2 Content Analysis. The seventh question on the Parent/ Guardian Survey Instrument – Intervention stated "Please write below or on back of this paper any comments you have about the light." Thirteen out of the seventy-six participants wrote comments about the art-light. All were positive, and included statements like "the lights calmed him down quickly after shots were received," "it seems to be a good idea," "the child kept looking at it," "seemed to keep the child's mind off the shots," "distracted the child and focused her away from the shots," "my son really enjoyed the light," "very helpful," and "I don't know but he kept looking at it." Three parents or guardians noted color, stating "more colorful environments help distract kids of the fear of the doctor," " brighter colors may keep more attention," and "the colors are bright and it distracts the children." One parent noted, "He really enjoyed it after he got the shots, he didn't pay attention during but enjoying now." Although the comments of the people who responded did so in a positive manner, no major conclusions can be drawn due to the small response rate.

5. Conclusion

5.1 Null Hypothesis cannot be rejected.

The purpose of this study was to examine the efficacy of using an art-light image developed by the researcher to assist in lowering children's pain and distress during a medical procedure. Specifically, the null hypothesis, H_0, stated the art-light mosaic image would not assist in lowering pain and distress in pediatric patients, 4 to 6 years old, during an immunization procedure. The alternative hypothesis, H_1, stated an art-light mosaic image, the intervention, would create a positive distraction that would assist in lowering the pain and distress in pediatric patients, 4 to 6 years old, during an immunization procedure. This study found no statistically significant difference between the hypothesized conditions for any of the measures: child self-report of pain, parent/guardian report, nurse report, or heartbeat. Since the research data analysis failed to show an effect from the intervention, the null hypothesis cannot be rejected.

5.2 Comparisons with previous research.

It is noteworthy to compare the results of this study with previous research. Although this study did not use behavioral measures, the results from the reports and heartrate measures concurred with Blount et al. (1992), Megel et al. (1998), French et al. (1994), and Cassidy et al. (2002): using a distraction during an immunization did not diminish the children's perception of pain. Blount et al. used both child, parent, and staff reports of the child's pain and fear and behavioral measures to study the use of a party blower as a positive distraction during an immunization. They reported no statistically significant differences between the conditions for any of the reports, OSBD total distress scores, or child coping behavior. However, the BAADS approach-avoidance and distress scores, CAMPIS-R distress behaviors, and child restraint were significantly lower in the distraction group. Blount et al. concluded that the children in the intervention group showed less distress and more coping promoting behaviors which indicated

the children and their parents benefited from the use of a distraction. In another study to determine the efficacy of music as a positive distraction during an immunization, Megel et al. stated that the study clearly indicated immunizations were a stressful experience for children as evidenced by the vital signs, distressed behaviors, and self-reports of pain. However, no statistically significant difference was found for heart rate, blood pressure, or the child's self-report measures between the control and intervention groups. Although the total distress scores were significantly less in the intervention group, the researchers concluded the music failed as a distraction. Unlike Blount, they did not accept the distress scores as an indicator of success, but stated that although the behaviors observed by a third party indicated less distress, it is the child and parents' pain report that make the final judgment. After all, it is the child's perception of pain that needs to be lowered, not the signs of distress.

Similarly, French et al.'s (1994) study using breathing techniques as a distraction also showed no statistically significant differences. However, the results did indicate a significant difference in the behavioral measures. Another study by Cassidy et al. (2002) reported similar results using a child's self-report of pain, parent report, and behavioral measures. The researchers reported no statistically significant differences between one group watching a movie on a television monitor and one group with a blank television screen in the room during the immunization. Cassidy et al. concluded both the movie and the blank screen produced an analgesic affect, reasoning that the child's curiosity about the blank television may have provided a distraction. Nonetheless, the children in both conditions still reported high levels of pain.

In contrast to the studies that ascribed no significantly discernable benefit to the distractions, Berberich and Landman (2009), Bowen and Dammeyer (1999), Cohen et. al (1997),

Sparks (2001), and Fowler-Kerry and Lander (1987) all reported statistically significant results from child and parent reports and only Cohen et. al and Berberich and Landman used behavioral measures. Interestingly, Berberich and Landman used the FACES pain scale, but deviated from using the words "pain" and "hurt" because they considered the words suggestive. They instead asked the children "how did you feel when you received the shot?" Also of note Fowler-Kerry and Lander used the child self-report 4-point visual analog scale (VAS). The 4-point VAS differed from the Oucher and FACES self-reports in that both of the latter are pain scales validated through prior research. The researchers did not discuss how the VAS scale was validated.

5.3 Discussion of results

5.3.1 Statistical power. The validity of the results of any research rests heavily on internal and external factors, many of which are beyond the researcher's control. Such factors place limitations on studies. One internal factor, sample size, determines the correct interpretation of the data analysis. Underpowered studies cannot detect moderate effects between conditions. Thus, in cases where a small sample size masks the presence of an effect, data analysis may not support rejecting the null hypothesis and thereby lead to a Type II error. It is probable that this study was underpowered considering the reduction in the number of the intended sample size from 120 to 75. Prior research studies also identified sample size as a concern. Bowen and Dammeyer (1999) commented the modest effect their study revealed may have resulted from group sizes (n=21, 29 and 30) not large enough to detect differences between the conditions. MacLaren, Cohen, and Cohen (2007) also noted their small sample size (n=159) compounded by the elimination of outliers created limitations in their study to understand the nature of a child's experience during an immunization. In another immunization study, Krauss

(1996) reported that although the children in the distraction group (n=25) appeared to display less stress than the control group (n=25), the analysis failed to reach significance ($p < .06$). He thought a larger sample size might have detected a statistically significant result.

5.3.2 Appropriate blinding. Study blinding is another internal factor to consider in interpreting data results. As mentioned before, the Oxford Quality Scale developed by Jadad et al. (1996, p. 9) to assess the quality of research design, identified "double blinding" as a significant component in bias reduction. The researchers stated that "double blinding implied that neither the person doing the assessment nor the study participant could identify the intervention being assessed." Although the parents and children in the control group were not aware of the conditions, it was not possible to conceal the interventions. Also, the nurses were aware of the three conditions being studied, which may have created bias in their reports. The lack of double blinding also existed in the design of previous studies. However, only French et al. (1994) commented that the inability to disguise the presence or absence of the distraction made completely controlling for bias an impossibility.

5.3.3 The number of nurses administering the immunizations. Unlike the internal factors discussed above, the external factors allowed little control. In this study the number of nurses administering the immunizations represented just such a factor. A total of 11 nurses were enrolled with nine having the highest participation numbers. Eleven nurses created a variance in areas difficult to control: personalities, skills, patient relations, immunization techniques, child coaching, and preciseness in the heartrate recording time. The workload, patient demands, time of day, and well-being of the nurses influenced their contribution to the study. Sparks (2001, p. 10) also noted the number of nurses as a limitation in her study using touch and bubble blowing as distractions stating that "individual differences in injection technique may have existed."

5.3.4 Prior invasive procedures. Invasive procedures prior to the children's immunizations was another external event that may have added pain and distress. Laboratory blood work was necessary for many of the children's well-being check and required a finger prick or venipuncture. The researcher requested the children be scheduled for lab work after the immunization, but the nurses did not want to disrupt the clinic workflow schedule and denied the request. Megel et al. (1998) confronted a similar complication. In their discussion on influencing factors, they noted that most of the children in their study had venipunctures, finger pricks, or tine tests (multiple-puncture tuberculin skin tests) prior to the immunization. They concluded that the impact of the prior procedures on the distress and pain of the children by the time of the immunization could not be determined, nor could the procedures be controlled.

5.3.5 Number of immunizations. The number of immunizations was another external event that could not be controlled. The data of the current study indicated that 47% of the children received three shots, 21 % received four, and 8% received five with the mean number of shots being three, the minimum one, and the maximum five. (see Table 17).

Table 5.1
Number of shots

Number	Frequency	Percent
1	12	16.0
2	6	8.0
3	35	46.7
4	16	21.3
5	6	8.0
Total	75	100.0

It is interesting to compare these data to the number of immunizations administered in prior studies: four reported studying one immunization, two reported studying two, one reported

studying three, and four did not disclose a number (see Table 6). Further examination revealed that two of the one-immunization, one of the two-immunizations, and one of the three-immunizations studies attained statistically significant lower pain in the intervention groups using the child's self-report. Given the likelihood of pain and distress increasing rather than decreasing with multiple shots, it is interesting that Berberich and Landman's (2009) study of three immunizations resulted in statistically significant lower pain and distress in the intervention groups where French et al. (1994) and Cassidy et al. (2002), both with fewer immunizations, did not. One explanation may be the differences in distractions. Whereas French et al. and Cassidy et al. studied a single intervention, Berberich and Landman combined verbal distraction, a topical anesthetic spray, a multipronged arm gripper, and a vibrating instrument descending on the contralateral arm to create a physical and psychological multifaceted distraction that obtained positive results. Berberich and Landman's study differed in many aspects from the current study where 29% of the participants received four or five shots and the intervention was single faceted.

One incident during the study emphasized the trauma of multiple immunizations and involved a very self-contained 4 year-old boy scheduled for three immunizations. He sat patiently and quietly while the nurse administered two shots, but when the nurse picked up the third needle, the young boy threw up his hands, looked the nurse in the eye, and said, "Stop it right there! That's enough!" The nurse in tears answered, "I am so sorry, but I must give you this last shot" After hearing this, the small boy started crying and submitted. By the time the immunizations were finished, the nurse, the little boy, and the parent were crying.

5.3.6 Difference in immunizations. The variance in pain perception that accompanies multiple immunizations may be compounded by differences in the delivery modes of the immunizations themselves. Vaccines are administered either subcutaneously using a small

needle that injects the fluid into the sub-Q tissue located under the skin or intramuscularly using a large needle that injects into the muscle. DTaP (Diptheria, Tetanus, Pertussis) is administered intramuscularly, MMR (Measles, Mumps, Rubella) and Varicella (chicken pox) subcutaneously, and IPV (polio) by either method. Berberich and Landman identified the MMR as more painful and divided the study to assess the children's response to the first two intramuscular immunizations separately from the third subcutaneous MMR injection. The children in the current study received subcutaneous and intramuscular injections. However, no provision was made to separate the injection type in the data analysis.

5.4 Observations from results.

5.4.1 Developmental level of the child. The child's age also appears to influence the response to the distraction. In a previous study of 200 children using a music distraction, Fowler-Kerry and Lander (1987) concluded the age of the child determined the efficacy of the distraction. Although the distraction significantly lowered pain and distress during the immunizations, it was less effective for the younger children. In fact, this pattern held true across all conditions: younger children consistently reported greater pain. This concurred with the findings of the current study where the rating of the Wong Baker Pain Scale correlated significantly with age ($F(1,64) = 46.507$, $p<.001$) with the youngest, the 4-year-olds, reporting higher pain (see Table 18). It is interesting to note that the 4-year-olds comprised 61% of the sampled population. The larger population of younger children reporting higher pain ratings supports the need for a highly effective positive distraction.

Table 5.2
Dependent Variable: Rating on the Wong Baker Scale

Age	Mean	Std. Error
4.0	3.394[a]	.286
5.0	2.758[a]	.360
6.0	2.000[a]	.875

Not all studies support this conclusion. While Megel et al. (1998) studied a musical distraction similar to Fowler-Kerry and Lander and addressed age as a variable, their data did not reveal a statistically significant difference based on age. One possible explanation for this may lie in the mean age of the children in the two studies. The mean in Fowler-Kerry and Lander's study (ages 4.5 to 6 years) was one year older than Megel et al.'s (ages 3 to 6 years).

5.4.2 Strength of the distraction. It is clear from the data analysis that the distraction provided by the art-light image did not prove strong enough to lower the pain and distress in children 4 to 6-years-old receiving multiple immunizations. As discussed above, many factors may have influenced the outcome. The data analysis, however, cannot be ignored, and the null hypothesis cannot be rejected. If this study did not commit a Type II error by not rejecting the null hypothesis, then it can be concluded that a more novel and unique intervention would be necessary to distract young children during a stressful medical event. Megel et al. (1998) recommended combining a pharmacological treatment and a psychological distraction to create a stronger intervention. Eleven years later, Berberich et al. (2009) combined a topical analgesic spray with a vibrating instrument that provided a physical and psychological distraction for children 4 to 6 years old receiving three immunizations and reported highly significant reductions of pain in the self-report and behavioral measures.

6. Recommendations for future studies.

6.1 Incorporate more training to reduce distress and pain.

In previous research, the leading recommendation for future studies identified the need to train nurses, parents, children, or a combination to use techniques to lower pain and distress during a child's immunization. Bowen et al. (1999) suggested that, although statistically significant, the modest effect in their research using party blowers and pinwheels was due to lack of training. The researchers designed the study to determine the efficacy of the distraction without training; nevertheless, after analyzing the data they recommended future research to include it. Blount et al. (1992) also used a party blower and though the data revealed non-significant results, they concluded that parents who received training reported less distress during their child's immunization. They extended this idea by stating that greater therapeutic benefits would ensue when the parents, children, and nurses worked together as team. Other researchers who recommended training, Cassidy et al. (2002) and Cohen et al. (1996), studied movies as a distraction with differing results. Cassidy provided no training and reported non-significant results, whereas Cohen et al. trained the parents and nurses to coach the children and reported statistically significant results. It is interesting to note that Cassidy et al. studied one immunization with no training and non-significant results whereas Cohen et al. studied two immunizations with training and statistically significant results.

Regardless of the number of immunizations, future studies should include training to increase good coaching and to avoid adult behaviors associated with distress measures. Blount et al. (1992) noted that the level of distress was dependent upon the level of the child's coping and suggested training adults to teach the child how to manage the noxious event. However, the researchers identified specific adult behaviors associated with the child's distress measures that

adults should be trained to avoid. Blount et al. suggested that future studies investigate whether these negative behaviors encourage or simply correlate with a child's distress during an immunization.

An event during the current study's data collection suggested the art-light distraction might be strengthened by training the parent and child. A young girl due to receive three immunizations wanted to be strong and not cry but was very frightened. Her mother told her to be brave, but she just didn't have the inner strength to stand strong. She was the last child assigned to the study so the researcher stayed in the room and coached the girl to watch the triangles. As the nurse administered the three injections, the researcher asked the young girl to guess what the picture would be and then suggested she count the triangles as each one turned on. Following the final injection, the child threw up her hands in victory and shouted, "I did it! I did it!" Later, the nurse commented that the movie certainly helped the young girl not to be afraid.

Given the potential influence of effective coaching, future studies might do well to examine distraction as a tool in the hands of certified child life specialists, trained professionals who work with parents and nurses to understand the emotional needs of children receiving medical care. These specialists come alongside during medical procedures using distractions and coping techniques to help children manage pain and anxiety. Adding this human factor may be necessary to help divert the children's attention away from noxious events. Parents and nurses might also receive training from child life specialists on specific ways to utilize the provided distraction. Sparks (2001) also endorsed the concept of adult coaching and recommended future research include positive suggestions to assist children during medical procedures.

6.2 Combine distraction with topical analgesic.

Prior studies also suggested a combination of psychological and physiological tools to increase the strength of distractions during child immunizations. Cohen et al. (1997), Sparks (2001), and Megel (1998) recommended using a topical analgesic along with music, movies, or party blowers. Two years later, Cohen et al. (1999) studied 4th graders receiving three immunizations over a period of six months. The study included three conditions: watching a movie, receiving a topical analgesic, and receiving typical care. Over the course of the six months, each child experienced all three conditions, one with each immunization. The researchers reported the children displayed less distress with the movie distraction than with the topical analgesic or the typical care. However, the child and nurse report of pain revealed no significant differences. Ten years later, Berberich and Landman (2009) combined the topical analgesic with a vibrator in their study of 4 to 6-year-olds receiving three immunizations during one office visit. The analysis of the child, parent, and nurse reports revealed a statistically significant difference between the conditions. These results encourage future studies combining topical analgesic with the distraction.

6.3 Research to better understand children.

The pain and anxiety children experience during an immunization result from a complex interaction of multiple variables. Differences in children's developmental stages, temperaments, previous experiences, and coping styles all have bearing on an individual child's response. This obviously complicates the researcher's task. Cassidy et al. (2002) suggested research to understand the differences in children as a means of understanding their reactions to distractions. Blount et al. (1992) concurred and added that the child's temperament, quality of parenting, and even the characteristics of marital interactions influence coping ability. Thus, while current

research has supported broader observations like more anxious children are less amenable to distraction and less likely to cope well, more insight into how particular stressors affect particular children will better inform the design and strength of the distraction needed to reduce the child's pain and distress. This type of insight will also contribute to the development of valid pain and distress measures. It is one matter for a researcher to identify a child's reaction to immunizations by observing his or her behavior and a different one to determine the pain and distress from the child's point of view. If the Oucher pain scales are valid measures, then children are experiencing high levels of pain during injections. It would be beneficial for future research to confirm the validity of the existing pain measures or develop superior ones for the purpose of providing a clear understanding of pain and distress from the child's point of view. This insight is crucial for the researcher to discern what distractions assist the child receiving immunizations.

6.4 Further insight into this study

Reflection on the process and results of this study revealed the viral role empathy must play in designing for the healthcare environment. Designers must sensitize themselves to the patient's experience of healthcare procedures, particularly young children receiving immunizations. During the well-child check, a child may stay in the examination room for an extended period of time, sometimes over an hour, with little to do. Some parents provide a small digital screen to distract the child. However, familiarity often decreases the effectiveness of such distractions. After extended or repeated viewing, even movies can become tedious. As a result, the child grows impatient and begins to explore the exam room climbing and swinging on any reachable object. After exhausting all means of entertainment, the child sees a nurse entering the room with three to five needles in a small basket and decides it is time to fight or flee. Needing

to complete multiple tasks for each patient, the nurse briefly instructs the parent to hold the child tightly against his or her chest and methodically administers the immunizations as the child fights to escape. Only by addressing this healthcare scenario can the designer hope to provide relief for all concerned.

Making the hope to providing spaces that alleviate distress a reality requires knowledge in healthcare facility design, psychology, and statistics: certainly a team effort. In fact, the Center for Health Design identified team effort as the key to designing facilities that encourage positive patient outcomes. They stated that gaining insight into these complex issues would require methodologically rigorous research. This field of research, however, is in the beginning stage with many open-ended questions and few standards of measurements. As a result, every piece of information provides insight into the problem. Knowledge builds upon knowledge. Thus, like all new areas of research, patient-supported healthcare design will begin with unknowns, and with every new piece of information, designers will take incremental steps toward developing the research standards necessary to create healthcare environments that communicate, "I care".

This study aimed at contributing to the growing body of knowledge related to evidence-based design. The results, however, raised more questions that they answered. Future studies addressing these questions might include conducting a separate analysis of this study's data to determine if there was a statistically significant difference between the conditions of children receiving one or two immunizations. The results may lead to the next question: does administering multiple immunizations increase the child's distress exponentially? Should 4-year-old children receive four and five immunizations at one time? Another study may continue to collect samples using this study's protocol to provide more power for the data analysis. Providing more power may reveal the possibility of rejecting the null hypothesis and accepting

the alternative hypothesis. Another area to explore is the child's temperament during the immunization. Is the child hurt, fearful, or just angry and ready to fight? Would these different temperaments influence how the child experienced the positive distraction? Along with these questions, others related to the distraction itself arise. While the art-light movie did provide a unique and engaging picture puzzle that encouraged children to guess what the next piece would be and even recaptured their attention post-procedure, it failed to provide sufficient distraction during the immunizations. Future studies could explore whether the art-light image could be strengthened to better hold a child's attention. Perhaps the most important question to address is, "Should these questions concern the designer?" Yes, they should and do because the role of the designer is to create environments that support the health, safety and welfare of the occupants.

References

Adobe.com. (2012). Photoshop/Viewing histograms and pixel values. http://help.adobe.com/enUS/photoshop/cs/using/WSfd1234e1c4b69f30ea53e41001031ab64768da.html#WS6E24386A-892E-406d-B9e8-C24F0002F8

Aitken, J. C., Wilson, S., Coury, D., & Moursi, A. M. (2002). The effect of music distraction on pain, anxiety and behavior in pediatric dental patients. *Pediatr Dent, 24(2),* 114-118.

Andel, C., Davidow, S. L., Hollander, M., & Moreno, D. A. (2012). The economics of health care quality and medical errors. *Journal of Health Care Finance, 39*(1), 39-50.

Bechtel, R. B. & Ts'erts'man, A. (2002). *Environmental psychology: From spatial-physical environment to sustainable development.* Retrieved from http://web.a.ebscohost.com.ezproxy.lib.vt.edu/ehost/ebookviewer/ebook/bmxlYmtfXzc5MDMyX19BTg2?sid=34c48b67-cb9f-451b-b356-cecdef4d7f66@sessionmgr4002&vid=2&format=EB&lpid=lp_i&rid=0

Bellieni, C. V., Cordelli, D. M., Raffaelli, M., Ricci, B., Morgese, G., & Buonocore, G. (2006). Analgesic effect of watching TV during venipuncture. *Arch Dis Child, 91*(12), 1015-1017. doi: 10.1136/adc.2006.097246

Berberich, F. R., & Landman, Z. (2009). Reducing immunization discomfort in 4- to 6-year-old children: A randomized clinical trial. *Pediatrics, 124*(2), e203-e29. doi: 1542/peds.2007-3466

Bieri, D., Reeve, R., Champion, G. D., Addicoat, L., & Ziegler, J. B. (1990). The faces pain scale for the self-assessment of the severity of pain experienced by children: Development, initial validation, and preliminary investigation for ratio scale properties. *Pain, 41*(2), 139-150. doi: http://dx.doi.org/10.1016/0304-3959(90)90018-9

Biotech. (2001). Medical College of Wisconsin; Space technology uses light to repair skin burns, ulcers, sores. *Biotech Week*, 2-3.

Blount, R. L., Bachanas, P. J., Powers, S. W., Cotter, M. C., Franklin, A., Chaplin, W., ... Blount, S. D., (1992). Training children to cope and parents to coach them during routine immunizations: Effects on child, parent, and staff behaviors. *Behavior Therapy, 23*(4), 689-705. doi: http://dx.doi.org/10.1016/S0005-7894(05)80229-1

Bowen, A. M., & Dammeger, M. M., (1999). Reducing children's immunization distress in a primary care setting. *Journal of Pediatric Nursing, 14*(5), 296-303. doi: http://dx.doi.org/10.1016/S0882-5963(99)80029-3

Broome, M. E., Lillis, P. P., & Smith, M. C. (1989). Pain intervention with children: A meta-analysis of research. *Nursing Research, 38*(3), 154-158.

Carlson, K. L., Broome, M., & Vessey, J. A. (2000). Using distraction to reduce reported pain, fear, and behavioral distress in children and adolescents: A multisite study. *Journal for Specialists in Pediatric Nursing, 5*(2), 75-85. doi: 10.1111/j.1744-6155.2000.tb00089.x

Cassidy, K., Reid, G. J., McGrath, P. J., Finley, G. A., Smith, D. J., Morley, C., ... Morton, B. (2002). Watch needle, watch TV: Audiovisual distraction in preschool immunization. *Pain Magazine, 3*(2), 108-118. doi: 10.1046/j.1526-4637.2002.02027.x

Center for Health Design (2016). Retrieved from https://www.healthdesign.org/

Centers for Disease Control and Prevention. (2014). *Advisory Committee on Immunization Practices (ACIP).* Retrieved from http://www.cdc.gov/vaccines/acip/about.html

Centers for Disease Control and Prevention. (2015). *Immunization schedules for infants and children in easy-to-read formats.* Retrieved from http://www.cdc.gov/vaccines/schedules/easy-to-read/child.html

Chen E, Zeltzer LK, Craske MG, Katz ER. Alteration of memory in the reduction of children's distress during repeated aversive medical procedures. *Journal of Consulting and Clinical Psychology 67(4)*,481–90.

Chambers, C. T., Taddio, A., Uman, L. S., & McMurtry, C. M. (2009). Psychological interventions for reducing pain and distress during routine childhood immunizations: A systematic review. *Clinical Therapeutics, 31,* S77-S103.

Cochrane Handbook for Systematic Reviews of Interventions (2011). J. P. Higgins & S. Green (Eds.).

Cohen, L. L., Blount, R. L., Cohen, R. J., Schaen, E. R. & Zaff, J. F. (1999). Comparative study of distraction versus topical anesthesia for pediatric pain management during immunizations. *Health Psychology, 18(6),* 591-598.

Cohen, L. L., Blount, R. L., & Panopoulos, G. (1997). Nurse coaching and cartoon distraction: An effective and practical intervention to reduce child, parent, and nurse distress during immunizations. *Journal of Pediatric Psychology, 22*(3), 355-370. doi: 10.1093/jpepsy/22.3.355

Construction costs estimates for hospital, 2-3 story in national, US. (2013). *RSMeans from the Gordian Group.* Retireved from: http://www.rsmeans.com/models/hospital/

Cramer-Berness, L. J., & Friedman, A. G. (2005). Behavioral interventions for infant immunizations. *Children's Health Care, 34*(2), 95-111. doi: 10.1207/s15326888chc3402_2

Crombie, I. K., Davies, H. T. (2009). *What is meta-analysis?* Hayward Medical Communications: London. Retrieved from http://www.medicine.ox.ac.uk/bandolier/painres/download/whatis/meta-

an.pdf

DCD sq. ft. cost analysis new hospital. (2013). *Design Cost Data.*

DeMore, M., & Cohen, L. L. (2005). Distraction for pediatric immunization pin: A critical review. *Journal of Clinical Psychology in Medical Settings, 12*(4), 281-291. doi: 10.1007/s10880-005-7813-1

Dutro, A. R. (2007). *Light image therapy in the health care environment.* (Master of Science), East Tennessee State University. Retrieved from http://etd-submit.etsu.edu/etd/theses/available/etd-1007107-181253/unrestricted/DutroA120607f.pdf

Eisen, S. L. (2006). *The healing effects of art in pediatric healthcare: art preferences of healthy children and hospitalized children.* (Doctoral Dissertation, Texas A&M University). Retrieved from http://hdl.handle.net/1969.1/5772

Endorphin. (n.d.). In Medical-Dictionary online. Retrieved from http://medical-dictionary.thefreedictionary.com/endorphin

Felt, B. T., Mollen, E., Diaz, S., Renaud, E., Zeglis, M., Wheatcroft, G., & Mendelow, D. (2000). Behavioral interventions reduce infant distress at immunization. *Archives of Pediatrics & Adolescent Medicine, 154*(7), 719-724. doi: 10.1001/archpedi.154.7.719

Fernald, C. D., & Corry, J. J. (1981) Empathic versus directive preparation of children for needles. *Children's Health Care, 10*(2), 44.

Finley, G. A. (2001). How much does it hurt? Pediatric pain measurement for doctors, nurses, and parents. *Canadian Journal of Anesthesia, 48*(1), R16-R21. doi: 10.1007/BF03028173

FMI Corporation. (2015). *FMI's Construction Outlook* (1st Quarter Report). Retrieved from

www.fminet.com/catalogsearch/advanced/result/?name=Fmi%27s+construction+outlook&show_pages=true&x=0&y=0

Fowler-Kerry, S. & Lander, J. R. (1987). Management of injection pain in children. *Pain, 30*(2), 169-175. doi: http://dx.doi.org/10.1016/0304-3959(87)91072-4

French, G. M., Painter, E. C., & Coury, D. L. (1994). Blowing away short pain: A technique for pain management during immunizations. *Pediatrics 93,* 384-388.

Fushimi, T., Inui, S., Nakajima, T., Ogasawara, M., Hosokawa, K., & Itami, S. (2012). Green light emitting diodes accelerate wound healing: Characterization of the effect and its molecular basis in vitro and in vivo. *Wound Repair & Regeneration, 20*(2), 226-235. doi: 10.1111/j.1524-475X.2012.00771.x

Gifford, R. (1997). *Environmental Psychology: Principles and practice.* Boston, MA: Allyn and Bacon.

Griffin, C. (2015). Game Change: An Evolving Role for Healthcare Architects. *The American Institute of Architects Architect's Knowledge Resource.* Retrieved from *http://www.aia.org/akr/Resources/Documents/AIAB102311?ssSourceSiteId=null*

Ham, J. R. C., Kort, Y. A. W., Klaming, L.,& Weda, J. (2012). Reducing anxiety with pulsating light as a breathing guide. Eindhoven University of Technology, Netherlands.

Hathorn, K., & Nanda, U. (2008). A guide to evidence-based art. *The Center for Health Design, 1-22.*

Institute of Medicine (2000). *Calling the shots—Immunization finance policies and practices.* Washington, DC: National Academy Press

Jaaniste, T., Hayes, B., & von Baeyer, C. L. (2007). Effects of preparatory information and distraction on children's cold-pressor pain outcomes: A randomized controlled trial.

Behaviour Research and Therapy, 45(11), 2789-2799. doi: http://dx.doi.org/10.1016/j.brat.2007.07.005

Jadad, A. R., Moore, R. A., Carroll, D., Jenkinson, C., Reynolds, D. J. M., Gavaghan, D. J., & McQuay, H. J. (1996). Assessing the quality of reports of randomized clinical trials: Is blinding necessary? *Controlled Clinical Trials, 17*(1), 1-12. doi: http://dx.doi.org/10.1016/0197-2456(95)00134-4

Jeffs, D. A. (2007). A pilot study of distraction for adolescents during allergy testing. *Journal for Specialists in pediatric nursing, 12*(3), 170-185. doi: 10.1111/j1744-6155.2007.00110.x

Joseph, A. (2012). Research at the Center for Health Design: Looking ahead. *Healthcare Design,* 1-4. Retrieved from http://www.healthcaredesignmagazine.com/article/research-center-health-design-looking-ahead

Kleiber, C., & Harper, D. C. (1999). Effects of distraction on children's pain and distress during medical procedures: A meta-analysis. *Nursing Research, 48*(1), 44-49.

Krauss, W. J. (1997). *Videotape modeling and parent participation: Effects on reducing distress behavior in children undergoing immunization procedures*. (Doctoral dissertation). Retrieved from: ProQuest Dissertations & Theses database (9805140).

Harrison, A. (1991). Preparing children for venous blood sampling. *Pain 45(3),*299–306.

Lott, F. R. (2008). *Optimize BIM to Achieve the Promise of Integrated Project Delivery.* American Institute of Architects. Retrieved from ww.aia.org/contractdocs/AIAB080149

MacLaren, J., Cohen, L. L., & Cohen, S. (2007). Children's behavior during immunization injections: A principle components analysis. *Children's Health Care, 36*(3), 237-248. doi: 10.1080/02739610701377921

McGrath, P. J. (1990). *Pain in children.* New York, NY: The Guilford Press.

McGrath, P. J. (1996). There is more to pain measurement in children than "ouch". *Canadian Psychology, 37*(2), 63-75. doi: 10.1037/0708-5591.37.2.63

McGrath, P. J., Craig, K. D. (1989). Developmental and psychological factors in children's pain. *Pediatric Clinics of North America, 36*(4), 823-836.

Medicaid.gov. (2015). *Accountability Guidance.* Retrieved from http://www.medicaid.gov/medicaid-chip-program-information/by-topics/financing-and-reimbursement/accountability-guidance.html

Medicare.gov. (2015). Retrieved from https://www.medicare.gov/sign-up-change-plans/decide-how-to-get-medicare/whats-medicare/what-is-medicare.html

Megel, M. E., Houser, C. W., & Gleaves, L. S. (1998). Children's responses to immunizations: Lullabies as a distraction. *Issues in Comprehensive Pediatric Nursing, 21*(3), 129-145. doi: 10.1080/014608698265456

NASA. (2009). LED device illuminates new path to healing. *NASA Tech Briefs, 31.*

Newton, T. (2015). What is HD? The difference between 720p, 1080i, and 1080p. *Recombu.* Retrieved from https://recombu.com/digital/article/what-is-hd-the-difference-720p-1080i-and-1080p_M10888.html

Nightingale, F. (1860). *Notes on nursing: What it is, and what it is not.* Retrieved from http://digital.library.upenn.edu/women/nightingale/nursing/nursing.html

Nilsson, S., Enskär, K., Hallqvist, C., & Kokinsky, E. (2007). Active and passive distraction in children undergoing wound dressings. *Journal of Pediatric Nursing.* doi: *10.1016/j.pedn.2012.06.003*

Olmsted, R. W., Zeltzer, L., & LeBaron, S. (1982). Hypnosis and nonhypnotic techniques for reduction of pain and anxiety during painful procedures in children and adolescents with

cancer. *The Journal of Pediatrics, 101*(6), 1032-1035. doi: http://dx.doi.org/10.1016/S0022-3476(82)80040-1

Pati, D., Nanda, U. (2011). Influence of positive distractions on children in two clinic waiting areas. *Herd, 4(3)*, 124-140.

Perlin, J. B., Kolodner, R. M., & Roswell, R. H. (2004). The veterans health administration: Quality, value, accountability, and information as transforming strategies for patient-centered care. *The American Journal of Managed Care, 10*(11 Pt 2), 828-836.

Pollatsek, A. & Well, A. D. (1995). On the use of counterbalanced designs in cognitive research: A suggestion for a better and nore powerful analysis. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21(3),* 785-794.

Posner K. (1998). *A pharmacobehavioral intervention to reduce child cancer distress.* (Doctoral Dissertation) Retrieved from ProQuest Dissertations Publishing, (UMI No. 9919373).

Quan, X., Joseph, A., Malone, E. & Debajyoti, P. (2011). Healthcare environmental terms and outcome measures: An evidence-based design glossary. *The Center for Health Design.* Retrieved from https://www.healthdesign.org/system/files/ch408_researchreportglossary_v6_final_0.pdf

Rapp, J. T., Carroll, R. A., Stangeland, L., Swanson, G., & Higgins, W. J. (2011). A comparison of reliability measures for continuous and discontinuous recording methods: inflated agreement scores with partial interval recording and momentary time sampling for duration events. *Behavior Modification, 35*(4), 389-402. doi: 10.1177/0145445511405512

Rasmussen, S. E. (1959). *Experiencing Architecture*. New York: The MIT Press.

Rising health care costs. (2015). *America's Health Insurance Plans.* Retrieved from

https://www.ahip.org/Issues/Rising-Health-Care-Costs.aspx

Slater, B. H. (1984). 'Experiencing' architecture. *Philosophy, 59*, 253-258.

Selye, H. (1976). *Stress in health and disease.* Retrieved from https://books.google.com/books?hl=en&lr=&id=wrfYBAAAQBAJ&oi=fnd&pg=PP1&ots=_ioqqh89qb&sig=fPp69uqMsADWCCDEczDUtdhydd8#v=onepage&q&f=false

Snider, L. (2010). *Photoshop CS5: the missing manual.* Sebastopol, CA: O'Reilly Media, Inc.

Sparks, L. (2001). Taking the "ouch" out of injections for children: Using distraction to decrease pain. *The American Journal of Maternal/Child Nursing, 26*(2), 72-78.

The Center for Health Design. (2015). *A view of who we are.* Retrieved from http://www.healthdesign.org/chd/about/view-who-we-are

Tofle, R., Schwarz, B. Yoon, S., & Max-Royale, A. (2004). Color in healthcare environments. *Coalition for Health Environments Research.* Retrieved from http://www.healthcaredesign.org/chd/research/color-healthcare-environments

U.S. Department of Health and Human Services, The Center for Medicaid and CHIP Services. (2015). *Accountability guidance: Guidance on annual upper payment limit demonstration.* Retrieved from: http://www.medicaid.gov/medicaid-chip-program-information/by-topics/financing-and-reimbursement/accountability-guidance.html

Ulrich, R. S. (1991). Effects on interior design on wellness: theory and recent scientific research. *Journal of Health Care Interior Design: Proceedings from the National Symposium on Health Care Interior Design, 3,* 97-109. Retrieved from: www.ncbi.nim.nih.gov/pubmed/10123973

Ulrich, R., Quan, X., Zimring, C., Joseph, A., & Choudhary, R. (2004). The role of the physical environment in the hospital of the 21st century: A once-in-a-lifetime opportunity. *The*

Center for Health Design, 1-65.

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology, 11*(3), 201-230. doi: http://dx.doi.org/10.1016/S0272-4944(05)80184-7

Uman, L. S., Chambers, C. T., McGrath, P. J., & Kisely, S. R. (2010). Psychological interventions for needle-related procedural pain and distress in children and adolescents. *Cochrane Database of Systematic Reviews*(4). doi: 10.1002/14651858.CD005179.pub2

University of Texas (2011). *Common ~~misteaks~~ mistakes in using statistics: Spotting and avoiding them.* Retrieved from https://www.ma.utexas.edu/users/mks/statmistakes/errortypes.html

Vesely, R. & Hoppszallern, S. (2015). Hospital construction survey results are in. *Health Facilities Management.* Retrieved from http://www.hfmmagazine.com/display/HFM-news-article.dhtml?dcrPath=/templatedata/HF_Common/NewsArticle/data/HFM/Magazine/2015/Feb/hfm-hospital-construction-survey

Vessey, J. A., Carlson, K. L., & McGill, J. (1994). Use of distraction with children during an acute pain experience. *Nursing Research, 43*(6), 369-372.

Whelan, H. T. (2002). The use of NASA light-emitting diode near-infrared technology for biostimulation. *Medical College of Wisconsin.* Retrieved from: www.synergylighttherapies.com/uploads/2/6/3/9/26399895nasa_study_-_led_biostimulation.pdf

Wong, D. L., & Baker, C. M. (1988). Pain in Children: comparison of assessment scales. *Pediatric Nursing, 14*(1), 9-17.

Appendix A

Table A-1

Environmental Psychology Theories

Major Theories	Theory definition
I. Integral	focuses on the interaction between individuals and their environments.
1. Interaction	the simplest form of the integral theory, identifies the individual and the environment as separate entities and studies the interactions between them.
II. Stimulation	defines individuals' reactions to stimuli in the real world. The stimuli can be as simple as light, sound, heat, and cold or as complex as a building, people, outdoor settings, or painful medical procedures.
1. Adaption-level	states that individuals have the ability to adapt to a certain level of stimuli. However, after the threshold of adaptation of stimuli is reached, there is a change in the individual's perception or behavior. The threshold of adaptation differs with each individual, stimulus, and stimulus load.
2. Arousal	identifies how the physiological make-up of individuals relates to stimuli.
3. Overload	addresses the results of too much stimulation.
4. Restricted-environmental	identifies individual reactions to environments that have little or no stimuli.
III. Control	how much control a person has, thinks he or she has, or would like to have over the stimuli encountered in the environment.
IV. Behavioral settings	seeks to explain activities that take place in designated spaces such as hospitals, grocery stores, classrooms, and gyms.

Appendix B

Informed consent document – pilot study 1

My name is Rae Dutro. I am working on a Ph.D. at Virginia Tech. In order to finish my studies, I need to complete a research study. Within this study, I am attempting to determine if things in the environment affect how children respond when vaccinated. I hope that future environments can be designed which will result in the least painful vaccinations possible.

This Informed Consent will explain about being a participant in this part of the research study. It is important that you read this material carefully and then decide if you wish to allow your child to take part in this study.

The purpose of this study is to determine which child-art pictures children prefer. The three pictures that the children choose as their favorites in this pilot study will be used to determine if pictures in the environment affect how children respond when vaccinated.

If you decide to allow your child to take part in this study, and your child agrees to participate in this study, the principle investigator, Anna Rae Dutro, will show your child six pictures (a squirrel, dog, frog, swan, duck, butterfly, and flowers) built from triangles of color. The P.I. will ask your child to rank the pictures in the order of how the child likes the picture.

The study should last about 15 minutes.

There are no foreseen risks to your child in this study. There are no foreseen benefits for your child in this study. Any possible benefits will be for children receiving an immunization procedure.

There will be no personal identification of your child recorded with the ranking information. A copy of the records from this study will be stored in the home office of Anna Rae Dutro in Jonesborough, TN, for at least 5 years after the end of this research. The results of this study may be published and/or presented at meetings without naming your child as a subject. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the ETSU IRB, and personnel particular to this research (Anna Rae Dutro and faculty advisors) have access to the study records.

Participating in this study is voluntary. You may choose not to allow your child to take part in this study or your child may choose not to participate in this study. There will be no loss of benefits to your child if you choose not to allow your child to participate in this study or your child chooses not to participate in this study.

If you choose to allow your child to participate in this study, your child can quit this study at any time.

If you have any questions concerning this study, you may call Rae Dutro at 1-423-306-0911. Also, the chairman of the Institutional Review Board at East Tennessee State University is available at 423/439-6054 for any questions you may have about your rights as a research subject. If you have any questions or concerns about the research and want to talk to someone independent of the research team or you can't reach the study staff, you may call an IRB Coordinator at 423/439-6055 or 423/439/6002.

Thank you for considering this request.

Sincerely,

Rae Dutro

By signing below, you confirm that you have read or had this document read to you. You will be given a signed copy of this informed consent document. You have been given the chance to ask questions and to discuss your participation with the investigator. You freely and voluntarily choose to allow your child to take part in this study.

SIGNATURE OF PARTICIPANT DATE

PRINTED NAME OF PARTICIPANT DATE

SIGNATURE OF INVESTIGATOR DATE

Appendix C

Child verbal script to ask permission

Pilot Study #1: Hello, my name is Miss Rae. Your mom (or dad, grandparent, etc.) said it would be okay if I ask you if you want to be a part of my study. If you say it's okay, I am going to show you six pictures and ask you to tell me the pictures you like best. If you don't want to be a part of this study, that's okay too. There is nothing wrong with not wanting to be a part of this study.

Pilot Study #1: Hello, my name is Miss Rae. Your mom (or dad, grandparent, etc.) said it would be okay if I ask you if you want to be a part of my study. If you say it's okay, I am going to show you a short movie. When it's over, I will ask you if you liked it. If you don't want to be a part of this study, that's okay too. There is nothing wrong with not wanting to be a part of this study.

JCCHC and WCHD research: Hello, my name is Miss Rae. Your mom (or dad, grandparent, etc.) said it would be okay if I ask you if you want to be a part of my study. If you say it's okay, when you are finished seeing the nurse today, your nurse will ask you to choose one of these smiley faces. (I will show the child the Wong-Baker Pain chart). If you don't want to be a part of this study, that's okay too. There is nothing wrong with not wanting to be a part of this study.

Appendix D

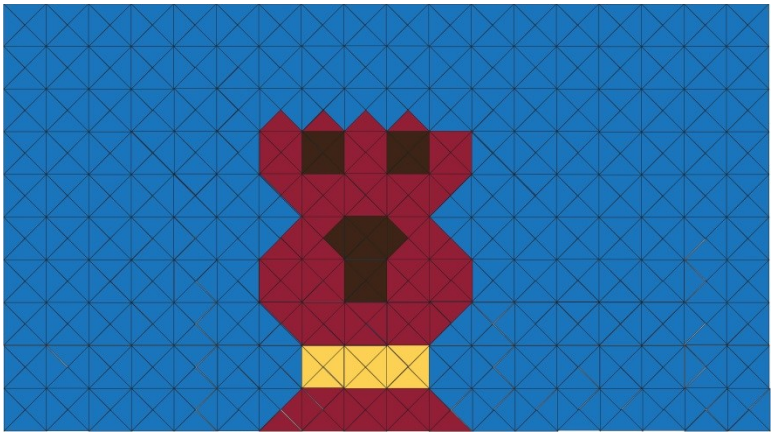


Figure X: 3-frame turn on after 12 seconds

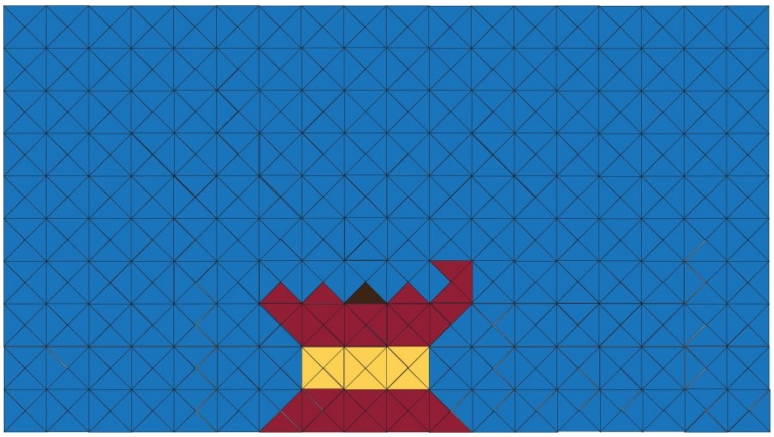


Figure X: 7-frame turn on after 12 seconds

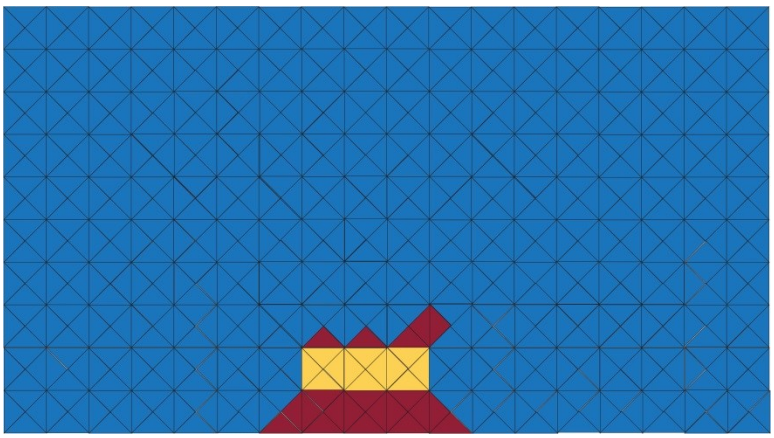


Figure X: 11-frame turn on after 12 seconds

Appendix E

Pilot study 2 data analysis

```
REGRESSION
  /DESCRIPTIVES MEAN STDDEV CORR SIG N
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT LookAway
  /METHOD=ENTER Picture Pixels OrderOfPic.
```

Regression

```
[DataSet1] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Pilot_Data_
SPSS_2.sav
```

Descriptive Statistics

	Mean	Std. Deviation	N
Number of times a child looked away per minute	1.06283	.927296	36
Picture being shown	2.00	.828	36
Pixel turn on rate	7.00	3.312	36
Where the picture was in the order	2.00	.828	36

Correlations

		Number of times a child looked away per minute	Picture being shown	Pixel turn on rate
Pearson Correlation	Number of times a child looked away per minute	1.000	-.159	.426
	Picture being shown	-.159	1.000	.000
	Pixel turn on rate	.426	.000	1.000
	Where the picture was in the order	-.099	.000	.000
Sig. (1-tailed)	Number of times a child looked away per minute	.	.177	.005
	Picture being shown	.177	.	.500
	Pixel turn on rate	.005	.500	.
	Where the picture was in the order	.283	.500	.500
N	Number of times a child looked away per minute	36	36	36
	Picture being shown	36	36	36
	Pixel turn on rate	36	36	36
	Where the picture was in the order	36	36	36

Correlations

		Where the picture was in the order
Pearson Correlation	Number of times a child looked away per minute	-.099

Model Summary

	Change Statistics	
Model	df2	Sig. F Change
1	32	.047

a. Predictors: (Constant), Where the picture was in the order, Pixel turn on rate, Picture being shown

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.520	3	2.173	2.950	.047[b]
	Residual	23.576	32	.737		
	Total	30.096	35			

a. Dependent Variable: Number of times a child looked away per minute

b. Predictors: (Constant), Where the picture was in the order, Pixel turn on rate, Picture being shown

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.806	.600		1.343	.189
	Picture being shown	-.178	.175	-.159	-1.015	.318
	Pixel turn on rate	.119	.044	.426	2.723	.010
	Where the picture was in the order	-.111	.175	-.099	-.634	.531

a. Dependent Variable: Number of times a child looked away per minute

```
ONEWAY LookAway BY Pixels
  /STATISTICS DESCRIPTIVES
  /MISSING ANALYSIS
  /POSTHOC=TUKEY ALPHA(0.05).
```

Oneway

```
[DataSet1] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Pilot_Data_
SPSS_2.sav
```

Model Summary

Model	Change Statistics	
	df2	Sig. F Change
1	32	.047

a. Predictors: (Constant), Where the picture was in the order, Pixel turn on rate, Picture being shown

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.520	3	2.173	2.950	.047[b]
	Residual	23.576	32	.737		
	Total	30.096	35			

a. Dependent Variable: Number of times a child looked away per minute

b. Predictors: (Constant), Where the picture was in the order, Pixel turn on rate, Picture being shown

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.806	.600		1.343	.189
	Picture being shown	-.178	.175	-.159	-1.015	.318
	Pixel turn on rate	.119	.044	.426	2.723	.010
	Where the picture was in the order	-.111	.175	-.099	-.634	.531

a. Dependent Variable: Number of times a child looked away per minute

```
ONEWAY LookAway BY Pixels
  /STATISTICS DESCRIPTIVES
  /MISSING ANALYSIS
  /POSTHOC=TUKEY ALPHA(0.05).
```

Oneway

```
[DataSet1] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Pilot_Data_
SPSS_2.sav
```

Descriptives

Number of times a child looked away per minute

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
3 Pixels/Second	12	.59450	.499654	.144238	.27703	.91197
7 Pixels/Second	12	1.04517	.711631	.205430	.59302	1.49732
11 Pixels/Second	12	1.54883	1.217628	.351499	.77519	2.32248
Total	36	1.06283	.927296	.154549	.74908	1.37659

Descriptives

Number of times a child looked away per minute

	Minimum	Maximum
3 Pixels/Second	.000	1.983
7 Pixels/Second	.242	2.169
11 Pixels/Second	.496	4.578
Total	.000	4.578

ANOVA

Number of times a child looked away per minute

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.470	2	2.735	3.665	.037
Within Groups	24.626	33	.746		
Total	30.096	35			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Number of times a child looked away per minute

Tukey HSD

(I) Pixel turn on rate	(J) Pixel turn on rate	Mean Difference (I-J)	Std. Error	Sig.	95% ...
					Lower Bound
3 Pixels/Second	7 Pixels/Second	-.450667	.352664	.417	-1.31603
	11 Pixels/Second	-.954333*	.352664	.028	-1.81970
7 Pixels/Second	3 Pixels/Second	.450667	.352664	.417	-.41470
	11 Pixels/Second	-.503667	.352664	.338	-1.36903
11 Pixels/Second	3 Pixels/Second	.954333*	.352664	.028	.08897
	7 Pixels/Second	.503667	.352664	.338	-.36170

Multiple Comparisons

Dependent Variable: Number of times a child looked away per minute

Tukey HSD

(I) Pixel turn on rate	(J) Pixel turn on rate	95% ... Upper Bound
3 Pixels/Second	7 Pixels/Second	.41470
	11 Pixels/Second	-.08897
7 Pixels/Second	3 Pixels/Second	1.31603
	11 Pixels/Second	.36170
11 Pixels/Second	3 Pixels/Second	1.81970
	7 Pixels/Second	1.36903

*. The mean difference is significant at the 0.05 level.

Homogeneous Subsets

Number of times a child looked away per minute

Tukey HSD[a]

Pixel turn on rate	N	Subset for alpha = 0.05	
		1	2
3 Pixels/Second	12	.59450	
7 Pixels/Second	12	1.04517	1.04517
11 Pixels/Second	12		1.54883
Sig.		.417	.338

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 12.000.

Appendix F

Informed consent document – pilot study 2

My name is Rae Dutro. I am working on a Ph.D. at Virginia Tech. In order to finish my studies, I need to complete a research study. Within this study, I am attempting to determine if things in the environment affect how children respond when vaccinated. I hope that future environments can be designed which will result in the least painful vaccinations possible.

This Informed Consent will explain about being a participant in this part of the research study. It is important that you read this material carefully and then decide if you wish to allow your child to take part in this study.

This part of the study will help me identify how long a movie of child art pictures being built one triangle at a time holds your child's attention. This information will be used to help me decide how often to add the triangles to build the pictures. The movie of the pictures will be used in the next part of my study, determining if pictures in the environment affect how children respond when vaccinated.

If you decide to allow your child to take part in this study, and your child agrees to participate in this study, a study staff member will show your child a movie of a child art picture that is built one triangle of color at a time. The study staff member will observe your child watching the movie to determine how long the movie holds the child's attention.

The study should last about 15 minutes.

There are no foreseen risks to your child in this study. There are no foreseen benefits for your child in this study. Any possible benefits will be for children receiving an immunization procedure.

There will be no personal identification of your child recorded with the information of how long the picture movie holds the child's attention. A copy of the records from this study will be stored in the home office of Anna Rae Dutro in Jonesborough, TN, for at least 5 years after the end of this research. The results of this study may be published and/or presented at meetings without naming your child as a subject. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the ETSU IRB, and personnel particular to this research (Anna Rae Dutro and faculty advisors) have access to the study records.

Participating in this study is voluntary. You may choose not to allow your child to take part in this study or your child may choose not to participate in this study. If you choose to allow your child to participate in this study, your child can quit this study at any time. There will be no loss of benefits to your child if you choose not to allow your child to participate in this study or your

child chooses not to participate in this study or your child chooses to quit this study.

If you have any questions concerning this study, you may call Rae Dutro at 1-423-306-0911. Also, the chairman of the Institutional Review Board at East Tennessee State University is available at 423/439-6054 for any questions you may have about your rights as a research subject. If you have any questions or concerns about the research and want to talk to someone independent of the research team or you can't reach the study staff, you may call an IRB Coordinator at 423/439-6055 or 423/439/6002.

Thank you for considering this request.

Sincerely,

Rae Dutro

By signing below, you confirm that you have read or had this document read to you. You will be given a signed copy of this informed consent document. You have been given the chance to ask questions and to discuss your participation with the investigator. You freely and voluntarily choose to allow your child to take part in this study.

SIGNATURE OF PARTICIPANT DATE

_____

PRINTED NAME OF PARTICIPANT DATE

_____

SIGNATURE OF INVESTIGATOR DATE

Appendix G

Parent/ guardian survey instrument – intervention

1. How upset was your child after getting the shot?

   □1 □2 □3 □4 □5 □6
   not at all very much

2. Compared to other painful things that have happened to your child, how painful was this shot?

   □1 □2 □3 □4 □5 □6
   not at all very much

3. How hard was your child crying during the shot?

   □1 □2 □3 □4 □5 □6
   not at all very much

4. How strongly did you have to hold your child?

   □1 □2 □3 □4 □5 □6
   not at all very much

5. How much did the art-light picture distract your child?

   □1 □2 □3 □4 □5 □6
   not at all very much

6. In the past when your child had a shot, did your child have any bad experiences because of the shot?
   □ yes □ no
   If yes, please explain on the back of this paper what the bad experience was.

7. Please write below or on back of this paper any comments you have about the light.

Spanish translation of parent/ puardian survey instrument – intervention
Instrumento para la encuesta para Padres o Tutor

1. ¿Cuánto malestar sintió su hijo/a después de recibir la vacuna?

   □1 □2 □3 □4 □5 □6
   ninguno muy mucho

2. En comparación con otras experiencias dolorosas que haya tenido su hijo/a, ¿cuánto dolor le causó esta inyección?

   □1 □2 □3 □4 □5 □6
   ninguno muy mucho

3. ¿Cuánto lloró su hijo/a durante la inyección?

   □1 □2 □3 □4 □5 □6
   nada muy mucho

4. ¿Cuán fuerte tuvo que sujetar a su hijo/a?

   □1 □2 □3 □4 □5 □6
   nada muy mucho

5. ¿Cuánto entretuvo a su hijo/a el cuadro artístico luminoso?

   □1 □2 □3 □4 □5 □6
   nada muy mucho

6. En el pasado, cuando su hijo recibió una inyección, ¿tuvo alguna mala experiencia relacionada con la inyección?
   □ sí □ no

   En caso afirmativo, por favor explique al reverso de esta hoja cuál fue la mala experiencia.

7. Por favor, escriba a continuación o en el reverso de la hoja cualquier comentario que tenga sobre el cuadro iluminado.

Appendix H

Parent/ guardian survey instrument – control

1. How upset was your child after getting the shot?

   □1 □2 □3 □4 □5 □6
   not at all very much

2. Compared to other painful things that have happened to your child, how painful was this shot?

   □1 □2 □3 □4 □5 □6
   not at all very much

3. How hard was your child crying during the shot?

   □1 □2 □3 □4 □5 □6
   not at all very much

4. How strongly did you have to hold your child?

   □1 □2 □3 □4 □5 □6
   not at all very much

5. In the past when your child had a shot, did your child have any bad experiences because of the shot?
   □ yes □ no

   If yes, please explain on the back of this paper what the bad experience was.

Spanish translation of parent/ guardian survey instrument – control
Instrumento para la encuesta para Padres o Tutor

1. ¿Cuánto malestar sintió su hijo/a después de recibir la vacuna?

   □1 □2 □3 □4 □5 □6
   ninguno muy mucho

2. En comparación con otras experiencias dolorosas que haya tenido su hijo/a, ¿cuánto dolor le causó esta inyección?

   □1 □2 □3 □4 □5 □6
   ninguno muy mucho

3. ¿Cuánto lloró su hijo/a durante la inyección?

   □1 □2 □3 □4 □5 □6
   nada muy mucho

4. ¿Cuán fuerte tuvo que sujetar a su hijo/a?

   □1 □2 □3 □4 □5 □6
   nada muy mucho

5. En el pasado, cuando su hijo/a recibió una inyección, ¿tuvo alguna mala experiencia relacionada con la inyección?
   □ sí □ no

   En caso afirmativo, por favor explique al reverso de esta hoja cuál fue la mala experiencia.

Appendix I

Patient information_ nurse report

Heart rate during the immunization procedure

1. immediately before immunization _____
2. Immediately after immunization _____
3. Five minutes after immunization _____

1. Gender of child
   - male
   - female
2. Age _____
3. Weight _____
4. Height _____
5. Length of time for the well-child check-up _____
6. Does this child take any prescribed medication?
   - yes
   - no
7. Does this child attend daycare on a regular basis?
   - yes
   - no

Appendix J

Informed consent document - nurse

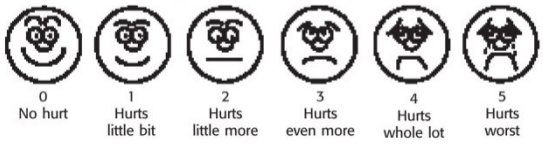
My name is Rae Dutro. I am working on a Ph.D. at Virginia Tech. In order to finish my studies, I need to complete a research study.

This Informed Consent will explain about being a participant in this research study. It is important that you read this material carefully and then decide if you wish to be a volunteer in this study.

Within this study, I am attempting to determine if things in the environment affect how children respond when vaccinated. I hope that future environments can be designed which will result in the least painful vaccinations possible. If you choose to participate in this study, you and your patient will be randomly assigned to one of three examination rooms. The only differences across the examination rooms are the pictures on TV monitors on the walls. I am attempting to determine if these differences affect how children respond to being vaccinated.

The study will only last as long as you and your patient are in the exam room for the vaccination and the time to answer the questionnaires; an average time of 20 minutes.

If you decide to participate in this study, one of three designated exam rooms will be assigned to you and your pediatric patient. You, the participating nurse, will use the pulse-oximeter to record your patient's heart rate before, during, and after the vaccination shot. After the vaccination shot, you will give your patient this picture chart



and ask your patient to point to the face that shows how much the shot hurt. You will be asked to answer two questionnaires. The first questionnaire contains five questions concerning the vaccination your patient just received. The second questionnaire contains seven questions concerning your patient's health; child's gender, age, weight, height, any prescribed medication the child may be taking, if the child attends regular daycare, the child's heart rate recorded during the vaccination procedure, and the length of time you and this child were in the examination room.

If the attending doctor or nurse determines that your pediatric patient is not well today, the patient will not be asked to be a part of this study.

This study will not put you or your patient into any foreseen risks. It will not add any discomfort to your patient during the vaccination. There may or may not be any benefit to you in this study. I am attempting to determine if the differences in the environment of the examination rooms may affect how children respond to vaccinations.

Every attempt will be made to see that these study results are kept confidential. Each patient will be given a numerical number. There will be no identification of the child or nurse recorded with the data. A copy of the records from this study will be stored in the home office of Anna Rae Dutro in Jonesborough, TN, for at least 5 years after the end of this research. The results of this study may be published and/or presented at meetings without naming the child as a subject. Although the rights and privacy of the pediatric patients will be maintained, the Secretary of the Department of Health and Human Services, the ETSU IRB, and personnel particular to this research (Anna Rae Dutro and faculty advisors) have access to the study records. The (medical) records will be kept completely confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above.

Participating in this study is voluntary. If you choose to participate in this study, you can quit this study at any time. If you choose not to participate in this study or choose to stop participation in this study, there will be no negative consequences. You will not lose any benefits to which you are entitled.

If you have any questions concerning this study, you may call Rae Dutro at 1-423-306-0911. Also, the chairman of the Institutional Review Board at East Tennessee State University is available at 423/439-6054 for any questions you may have about your rights as a research subject. If you have any questions or concerns about the research and want to talk to someone independent of the research team or you can't reach the study staff, you may call an IRB Coordinator at 423/439-6055 or 423/439/6002.

Thank you for considering this request.

Sincerely,

Rae Dutro

By signing below, you confirm that you have read this document. You will be given a signed copy of this informed consent document. You have been given the chance to ask questions and to discuss your participation with the investigator. You freely and voluntarily choose to be in this research project.

SIGNATURE OF PARTICIPATING NURSE DATE

_____

PRINTED NAME OF PARTICIPATING NURSE DATE

_____

SIGNATURE OF INVESTIGATOR DATE

Appendix K

Informed consent document – parent/guardian

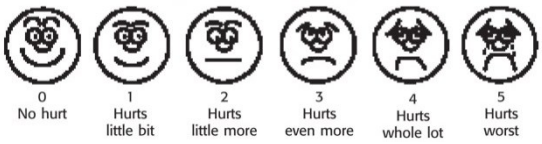
My name is Rae Dutro. I am working on a Ph.D. at Virginia Tech. In order to finish my studies, I need to complete a research study.

This Informed Consent will explain about being a participant in this research study. It is important that you read this material carefully and then decide if you wish to be a volunteer and allow your child to take part in this study.

Within this study, I am attempting to determine if things in the environment affect how children respond when vaccinated. I hope that future environments can be designed which will result in the least painful vaccinations possible. If you choose to participate in this study and allow your child to take part in this study, you and your child will be randomly assigned to one of three examination rooms. The only differences across the examination rooms are the pictures on TV monitors on the walls. I am attempting to determine if these differences affect how children respond to being vaccinated.

After the well child examination, the nurse will place your child's finger on a pad that will record your child's heart rate before, during, and after the vaccination shot. There will be no discomfort to your child from reading the heart rate. The nurse will record your child's gender, age, weight, height, any prescribed medication your child may be taking, if your child attends regular daycare, your child's heart rate recorded during the vaccination procedure, and the length of time you and your child were in the examination room.

After the vaccination shot, the nurse will give your child this picture chart



and ask your child to point to the face that shows how much the shot hurt. You, the parent or guardian, will be asked to answer seven questions on a questionnaire. The questions will be about the vaccination your child just received.

The study will only last as long as you and your child are in the exam room for the vaccination, and the time to answer the questionnaire; an average time of 20 minutes.

If the doctor or nurse determines that your child is not well today, your child will not be asked to be a part of this study. If your child cannot be a part of this study because he or she is sick, your child will still receive all of the medical care he or she needs.

This study will not put your child into any foreseen risks. It will not add any discomfort to your child during the vaccination. There may or may not be any benefit to your child in this study. I

am attempting to determine if the differences in the environment of the examination rooms may affect how children respond to vaccinations.

Every attempt will be made to see that your study results are kept confidential. There will be no identification of your child recorded with the medical information. A copy of the records from this study will be stored in the home office of Anna Rae Dutro in Jonesborough, TN, for at least 5 years after the end of this research. The results of this study may be published and/or presented at meetings without naming your child as a subject. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the ETSU IRB, and personnel particular to this research (Anna Rae Dutro and faculty advisors) have access to the study records. Your (medical) records will be kept completely confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above.

Participating in this study is voluntary. You may choose not to allow your child to take part in this study or your child may choose not to participate in this study. If you do not wish to participate or allow your child to take part in this study or if your child chooses not to participate in this study, you child will still receive the same excellent medical care that this clinic offers. If you choose to participate in this study and allow your child to take part in this study, you and your child can quit this study at any time.

If you have any questions concerning this study, you may call Rae Dutro at 1-423-306-0911. Also, the chairman of the Institutional Review Board at East Tennessee State University is available at 423/439-6054 for any questions you may have about your rights as a research subject. If you have any questions or concerns about the research and want to talk to someone independent of the research team or you can't reach the study staff, you may call an IRB Coordinator at 423/439-6055 or 423/439/6002.

Thank you for considering this request.

Sincerely,

Rae Dutro

AUTHORIZATION TO USE AND DISCLOSE PROTECTED HEALTH INFORMATION FOR RESEARCH PURPOSES

The privacy law, Health Insurance Portability & Accountability Act (HIPAA), protects my child's individually identifiable health information (protected health information). The privacy law requires me to sign an authorization (or agreement) in order for researchers to be able to use or disclose my child's protected health information for research purposes in the study entitled "An Art-Light Mosaic Light Distraction for the Pediatric Healthcare Environment".

I authorize Anna Rae Dutro and her research staff to use and disclose my child's protected health information for the purposes described below. I also permit my doctors and other health care providers to disclose my child's protected health information for the purposes described above.

MY PROTECTED HEALTH INFORMATION THAT MAY BE USED AND DISCLOSED INCLUDES:

- Your child's gender
- Age
- Weight
- Height
- Any prescribed medication
- If your child attends regular daycare
- Your child's heart rate recorded during the immunization procedure
- The length of time you and your child were in the examination room

THE INVESTIGATOR, ANNA RAE DUTRO MAY USE AND SHARE MY CHILD'S HEALTH INFORMATION WITH:

- The East Tennessee State University Human Research Protections Program (HRPP) Institutional Review Board Administration when the researcher or the research site is undergoing *Quality Improvement Program* (*QIP)* auditing.
- Government representatives, when required by law
- ETSU and Virginia Tech University Faculty advisors
- Published in a dissertation

Once my child's health information has been disclosed to anyone outside of this study, the information may no longer be protected under this authorization.
The investigator, Anna Rae Dutro, agrees to protect my child's health information by using and disclosing it only as permitted by me in this Authorization and as directed by state and federal law.

I do not have to sign this Authorization. If I decide not to sign the Authorization:

- It will not affect my child's treatment, payment or enrollment in any health plans nor affect my child's eligibility for benefits.
- I and my child cannot be allowed to participate in this research study.

After signing the Authorization, I can change my mind and:

- Not let the researcher disclose or use my child's protected health information (revoke the Authorization).
- If I revoke the Authorization, I will send a written letter to: Anna Rae Dutro, 135 Bill Cox Road, Jonesborough, TN 37659, to inform her of my decision.
- If I revoke this Authorization, researchers may only use and disclose the protected health information **already collected** for this research study.

- If I revoke this Authorization my child's protected health information may still be used and disclosed should my child have an adverse event (a bad effect, or experience something unanticipated).
- If I change my mind and withdraw the authorization, I and my child may not be allowed to continue to participate in the study.

This Authorization does not have an expiration date.

If I have not already received a copy of the Privacy Notice, I may request one by contacting the Privacy Officer. If I have any questions or concerns about my privacy rights, I should contact East Tennessee State University at 423-439-6000.

I am the subject or am authorized to act on behalf of my child. I have read this information, and I will receive a copy of this form after it is signed.

By signing below, you confirm that you have read or had this document read to you. You will be given a signed copy of this informed consent document. You have been given the chance to ask questions and to discuss your participation and your child's participation in this study with the investigator. You freely and voluntarily choose to be in this research project and allow your child to take part in this study.

In addition, by signing below, you are authorizing the use and disclosure of your child's protected health information for research purposes as described above.

SIGNATURE OF PARTICIPANT DATE

PRINTED NAME OF PARTICIPANT DATE

SIGNATURE OF INVESTIGATOR DATE

Informed consent document – parent/guardian Spanish translation

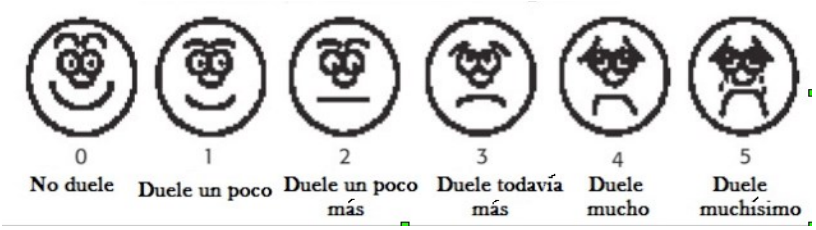
Mi nombre es Rae Dutro. Estoy trabajando en un Doctorado en la Universidad Tecnológica de Virginia. Para terminar mis estudios, tengo que completar un trabajo de investigación.

Este Formulario Informativo de Consentimiento le explicará acerca de la participación en este estudio de investigación. Es importante leer con atención este material antes de decidir si desea participar como voluntario/a y permitir que su hijo/a tome parte en el estudio.

En este estudio, estoy tratando de determinar si los elementos del entorno afectan la reacción de los niños a la vacunación. Espero que en el futuro los entornos puedan ser diseñados de manera que las vacunas sean lo menos dolorosas posible. Si decide participar en este estudio y permite que su hijo/a forme parte del mismo, a usted y su hijo/a se les asignará una sala de examen al azar. Las únicas diferencias entre las salas de examen serán las imágenes en los monitores de televisión colgados de las paredes. Estoy tratando de determinar si estas diferencias afectan la reacción de los niños a la vacunación.

Tras la examinación de rutina, la enfermera colocará el dedo de su niño/a en una tableta que registrará su ritmo cardiaco antes, durante y después de la inyección de la vacuna. Su hijo no sentirá ninguna molestia con esta lectura del ritmo cardiaco. La enfermera anotará la edad, sexo, peso y estatura de su hijo/a, cualquier medicación recetada que esté tomando, si asiste regularmente a guardería, el ritmo cardiaco del niño/a durante la vacunación y cuánto tiempo usted y su hijo/a estuvieron en la sala de examen.

Tras la administración de la vacuna, la enfermera le dará a su niño este gráfico



y le pedirá a su hijo que señale la cara que muestra cuánto le dolió la inyección. A usted, padre o tutor, se le pedirá que llene un cuestionario con siete preguntas acerca de la vacunación que su hijo ha recibido.

El estudio sólo durará el tiempo que usted y su hijo/a se encuentren en la sala de examen para la vacunación y el tiempo que tarde en contestar el cuestionario, con una duración aproximada de 20 minutos.

Si el doctor o la enfermera determinan que su hijo/a no está bien el día del examen, no se le pedirá que participe en el estudio. Si su hijo/a no puede ser parte del estudio porque está enfermo/a, de todas maneras recibirá la atención médica que necesite.

Este estudio no pondrá a su hijo/a en ningún riesgo previsible. No agregará ninguna molestia a su hijo/a durante la vacunación. Puede que su hijo/a obtenga algún beneficio del estudio o puede que no. Estoy tratando de determinar si las diferencias en el entorno de las salas de examen pueden afectar la reacción de los niños a las vacunas.

Se hará todo lo posible para que sus resultados del estudio sean confidenciales. No se identificará a su hijo/a en la información médica. Una copia de los datos del estudio se guardará en la oficina de Anna Rae Dutro en Jonesborough, TN, durante al menos 5 años desde la finalización de la investigación. Los resultados del estudio podrán ser publicados y/o presentados en reuniones sin nombrar a su hijo/a como sujeto. Se preservarán sus derechos y su privacidad pero el Secretario del Departamento de Salud y Servicios Humanos, la Junta de Revisión Institucional (IRB por sus siglas en inglés) de ETSU y el personal afectado a esta investigación (Anna Rae Dutro y profesores consejeros) tendrán acceso a los datos del estudio. Su historial médico se mantendrá completamente confidencial de acuerdo con los requisitos legales actuales. No serán revelados excepto si lo requiere la ley, o como se ha indicado arriba.

Su participación en este estudio es voluntaria. Usted puede elegir que su hijo/a no forme parte del estudio, o su hijo/a puede elegir no participar. Si usted no desea participar o permitir que su hijo/a forme parte del estudio o si su hijo elige no participar, su hijo/a recibirá igualmente la misma atención médica excelente que esta clínica ofrece. Si elige participar en el estudio y permitir a su hijo/a formar parte de él, usted y su hijo/a pueden abandonar el estudio en cualquier momento.

Si tiene alguna pregunta con respecto al estudio, puede llamar a Rae Dutro en el 1-423-306-0911. Además, el presidente de la Junta de Revisión Institucional en la East Tennessee State University está disponible en el 423/439-6054 para responder a cualquier pregunta que usted pueda tener acerca de sus derechos como sujeto de investigación. Si tiene alguna pregunta o preocupación sobre la investigación y quiere hablar con alguien ajeno al equipo de investigación o no consigue contactar con el personal del estudio, puede llamar al Coordinador de IRB al 423/439-6055 o al 423/439/6002.

Gracias por considerar esta petición.

Atentamente,

Rae Dutro

AUTORIZACIÓN PARA EL USO Y DIVULGACIÓN DE INFORMACIÓN DE SALUD PROTEGIDA CON PROPÓSITOS INVESTIGATIVOS

La ley de privacidad, Health Insurance Portability & Accountability Act (HIPAA), protege la información de salud que identifica individualmente a mi hijo/a (información de salud protegida). La ley de privacidad me exige que firme una autorización (o acuerdo) para que los investigadores puedan usar o divulgar la información de salud protegida de mi hijo/a con

propósitos investigativos en el estudio titulado "Un Mosaico Artístico Luminoso para Entretenimiento en el Entorno del Servicio de Pediatría".

Autorizo a Anna Rae Dutro y a su personal de investigación a usar y divulgar la información de salud protegida de mi hijo/a con los propósitos descritos a continuación. También permito a mis doctores y a otros prestadores de salud a divulgar la información de salud protegida de mi hijo/a con los propósitos descritos con anterioridad.

- Sexo de su hijo/a
- Edad
- Peso
- Estatura
- Cualquier medicación prescrita
- Si su hijo/a asiste regularmente a guardería
- El ritmo cardiaco registrado durante el proceso de administración de la vacuna
- El espacio de tiempo que usted y su hijo/a estuvieron en la sala de examen

LA INVESTIGADORA, ANNA RAE DUTRO, PUEDE USAR Y COMPARTIR LA INFORMACIÓN DE SALUD DE MI HIJO/A CON:

- La Administración de la Junta de Revisión Institucional y el Programa de Protección en la Investigación con Humanos (HRPP) de East Tennessee State University, cuando la investigadora o el lugar de investigación esté realizando una auditoría del *Programa de Mejora de Calidad (QIP).*
- Representantes del gobierno, cuando lo exija la ley.
- Profesores consejeros de ETSU y Virginia Tech University.
- Publicación en una disertación.

Una vez que la información de salud de mi hijo/a haya sido divulgada a cualquier persona ajena a este estudio, la información puede dejar de estar protegida bajo esta autorización.

La investigadora, Anna Rae Dutro, accede a proteger la información de salud de mi hijo/a usándola y divulgándola solamente de la manera en la que ha sido autorizada por mí y como lo dicta la ley estatal y federal.

No tengo obligación de firmar esta autorización. Si decido no firmarla:

- No afectará al tratamiento, pago o matrícula de mi hijo/a en ningún plan de salud, ni afectará a la elegibilidad de mi hijo/a para cualquier beneficio.
- Mi hijo y yo no podremos participar en este estudio de investigación.

Después de firmar la Autorización, puedo cambiar de opinión y:

- No dejar al investigador divulgar o usar la información de salud protegida de mi hijo/a (anulando la autorización).
- Si anulo la autorización, enviaré una carta a: Anna Rae Dutro, 135 Bill Cox Road, Jonesborough, TN 37659, para informarle de mi decisión.
- Si anulo esta autorización, los investigadores pueden solamente usar y divulgar la información de salud protegida que **ya haya sido recopilada** para este estudio de investigación.
- Si anulo esta autorización, la información de salud protegida de mi hijo/a puede usarse y divulgarse si mi hijo/a tiene un efecto contrario (efecto desfavorable o una experiencia no anticipada).
- Si cambio de opinión y retiro la autorización, mi hijo/a y yo no podremos seguir participando en el estudio.

Esta autorización no tiene fecha de expiración.

Si no he recibido todavía una copia del Aviso de Privacidad, puedo pedirla poniéndome en contacto con el Oficial de Privacidad. Si tengo alguna pregunta o preocupación con respecto a mis derechos de privacidad, puedo contactar con East Tennessee State University en el 423-439-6000.

Soy el sujeto o estoy autorizado/a para actuar en representación de mi hijo/a. He leído esta información, y recibiré una copia de este formulario después de firmarlo.

Con su firma a continuación, usted confirma que ha leído o le han leído este documento. Se le dará una copia firmada de este documento informativo de consentimiento. Se le ha dado la oportunidad de preguntar y hablar con la investigadora sobre la participación de su hijo/a en este estudio. Usted decide voluntaria y libremente ser parte de este proyecto de investigación y permitir a su hijo/a ser parte del estudio.

Además, con su firma a continuación, usted autoriza el uso y la divulgación de la información de salud protegida de su hijo/a con los propósitos investigativos descritos con anterioridad.

FIRMA DEL PARTICIPANTE FECHA

NOMBRE EN LETRA DE MOLDE DEL PARTICIPANTE FECHA

FIRMA DE LA INVESTIGADORA FECHA

Appendix L

Data Analysis Correlations

		Clinic	Room Number	Condition	Race	Gender	Age	Weight in pounds
Clinic	Pearson Correlation	1	1.000**	.026	-.371**	-.093	.013	-.149
	Sig. (2-tailed)		.000	.826	.001	.426	.910	.201
	N	75	75	75	75	75	75	75
Room Number	Pearson Correlation	1.000**	1	.019	-.374**	-.093	.016	-.150
	Sig. (2-tailed)	.000		.871	.001	.429	.891	.198
	N	75	75	75	75	75	75	75
Condition	Pearson Correlation	.026	.019	1	.031	.038	.076	.097
	Sig. (2-tailed)	.826	.871		.794	.749	.517	.406
	N	75	75	75	75	75	75	75
Race	Pearson Correlation	-.371**	-.374**	.031	1	-.173	-.141	.088
	Sig. (2-tailed)	.001	.001	.794		.138	.229	.452
	N	75	75	75	75	75	75	75
Gender	Pearson Correlation	-.093	-.093	.038	-.173	1	-.002	.030
	Sig. (2-tailed)	.426	.429	.749	.138		.989	.797
	N	75	75	75	75	75	75	75
Age	Pearson Correlation	.013	.016	.076	-.141	-.002	1	.429**
	Sig. (2-tailed)	.910	.891	.517	.229	.989		.000
	N	75	75	75	75	75	75	75
Weight in pounds	Pearson Correlation	-.149	-.150	.097	.088	.030	.429**	1
	Sig. (2-tailed)	.201	.198	.406	.452	.797	.000	
	N	75	75	75	75	75	75	75
Height in inches	Pearson Correlation	-.062	-.058	.146	.015	.035	.566**	.624**
	Sig. (2-tailed)	.597	.623	.211	.896	.765	.000	.000
	N	75	75	75	75	75	75	75
Time in exam room	Pearson Correlation	-.385**	-.380**	-.086	.215	-.093	-.076	.104

	Sig. (2-tailed)	.001	.001	.477	.071	.442	.531	.388
	N	71	71	71	71	71	71	71
Currently taking prescription medication	Pearson Correlation	-.299**	-.299**	.059	.084	.080	.035	.312**
	Sig. (2-tailed)	.009	.009	.616	.475	.495	.766	.006
	N	75	75	75	75	75	75	75
Currently in daycare	Pearson Correlation	.103	.105	-.036	.000	-.047	.029	.020
	Sig. (2-tailed)	.381	.372	.759	1.000	.686	.807	.863
	N	75	75	75	75	75	75	75
Number of shots	Pearson Correlation	.462**	.461**	-.045	-.270*	-.093	-.282*	-.268*
	Sig. (2-tailed)	.000	.000	.698	.019	.427	.014	.020
	N	75	75	75	75	75	75	75
Nurse	Pearson Correlation	.978**	.976**	.037	-.383**	-.065	-.019	-.158
	Sig. (2-tailed)	.000	.000	.755	.001	.577	.873	.175
	N	75	75	75	75	75	75	75
Heart rate before shots	Pearson Correlation	-.025	-.025	-.191	-.098	-.144	-.147	.122
	Sig. (2-tailed)	.833	.835	.103	.406	.219	.212	.300
	N	74	74	74	74	74	74	74
Heart rate immediately after shots	Pearson Correlation	-.119	-.119	-.093	-.027	.054	-.372**	-.077
	Sig. (2-tailed)	.309	.310	.427	.821	.645	.001	.512
	N	75	75	75	75	75	75	75
Heart rate five minutes after shots	Pearson Correlation	-.125	-.121	.123	.059	-.041	-.155	-.025
	Sig. (2-tailed)	.284	.303	.292	.616	.725	.184	.831
	N	75	75	75	75	75	75	75
HR change from immediate to 5 minutes after	Pearson Correlation	.024	.027	.168	.064	-.077	.233*	.053
	Sig. (2-tailed)	.840	.820	.151	.587	.511	.044	.652
	N	75	75	75	75	75	75	75
HR change from pre shot to 5 min after	Pearson Correlation	-.074	-.071	.244*	.115	.089	-.006	-.118
	Sig. (2-tailed)	.528	.549	.036	.327	.453	.957	.318

	N	74	74	74	74	74	74	74
Rating on the Wong Baker Pain Scale	Pearson Correlation	-.038	-.033	-.027	.113	-.111	-.379**	-.290*
	Sig. (2-tailed)	.756	.786	.822	.350	.360	.001	.015
	N	70	70	70	70	70	70	70
How upset was this child after getting the shot?	Pearson Correlation	.092	.088	-.082	.090	-.261*	-.316**	-.131
	Sig. (2-tailed)	.436	.455	.489	.446	.025	.006	.265
	N	74	74	74	74	74	74	74
How hard was this child crying during the shot?	Pearson Correlation	.140	.137	-.113	-.013	-.162	-.467**	-.314**
	Sig. (2-tailed)	.234	.243	.337	.912	.168	.000	.006
	N	74	74	74	74	74	74	74
Compared to other children, what was this child's pain	Pearson Correlation	.030	.027	-.049	.098	-.094	-.477**	-.213
	Sig. (2-tailed)	.799	.818	.677	.404	.427	.000	.068
	N	74	74	74	74	74	74	74
How afraid was this child during the shot?	Pearson Correlation	.027	.028	-.031	.020	-.226	-.262*	-.151
	Sig. (2-tailed)	.818	.816	.791	.863	.053	.024	.200
	N	74	74	74	74	74	74	74
How much did the art-light picture distract this child?	Pearson Correlation	.093	.094	-.160	.031	-.095	.171	.295*
	Sig. (2-tailed)	.540	.535	.289	.836	.532	.255	.047
	N	46	46	46	46	46	46	46
How upset was your child after getting the shot?	Pearson Correlation	.063	.062	-.122	.010	-.203	-.336**	-.322**
	Sig. (2-tailed)	.591	.597	.296	.934	.081	.003	.005
	N	75	75	75	75	75	75	75
Compared to other painful things that have happened	Pearson Correlation	.137	.136	-.149	-.020	-.237*	-.377**	-.284*
	Sig. (2-tailed)	.240	.245	.203	.864	.040	.001	.013
	N	75	75	75	75	75	75	75
How hard was your child crying during the shot?	Pearson Correlation	.203	.199	-.214	-.018	-.172	-.399**	-.294*
	Sig. (2-tailed)	.081	.087	.065	.881	.139	.000	.011
	N	75	75	75	75	75	75	75

How strongly did you have to hold your child?	Pearson Correlation	.188	.185	-.168	-.132	-.067	-.278*	-.291*
	Sig. (2-tailed)	.106	.112	.149	.257	.567	.016	.011
	N	75	75	75	75	75	75	75
In the past when your child had a shot, did your child have any bad	Pearson Correlation	.050	.049	-.027	-.122	-.136	.246*	-.003
	Sig. (2-tailed)	.672	.682	.822	.299	.250	.035	.979
	N	74	74	74	74	74	74	74
How much did the art-light picture distract your child?	Pearson Correlation	.103	.104	.159	.231	-.171	.033	-.027
	Sig. (2-tailed)	.472	.468	.264	.104	.231	.819	.851
	N	51	51	51	51	51	51	51
Total first four items on Parent Survey (higher = more	Pearson Correlation	.178	.175	-.196	-.048	-.201	-.414**	-.354**
	Sig. (2-tailed)	.127	.133	.092	.683	.084	.000	.002
	N	75	75	75	75	75	75	75
Total first 4 items on Nurse Survey (higher = more	Pearson Correlation	.083	.080	-.078	.053	-.210	-.428**	-.230*
	Sig. (2-tailed)	.483	.497	.508	.656	.073	.000	.049
	N	74	74	74	74	74	74	74

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Height in inches	Time in exam room	Currently taking prescription medication	Currently in daycare	Number of shots	Nurse	Heart rate before shots
Clinic	Pearson Correlation	-.062	-.385**	-.299**	.103	.462**	.978**	-.025
	Sig. (2-tailed)	.597	.001	.009	.381	.000	.000	.833
	N	75	71	75	75	75	75	74
Room Number	Pearson Correlation	-.058	-.380**	-.299**	.105	.461**	.976**	-.025
	Sig. (2-tailed)	.623	.001	.009	.372	.000	.000	.835
	N	75	71	75	75	75	75	74
Condition	Pearson Correlation	.146	-.086	.059	-.036	-.045	.037	-.191
	Sig. (2-tailed)	.211	.477	.616	.759	.698	.755	.103
	N	75	71	75	75	75	75	74
Race	Pearson Correlation	.015	.215	.084	.000	-.270*	-.383**	-.098
	Sig. (2-tailed)	.896	.071	.475	1.000	.019	.001	.406
	N	75	71	75	75	75	75	74
Gender	Pearson Correlation	.035	-.093	.080	-.047	-.093	-.065	-.144
	Sig. (2-tailed)	.765	.442	.495	.686	.427	.577	.219
	N	75	71	75	75	75	75	74
Age	Pearson Correlation	.566**	-.076	.035	.029	-.282*	-.019	-.147
	Sig. (2-tailed)	.000	.531	.766	.807	.014	.873	.212
	N	75	71	75	75	75	75	74
Weight in pounds	Pearson Correlation	.624**	.104	.312**	.020	-.268*	-.158	.122
	Sig. (2-tailed)	.000	.388	.006	.863	.020	.175	.300
	N	75	71	75	75	75	75	74

Height in inches	Pearson Correlation	1	.113	.211	.065	-.214	-.091	-.126
	Sig. (2-tailed)		.347	.070	.581	.066	.438	.283
	N	75	71	75	75	75	75	74
Time in exam room	Pearson Correlation	.113	1	.132	.014	-.183	-.430**	-.041
	Sig. (2-tailed)	.347		.274	.908	.127	.000	.737
	N	71	71	71	71	71	71	70
Currently taking prescription medication	Pearson Correlation	.211	.132	1	.114	-.019	-.316**	-.107
	Sig. (2-tailed)	.070	.274		.330	.870	.006	.365
	N	75	71	75	75	75	75	74
Currently in daycare	Pearson Correlation	.065	.014	.114	1	-.061	.058	-.106
	Sig. (2-tailed)	.581	.908	.330		.605	.622	.369
	N	75	71	75	75	75	75	74
Number of shots	Pearson Correlation	-.214	-.183	-.019	-.061	1	.443**	.151
	Sig. (2-tailed)	.066	.127	.870	.605		.000	.200
	N	75	71	75	75	75	75	74
Nurse	Pearson Correlation	-.091	-.430**	-.316**	.058	.443**	1**	-.020
	Sig. (2-tailed)	.438	.000	.006	.622	.000	0.000	.867
	N	75	71	75	75	75	75	74
Heart rate before shots	Pearson Correlation	-.126	-.041	-.107	-.106	.151	-.020	1**
	Sig. (2-tailed)	.283	.737	.365	.369	.200	.867	0.000
	N	74	70	74	74	74	74	74
Heart rate immediately after shots	Pearson Correlation	-.213	.053	-.093	-.032	.008	-.106	.428**
	Sig. (2-tailed)	.066	.663	.426	.785	.945	.366	.000
	N	75	71	75	75	75	75	74
Heart rate five minutes after shots	Pearson Correlation	-.069	.111	.013	.111	.027	-.141	.182
	Sig. (2-tailed)	.554	.358	.914	.343	.818	.227	.121
	N	75	71	75	75	75	75	74

HR change from immediate to 5 minutes after	Pearson Correlation	.147	.028	.093	.104	.011	.001	-.269*
	Sig. (2-tailed)	.208	.815	.426	.375	.926	.993	.020
	N	75	71	75	75	75	75	74
HR change from pre shot to 5 min after	Pearson Correlation	.042	.098	.097	.175	-.093	-.093	-.613**
	Sig. (2-tailed)	.726	.419	.413	.137	.432	.429	.000
	N	74	70	74	74	74	74	74
Rating on the Wong Baker Pain Scale	Pearson Correlation	-.102	-.007	-.057	.093	-.108	-.026	-.076
	Sig. (2-tailed)	.399	.956	.637	.445	.373	.829	.536
	N	70	66	70	70	70	70	69
How upset was this child after getting the shot?	Pearson Correlation	-.214	.092	-.078	.094	.154	.095	.110
	Sig. (2-tailed)	.067	.447	.509	.428	.189	.421	.353
	N	74	70	74	74	74	74	73
How hard was this child crying during the shot?	Pearson Correlation	-.332**	.001	-.188	.056	.234*	.132	.186
	Sig. (2-tailed)	.004	.991	.108	.635	.045	.264	.115
	N	74	70	74	74	74	74	73
Compared to other children, what was this child's pain	Pearson Correlation	-.246*	.037	-.085	.012	.210	.017	.085
	Sig. (2-tailed)	.035	.761	.472	.921	.072	.883	.472
	N	74	70	74	74	74	74	73
How afraid was this child during the shot?	Pearson Correlation	-.075	.120	-.081	.284*	.186	-.004	.221
	Sig. (2-tailed)	.523	.322	.491	.014	.112	.975	.061
	N	74	70	74	74	74	74	73
How much did the art-light picture distract this child?	Pearson Correlation	.244	-.099	-.136	.178	-.205	.090	.052
	Sig. (2-tailed)	.102	.521	.368	.236	.173	.550	.732
	N	46	44	46	46	46	46	45
How upset was your child after getting the shot?	Pearson Correlation	-.250*	.015	-.012	.064	.259*	.066	.082
	Sig. (2-tailed)	.030	.903	.921	.587	.025	.574	.486
	N	75	71	75	75	75	75	74

Compared to other painful things that have happened to your	Pearson Correlation	-.267*	-.089	-.094	.061	.348**	.141	.244*
	Sig. (2-tailed)	.020	.461	.424	.602	.002	.228	.036
	N	75	71	75	75	75	75	74
How hard was your child crying during the shot?	Pearson Correlation	-.220	-.035	-.140	.095	.333**	.194	.202
	Sig. (2-tailed)	.058	.774	.229	.416	.004	.095	.084
	N	75	71	75	75	75	75	74
How strongly did you have to hold your child?	Pearson Correlation	-.278*	-.010	-.141	.047	.280*	.185	.078
	Sig. (2-tailed)	.016	.931	.228	.689	.015	.111	.510
	N	75	71	75	75	75	75	74
In the past when your child had a shot, did your child have any bad	Pearson Correlation	.063	-.107	-.057	.031	-.094	.060	-.080
	Sig. (2-tailed)	.593	.378	.629	.791	.426	.611	.502
	N	74	70	74	74	74	74	73
How much did the art-light picture distract your child?	Pearson Correlation	.050	.050	-.095	.050	-.054	.130	-.279
	Sig. (2-tailed)	.725	.734	.507	.730	.708	.363	.050
	N	51	48	51	51	51	51	50
Total first four items on Parent Survey (higher = more	Pearson Correlation	-.301**	-.035	-.117	.080	.363**	.176	.182
	Sig. (2-tailed)	.009	.772	.318	.493	.001	.130	.121
	N	75	71	75	75	75	75	74
Total first 4 items on Nurse Survey (higher = more	Pearson Correlation	-.245*	.071	-.124	.128	.222	.069	.172
	Sig. (2-tailed)	.036	.561	.294	.278	.057	.561	.146
	N	74	70	74	74	74	74	73

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Heart rate immediately after shots	Heart rate five minutes after shots	HR change from immediate to 5 minutes after	HR change from pre shot to 5 min after	Rating on the Wong Baker Pain Scale	How upset was this child after getting the shot?	How hard was this child crying during the shot?
Clinic	Pearson Correlation	-.119	-.125	.024	-.074	-.038	.092	.140
	Sig. (2-tailed)	.309	.284	.840	.528	.756	.436	.234
	N	75	75	75	74	70	74	74
Room Number	Pearson Correlation	-.119	-.121	.027	-.071	-.033	.088	.137
	Sig. (2-tailed)	.310	.303	.820	.549	.786	.455	.243
	N	75	75	75	74	70	74	74
Condition	Pearson Correlation	-.093	.123	.168	.244*	-.027	-.082	-.113
	Sig. (2-tailed)	.427	.292	.151	.036	.822	.489	.337
	N	75	75	75	74	70	74	74
Race	Pearson Correlation	-.027	.059	.064	.115	.113	.090	-.013
	Sig. (2-tailed)	.821	.616	.587	.327	.350	.446	.912
	N	75	75	75	74	70	74	74
Gender	Pearson Correlation	.054	-.041	-.077	.089	-.111	-.261*	-.162
	Sig. (2-tailed)	.645	.725	.511	.453	.360	.025	.168
	N	75	75	75	74	70	74	74
Age	Pearson Correlation	-.372**	-.155	.233*	-.006	-.379**	-.316**	-.467**
	Sig. (2-tailed)	.001	.184	.044	.957	.001	.006	.000
	N	75	75	75	74	70	74	74
Weight in pounds	Pearson Correlation	-.077	-.025	.053	-.118	-.290*	-.131	-.314**
	Sig. (2-tailed)	.512	.831	.652	.318	.015	.265	.006
	N	75	75	75	74	70	74	74

Height in inches	Pearson Correlation	-.213	-.069	.147	.042	-.102	-.214	-.332**
	Sig. (2-tailed)	.066	.554	.208	.726	.399	.067	.004
	N	75	75	75	74	70	74	74
Time in exam room	Pearson Correlation	.053	.111	.028	.098	-.007	.092	.001
	Sig. (2-tailed)	.663	.358	.815	.419	.956	.447	.991
	N	71	71	71	70	66	70	70
Currently taking prescription medication	Pearson Correlation	-.093	.013	.093	.097	-.057	-.078	-.188
	Sig. (2-tailed)	.426	.914	.426	.413	.637	.509	.108
	N	75	75	75	74	70	74	74
Currently in daycare	Pearson Correlation	-.032	.111	.104	.175	.093	.094	.056
	Sig. (2-tailed)	.785	.343	.375	.137	.445	.428	.635
	N	75	75	75	74	70	74	74
Number of shots	Pearson Correlation	.008	.027	.011	-.093	-.108	.154	.234*
	Sig. (2-tailed)	.945	.818	.926	.432	.373	.189	.045
	N	75	75	75	74	70	74	74
Nurse	Pearson Correlation	-.106	-.141	.001	-.093	-.026	.095	.132
	Sig. (2-tailed)	.366	.227	.993	.429	.829	.421	.264
	N	75	75	75	74	70	74	74
Heart rate before shots	Pearson Correlation	.428**	.182	-.269*	-.613**	-.076	.110	.186
	Sig. (2-tailed)	.000	.121	.020	.000	.536	.353	.115
	N	74	74	74	74	69	73	73
Heart rate immediately after shots	Pearson Correlation	1	.229*	-.754**	-.131	.345**	.314**	.341**
	Sig. (2-tailed)		.049	.000	.265	.003	.007	.003
	N	75	75	75	74	70	74	74
Heart rate five minutes after shots	Pearson Correlation	.229*	1	.467**	.665**	.251*	.260*	.255*
	Sig. (2-tailed)	.049		.000	.000	.036	.025	.028
	N	75	75	75	74	70	74	74

HR change from immediate to 5 minutes after	Pearson Correlation	-.754**	.467**	1	.571**	-.151	-.106	-.133
	Sig. (2-tailed)	.000	.000		.000	.212	.370	.260
	N	75	75	75	74	70	74	74
HR change from pre shot to 5 min after	Pearson Correlation	-.131	.665**	.571**	1	.269*	.109	.060
	Sig. (2-tailed)	.265	.000	.000		.025	.359	.613
	N	74	74	74	74	69	73	73
Rating on the Wong Baker Pain Scale	Pearson Correlation	.345**	.251*	-.151	.269*	1	.470**	.458**
	Sig. (2-tailed)	.003	.036	.212	.025		.000	.000
	N	70	70	70	69	70	69	69
How upset was this child after getting the shot?	Pearson Correlation	.314**	.260*	-.106	.109	.470**	1	.691**
	Sig. (2-tailed)	.007	.025	.370	.359	.000		.000
	N	74	74	74	73	69	74	74
How hard was this child crying during the shot?	Pearson Correlation	.341**	.255*	-.133	.060	.458**	.691**	1
	Sig. (2-tailed)	.003	.028	.260	.613	.000	.000	
	N	74	74	74	73	69	74	74
Compared to other children, what was this child's pain reaction	Pearson Correlation	.379**	.290*	-.143	.164	.417**	.733**	.843**
	Sig. (2-tailed)	.001	.012	.224	.165	.000	.000	.000
	N	74	74	74	73	69	74	74
How afraid was this child during the shot?	Pearson Correlation	.257*	.276*	-.046	.050	.248*	.602**	.713**
	Sig. (2-tailed)	.027	.017	.700	.674	.040	.000	.000
	N	74	74	74	73	69	74	74
How much did the art-light picture distract this child?	Pearson Correlation	-.224	-.279	.020	-.279	.013	-.346*	-.330*
	Sig. (2-tailed)	.135	.060	.896	.064	.932	.018	.025
	N	46	46	46	45	43	46	46
How upset was your child after getting the shot?	Pearson Correlation	.075	-.029	-.087	-.100	.330**	.337**	.442**
	Sig. (2-tailed)	.524	.806	.456	.395	.005	.003	.000
	N	75	75	75	74	70	74	74

Compared to other painful things that have happened	Pearson Correlation	.212	.067	-.148	-.146	.341**	.353**	.452**
	Sig. (2-tailed)	.068	.570	.206	.214	.004	.002	.000
	N	75	75	75	74	70	74	74
How hard was your child crying during the shot?	Pearson Correlation	.272*	.150	-.146	-.046	.370**	.540**	.714**
	Sig. (2-tailed)	.018	.199	.211	.700	.002	.000	.000
	N	75	75	75	74	70	74	74
How strongly did you have to hold your child?	Pearson Correlation	.221	.089	-.141	-.003	.339**	.534**	.597**
	Sig. (2-tailed)	.056	.447	.228	.978	.004	.000	.000
	N	75	75	75	74	70	74	74
In the past when your child had a shot, did your child have any	Pearson Correlation	-.121	.139	.205	.152	.031	-.013	-.135
	Sig. (2-tailed)	.304	.238	.080	.199	.798	.916	.254
	N	74	74	74	73	69	73	73
How much did the art-light picture distract your child?	Pearson Correlation	-.141	-.044	.107	.185	.046	.138	-.117
	Sig. (2-tailed)	.322	.759	.454	.198	.757	.336	.413
	N	51	51	51	50	48	51	51
Total first four items on Parent Survey (higher = more	Pearson Correlation	.235*	.085	-.156	-.086	.418**	.529**	.662**
	Sig. (2-tailed)	.043	.468	.182	.464	.000	.000	.000
	N	75	75	75	74	70	74	74
Total first 4 items on Nurse Survey (higher = more	Pearson Correlation	.362**	.304**	-.120	.105	.450**	.849**	.917**
	Sig. (2-tailed)	.002	.008	.310	.375	.000	.000	.000
	N	74	74	74	73	69	74	74

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Compared to other children, what was this child's pain reaction like?	How afraid was this child during the shot?	How much did the art-light picture distract this child?	How upset was your child after getting the shot?	Compared to other painful things that have happened to your child, how painful was this shot?	How hard was your child crying during the shot?	How strongly did you have to hold your child?
Clinic	Pearson Correlation	.030	.027	.093	.063	.137	.203	.188
	Sig. (2-tailed)	.799	.818	.540	.591	.240	.081	.106
	N	74	74	46	75	75	75	75
Room Number	Pearson Correlation	.027	.028	.094	.062	.136	.199	.185
	Sig. (2-tailed)	.818	.816	.535	.597	.245	.087	.112
	N	74	74	46	75	75	75	75
Condition	Pearson Correlation	-.049	-.031	-.160	-.122	-.149	-.214	-.168
	Sig. (2-tailed)	.677	.791	.289	.296	.203	.065	.149
	N	74	74	46	75	75	75	75
Race	Pearson Correlation	.098	.020	.031	.010	-.020	-.018	-.132
	Sig. (2-tailed)	.404	.863	.836	.934	.864	.881	.257
	N	74	74	46	75	75	75	75
Gender	Pearson Correlation	-.094	-.226	-.095	-.203	-.237*	-.172	-.067
	Sig. (2-tailed)	.427	.053	.532	.081	.040	.139	.567
	N	74	74	46	75	75	75	75
Age	Pearson Correlation	-.477**	-.262*	.171	-.336**	-.377**	-.399**	-.278*
	Sig. (2-tailed)	.000	.024	.255	.003	.001	.000	.016
	N	74	74	46	75	75	75	75
Weight in pounds	Pearson Correlation	-.213	-.151	.295*	-.322**	-.284*	-.294*	-.291*
	Sig. (2-tailed)	.068	.200	.047	.005	.013	.011	.011
	N	74	74	46	75	75	75	75

Height in inches	Pearson Correlation	-.246*	-.075	.244	-.250*	-.267*	-.220	-.278*
	Sig. (2-tailed)	.035	.523	.102	.030	.020	.058	.016
	N	74	74	46	75	75	75	75
Time in exam room	Pearson Correlation	.037	.120	-.099	.015	-.089	-.035	-.010
	Sig. (2-tailed)	.761	.322	.521	.903	.461	.774	.931
	N	70	70	44	71	71	71	71
Currently taking prescription medication	Pearson Correlation	-.085	-.081	-.136	-.012	-.094	-.140	-.141
	Sig. (2-tailed)	.472	.491	.368	.921	.424	.229	.228
	N	74	74	46	75	75	75	75
Currently in daycare	Pearson Correlation	.012	.284*	.178	.064	.061	.095	.047
	Sig. (2-tailed)	.921	.014	.236	.587	.602	.416	.689
	N	74	74	46	75	75	75	75
Number of shots	Pearson Correlation	.210	.186	-.205	.259*	.348**	.333**	.280*
	Sig. (2-tailed)	.072	.112	.173	.025	.002	.004	.015
	N	74	74	46	75	75	75	75
Nurse	Pearson Correlation	.017	-.004	.090	.066	.141	.194	.185
	Sig. (2-tailed)	.883	.975	.550	.574	.228	.095	.111
	N	74	74	46	75	75	75	75
Heart rate before shots	Pearson Correlation	.085	.221	.052	.082	.244*	.202	.078
	Sig. (2-tailed)	.472	.061	.732	.486	.036	.084	.510
	N	73	73	45	74	74	74	74
Heart rate immediately after shots	Pearson Correlation	.379**	.257*	-.224	.075	.212	.272*	.221
	Sig. (2-tailed)	.001	.027	.135	.524	.068	.018	.056
	N	74	74	46	75	75	75	75
Heart rate five minutes after shots	Pearson Correlation	.290*	.276*	-.279	-.029	.067	.150	.089
	Sig. (2-tailed)	.012	.017	.060	.806	.570	.199	.447
	N	74	74	46	75	75	75	75

HR change from immediate to 5 minutes after	Pearson Correlation	-.143	-.046	.020	-.087	-.148	-.146	-.141
	Sig. (2-tailed)	.224	.700	.896	.456	.206	.211	.228
	N	74	74	46	75	75	75	75
HR change from pre shot to 5 min after	Pearson Correlation	.164	.050	-.279	-.100	-.146	-.046	-.003
	Sig. (2-tailed)	.165	.674	.064	.395	.214	.700	.978
	N	73	73	45	74	74	74	74
Rating on the Wong Baker Pain Scale	Pearson Correlation	.417**	.248*	.013	.330**	.341**	.370**	.339**
	Sig. (2-tailed)	.000	.040	.932	.005	.004	.002	.004
	N	69	69	43	70	70	70	70
How upset was this child after getting the shot?	Pearson Correlation	.733**	.602**	-.346*	.337**	.353**	.540**	.534**
	Sig. (2-tailed)	.000	.000	.018	.003	.002	.000	.000
	N	74	74	46	74	74	74	74
How hard was this child crying during the shot?	Pearson Correlation	.843**	.713**	-.330*	.442**	.452**	.714**	.597**
	Sig. (2-tailed)	.000	.000	.025	.000	.000	.000	.000
	N	74	74	46	74	74	74	74
Compared to other children, what was this child's pain reaction	Pearson Correlation	1	.721**	-.403**	.327**	.343**	.605**	.539**
	Sig. (2-tailed)		.000	.005	.004	.003	.000	.000
	N	74	74	46	74	74	74	74
How afraid was this child during the shot?	Pearson Correlation	.721**	1	-.359*	.254*	.342**	.558**	.517**
	Sig. (2-tailed)	.000		.014	.029	.003	.000	.000
	N	74	74	46	74	74	74	74
How much did the art-light picture distract this child?	Pearson Correlation	-.403**	-.359*	1	-.011	-.019	-.231	-.405**
	Sig. (2-tailed)	.005	.014		.942	.900	.123	.005
	N	46	46	46	46	46	46	46
How upset was your child after getting the shot?	Pearson Correlation	.327**	.254*	-.011	1	.753**	.612**	.426**
	Sig. (2-tailed)	.004	.029	.942		.000	.000	.000
	N	74	74	46	75	75	75	75

Compared to other painful things that have happened to your	Pearson Correlation	.343**	.342**	-.019	.753**	1	.679**	.483**
	Sig. (2-tailed)	.003	.003	.900	.000		.000	.000
	N	74	74	46	75	75	75	75
How hard was your child crying during the shot?	Pearson Correlation	.605**	.558**	-.231	.612**	.679**	1	.684**
	Sig. (2-tailed)	.000	.000	.123	.000	.000		.000
	N	74	74	46	75	75	75	75
How strongly did you have to hold your child?	Pearson Correlation	.539**	.517**	-.405**	.426**	.483**	.684**	1
	Sig. (2-tailed)	.000	.000	.005	.000	.000	.000	
	N	74	74	46	75	75	75	75
In the past when your child had a shot, did your child have any bad	Pearson Correlation	-.094	-.030	.007	.063	.130	.109	.190
	Sig. (2-tailed)	.429	.799	.965	.593	.271	.354	.105
	N	73	73	45	74	74	74	74
How much did the art-light picture distract your child?	Pearson Correlation	-.051	.008	.210	.019	-.065	-.013	-.046
	Sig. (2-tailed)	.721	.956	.160	.896	.648	.928	.750
	N	51	51	46	51	51	51	51
Total first four items on Parent Survey (higher = more	Pearson Correlation	.546**	.503**	-.203	.825**	.862**	.893**	.777**
	Sig. (2-tailed)	.000	.000	.175	.000	.000	.000	.000
	N	74	74	46	75	75	75	75
Total first 4 items on Nurse Survey (higher = more	Pearson Correlation	.926**	.858**	-.405**	.384**	.421**	.683**	.617**
	Sig. (2-tailed)	.000	.000	.005	.001	.000	.000	.000
	N	74	74	46	74	74	74	74

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix M

Immunization research data analysis

Final analysis output univariate in ANCOVA

Univariate Analysis of Variance

[DataSet2] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Final_Data_SPSS.sav

Between-Subjects Factors

		Value Label	N
Condition	1	Control	23
	2	Movie	26
	3	Picture	21

Descriptive Statistics

Dependent Variable: Rating on the Wong Baker Pain

Condition	Mean	Std. Deviation	N
Control	3.65	1.824	23
Movie	3.54	2.044	26
Picture	3.52	1.887	21
Total	3.57	1.900	70

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Rating on the Wong Bake

F	df1	df2	Sig.
2.357	2	67	.102

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Age + Nurse + numshots + condition

Tests of Between-Subjects Effects

Dependent Variable: Rating on the Wong Baker Pain Scale

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	49.934[a]	5	9.987	3.208	.012	.200
Intercept	103.928	1	103.928	33.389	.000	.343
Age	46.507	1	46.507	14.941	.000	.189
Nurse	2.291	1	2.291	.736	.394	.011
numshots	13.304	1	13.304	4.274	.043	.063
condition	1.097	2	.548	.176	.839	.005
Error	199.209	64	3.113			
Total	1142.000	70				
Corrected Total	249.143	69				

a. R Squared = .200 (Adjusted R Squared = .138)

Estimated Marginal Means

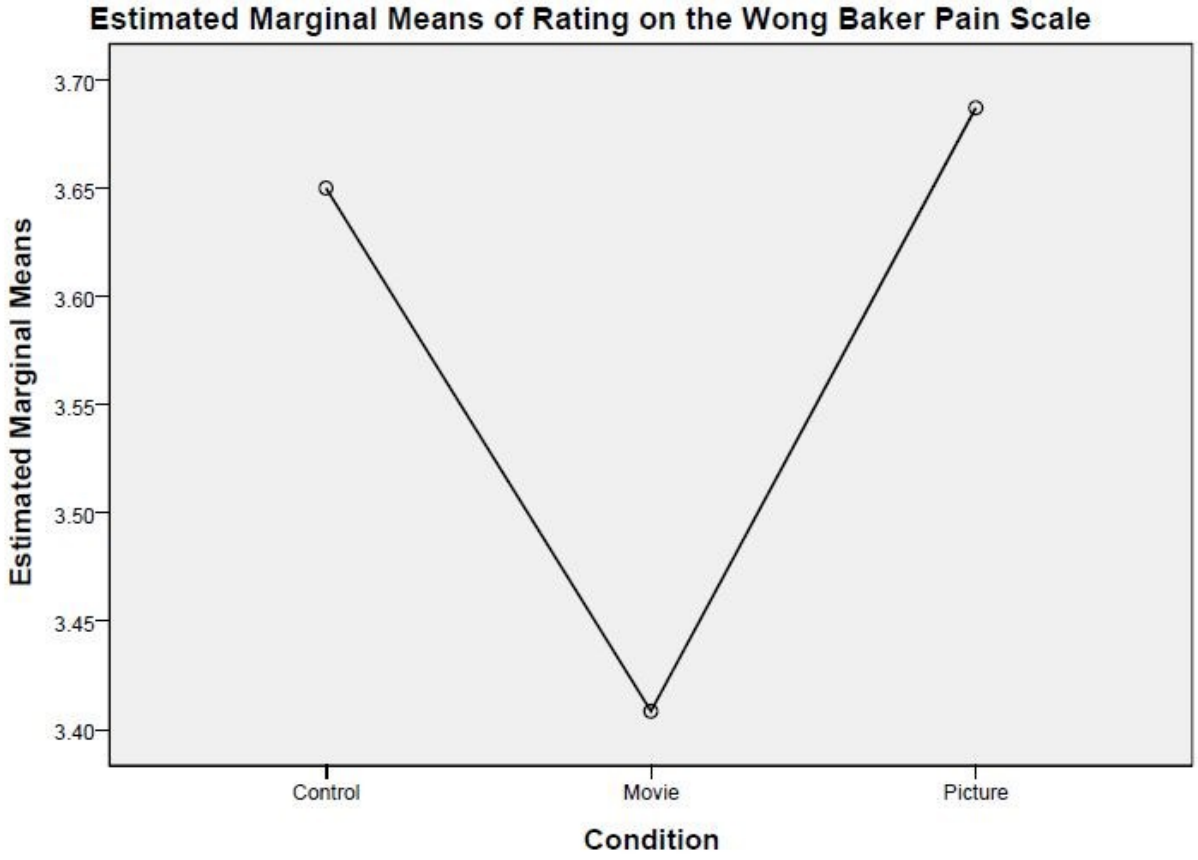
Condition

Dependent Variable: Rating on the Wong Baker Pain Scale

Condition	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control	3.650[a]	.369	2.913	4.387
Movie	3.408[a]	.348	2.714	4.103
Picture	3.687[a]	.389	2.911	4.463

a. Covariates appearing in the model are evaluated at the following values: Age = 4.386, Nurse = 6.04, Number of shots = 3.00.

Profile Plots



Covariates appearing in the model are evaluated at the following values: Age = 4.386, Nurse = 6.04, Number of shots = 3.00

```
UNIANOVA ParentTot BY condition WITH Age Nurse numshots
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /SAVE=SRESID
```

```
  /PLOT=PROFILE(condition)
  /EMMEANS=TABLES(condition) WITH(Age=MEAN Nurse=MEAN numshots=MEAN)
  /PRINT=ETASQ HOMOGENEITY DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=Age Nurse numshots condition.
```

Univariate Analysis of Variance

```
[DataSet2] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Final_Data_SPSS.sav
```

Between-Subjects Factors

		Value Label	N
Condition	1	Control	25
	2	Movie	27
	3	Picture	23

Descriptive Statistics

Dependent Variable: Total first four items on Parent S

Condition	Mean	Std. Deviation	N
Control	15.1600	5.55788	25
Movie	15.5556	5.85290	27
Picture	12.2609	5.76996	23
Total	14.4133	5.83580	75

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Total first four items on P

F	df1	df2	Sig.
.680	2	72	.510

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Age + Nurse + numshots + condition

Tests of Between-Subjects Effects

Dependent Variable: Total first four items on Parent Survey (higher = more distress)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	696.798[a]	5	139.360	5.274	.000	.276
Intercept	518.135	1	518.135	19.607	.000	.221
Age	219.507	1	219.507	8.306	.005	.107
Nurse	11.182	1	11.182	.423	.518	.006
numshots	100.227	1	100.227	3.793	.056	.052
condition	89.040	2	44.520	1.685	.193	.047
Error	1823.388	69	26.426			
Total	18101.000	75				
Corrected Total	2520.187	74				

a. R Squared = .276 (Adjusted R Squared = .224)

Estimated Marginal Means

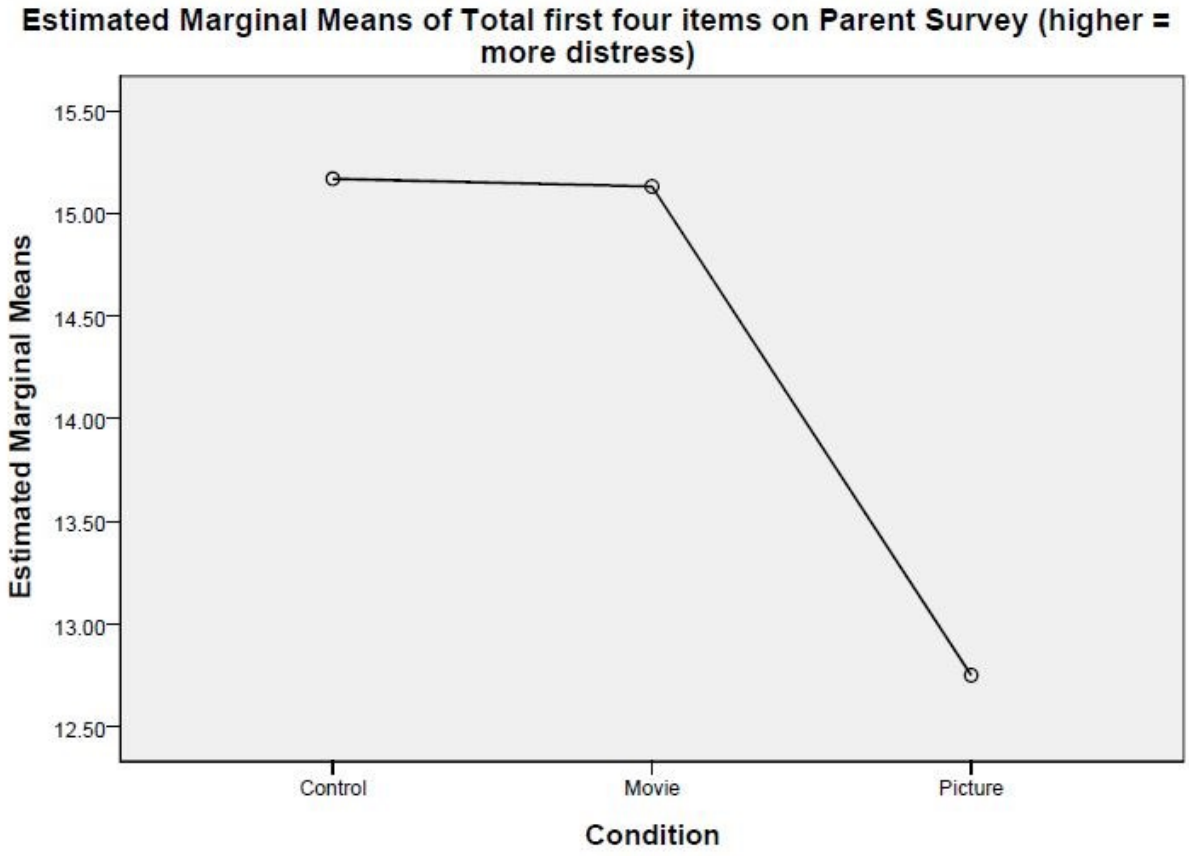
Condition

Dependent Variable: Total first four items on Parent Survey (higher = r

Condition	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control	15.168[a]	1.030	13.112	17.223
Movie	15.130[a]	1.002	13.132	17.129
Picture	12.752[a]	1.083	10.591	14.912

a. Covariates appearing in the model are evaluated at the following values: Age = 4.453, Nurse = 5.91, Number of shots = 2.97.

Profile Plots



Covariates appearing in the model are evaluated at the following values: Age = 4.453, Nurse = 5.91, Number of shots = 2.97

```
UNIANOVA NurseTot BY condition WITH Age Nurse numshots
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /SAVE=SRESID
```

```
  /PLOT=PROFILE(condition)
  /EMMEANS=TABLES(condition) WITH(Age=MEAN Nurse=MEAN numshots=MEAN)
  /PRINT=ETASQ HOMOGENEITY DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=Age Nurse numshots condition.
```

Univariate Analysis of Variance

```
[DataSet2] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Final_Data_SPSS.sav
```

Between-Subjects Factors

		Value Label	N
Condition	1	Control	24
	2	Movie	27
	3	Picture	23

Descriptive Statistics

Dependent Variable: Total first 4 items on Nurse Sur

Condition	Mean	Std. Deviation	N
Control	11.8750	5.64387	24
Movie	12.1111	5.13160	27
Picture	10.7826	6.02236	23
Total	11.6216	5.53866	74

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Total first 4 items on Nurs

F	df1	df2	Sig.
1.393	2	71	.255

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Age + Nurse + numshots + condition

Tests of Between-Subjects Effects

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	434.577[a]	5	86.915	3.275	.010	.194
Intercept	599.858	1	599.858	22.601	.000	.249
Age	300.897	1	300.897	11.337	.001	.143
Nurse	.754	1	.754	.028	.867	.000
numshots	12.828	1	12.828	.483	.489	.007
condition	3.870	2	1.935	.073	.930	.002
Error	1804.829	68	26.542			
Total	12234.000	74				
Corrected Total	2239.405	73				

a. R Squared = .194 (Adjusted R Squared = .135)

Estimated Marginal Means

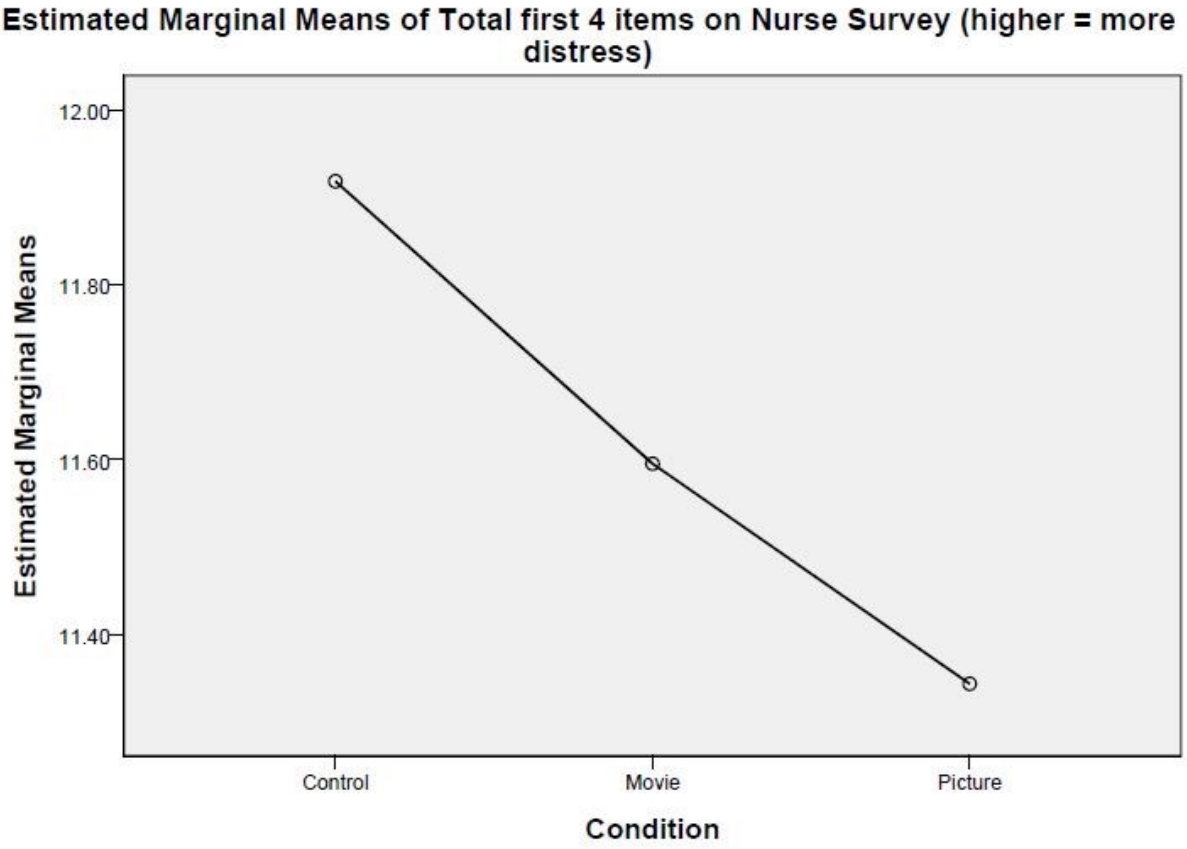
Condition

Dependent Variable: Total first 4 items on Nurse Survey (higher = mor

Condition	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control	11.918[a]	1.053	9.818	14.018
Movie	11.595[a]	1.002	9.595	13.595
Picture	11.343[a]	1.087	9.175	13.512

a. Covariates appearing in the model are evaluated at the following values: Age = 4.446, Nurse = 5.84, Number of shots = 2.95.

Profile Plots



Covariates appearing in the model are evaluated at the following values: Age = 4.446, Nurse = 5.84, Number of shots = 2.95

Final analysis output descriptives and repeated measures in ANCOVA

```
USE ALL.
COMPUTE filter_$=(Patient > 1).
VARIABLE LABELS filter_$ 'Patient > 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.

FREQUENCIES VARIABLES=Patient Location Roomnum condition Race Gender Age Weight_lb Height_in
    Timenroom_min meds daycare numshots Hrbefore HRafter HR5min HRImto5min HRpreto5min WongBaker Nurse Nurs
eQ_1 NurseQ_2
    NurseQ_3 NurseQ_4 NurseQ_5 ParentQ_1 ParentQ_2 ParentQ_3 ParentQ_4 ParentQ_5c6i ParentQ_5i
  /STATISTICS=STDDEV MINIMUM MAXIMUM MEAN MEDIAN
  /ORDER=ANALYSIS.
```

Frequencies

```
[DataSet1] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Final_Data_SPSS.sav
```

Statistics

		Patient Number	Clinic	Room Number	Condition	Race	Gender	Age	Weight in pounds	Height in inches
N	Valid	75	75	75	75	75	75	75	75	75
	Missing	0	0	0	0	0	0	0	0	0
Mean		39.00	1.37	135.88	1.97	1.60	.560	4.453	44.0980	42.20813
Median		39.00	1.00	109.00	2.00	2.00	1.000	4.000	42.2000	42.00000
Std. Deviation		21.794	.487	36.714	.805	.658	.4997	.6429	11.50911	3.409987
Minimum		2	1	106	1	1	.0	4.0	28.80	31.200
Maximum		76	2	184	3	3	1.0	6.0	116.80	51.770

Statistics

		Time in exam room	Currently taking prescription medication	Currently in daycare	Number of shots	Heart rate before shots	Heart rate immediately after shots	Heart rate five minutes after shots
N	Valid	71	75	75	75	74	75	75
	Missing	4	0	0	0	1	0	0
Mean		40.99	.19	.13	2.97	99.50	112.16	100.17
Median		32.00	.00	.00	3.00	100.00	111.00	102.00
Std. Deviation		18.717	.392	.342	1.127	16.921	24.111	17.892
Minimum		10	0	0	1	55	59	48
Maximum		90	1	1	5	144	162	152

Statistics

		HR change from immediate to 5 minutes after	HR change from pre shot to 5 min after	Rating on the Wong Baker Pain Scale	Nurse	How upset was this child after getting the shot?	How hard was this child crying during the shot?	Compared to other children, what was this child's pain reaction like?	How afraid was this child during the shot?
N	Valid	75	74	70	75	74	74	74	74
	Missing	0	1	5	0	1	1	1	1
Mean		-11.9867	.4324	3.57	5.91	2.74	3.07	2.76	3.05
Median		-10.0000	2.5000	5.00	2.00	2.50	3.00	3.00	3.00
Std. Deviation		26.53885	22.27664	1.900	5.411	1.518	1.650	1.469	1.604
Minimum		-89.00	-73.00	0	1	1	1	1	1
Maximum		57.00	48.00	5	17	6	6	6	6

Statistics

		How much did the art-light picture distract this child?	How upset was your child after getting the shot?	Compared to other painful things that have happened to your child, how painful was this shot?	How hard was your child crying during the shot?	How strongly did you have to hold your child?	In the past when your child had a shot, did your child have any bad experiences because of the shot?	How much did the art-light picture distract your child?
N	Valid	46	75	75	75	75	74	51
	Missing	29	0	0	0	0	1	24
Mean		3.02	3.83	3.75	3.55	3.29	.19	2.92
Median		2.50	4.00	4.00	4.00	3.00	.00	3.00
Std. Deviation		1.782	1.696	1.637	1.877	1.738	.394	1.798
Minimum		1	1	1	1	1	0	0
Maximum		6	6	6	6	6	1	6

Frequency Table

Patient Number

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	1.3	1.3	1.3
	3	1	1.3	1.3	2.7
	4	1	1.3	1.3	4.0
	5	1	1.3	1.3	5.3
	6	1	1.3	1.3	6.7
	7	1	1.3	1.3	8.0
	8	1	1.3	1.3	9.3
	9	1	1.3	1.3	10.7
	10	1	1.3	1.3	12.0
	11	1	1.3	1.3	13.3
	12	1	1.3	1.3	14.7
	13	1	1.3	1.3	16.0
	14	1	1.3	1.3	17.3
	15	1	1.3	1.3	18.7
	16	1	1.3	1.3	20.0
	17	1	1.3	1.3	21.3
	18	1	1.3	1.3	22.7
	19	1	1.3	1.3	24.0
	20	1	1.3	1.3	25.3
	21	1	1.3	1.3	26.7
	22	1	1.3	1.3	28.0
	23	1	1.3	1.3	29.3
	24	1	1.3	1.3	30.7
	25	1	1.3	1.3	32.0
	26	1	1.3	1.3	33.3
	27	1	1.3	1.3	34.7
	28	1	1.3	1.3	36.0

Patient Number

	Frequency	Percent	Valid Percent	Cumulative Percent
29	1	1.3	1.3	37.3
30	1	1.3	1.3	38.7
31	1	1.3	1.3	40.0
32	1	1.3	1.3	41.3
33	1	1.3	1.3	42.7
34	1	1.3	1.3	44.0
35	1	1.3	1.3	45.3
36	1	1.3	1.3	46.7
37	1	1.3	1.3	48.0
38	1	1.3	1.3	49.3
39	1	1.3	1.3	50.7
40	1	1.3	1.3	52.0
41	1	1.3	1.3	53.3
42	1	1.3	1.3	54.7
43	1	1.3	1.3	56.0
44	1	1.3	1.3	57.3
45	1	1.3	1.3	58.7
46	1	1.3	1.3	60.0
47	1	1.3	1.3	61.3
48	1	1.3	1.3	62.7
49	1	1.3	1.3	64.0
50	1	1.3	1.3	65.3
51	1	1.3	1.3	66.7
52	1	1.3	1.3	68.0
53	1	1.3	1.3	69.3
54	1	1.3	1.3	70.7
55	1	1.3	1.3	72.0

Patient Number

	Frequency	Percent	Valid Percent	Cumulative Percent
56	1	1.3	1.3	73.3
57	1	1.3	1.3	74.7
58	1	1.3	1.3	76.0
59	1	1.3	1.3	77.3
60	1	1.3	1.3	78.7
61	1	1.3	1.3	80.0
62	1	1.3	1.3	81.3
63	1	1.3	1.3	82.7
64	1	1.3	1.3	84.0
65	1	1.3	1.3	85.3
66	1	1.3	1.3	86.7
67	1	1.3	1.3	88.0
68	1	1.3	1.3	89.3
69	1	1.3	1.3	90.7
70	1	1.3	1.3	92.0
71	1	1.3	1.3	93.3
72	1	1.3	1.3	94.7
73	1	1.3	1.3	96.0
74	1	1.3	1.3	97.3
75	1	1.3	1.3	98.7
76	1	1.3	1.3	100.0
Total	75	100.0	100.0	

Clinic

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	JCCHC	47	62.7	62.7	62.7
	WCHD	28	37.3	37.3	100.0
	Total	75	100.0	100.0	

Room Number

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	106	14	18.7	18.7	18.7
	108	17	22.7	22.7	41.3
	109	16	21.3	21.3	62.7
	182	9	12.0	12.0	74.7
	183	7	9.3	9.3	84.0
	184	12	16.0	16.0	100.0
	Total	75	100.0	100.0	

Condition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Control	25	33.3	33.3	33.3
	Movie	27	36.0	36.0	69.3
	Picture	23	30.7	30.7	100.0
	Total	75	100.0	100.0	

Race

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	37	49.3	49.3	49.3
	Hispanic	31	41.3	41.3	90.7
	Other	7	9.3	9.3	100.0
	Total	75	100.0	100.0	

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	33	44.0	44.0	44.0
	Male	42	56.0	56.0	100.0
	Total	75	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	47	62.7	62.7	62.7
	5.0	22	29.3	29.3	92.0
	6.0	6	8.0	8.0	100.0
	Total	75	100.0	100.0	

Weight in pounds

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	28.80	1	1.3	1.3	1.3
	29.60	1	1.3	1.3	2.7
	32.20	1	1.3	1.3	4.0
	33.40	1	1.3	1.3	5.3
	34.00	1	1.3	1.3	6.7
	34.20	1	1.3	1.3	8.0
	34.40	1	1.3	1.3	9.3
	35.00	1	1.3	1.3	10.7
	35.20	1	1.3	1.3	12.0
	35.40	1	1.3	1.3	13.3
	35.80	1	1.3	1.3	14.7
	36.00	1	1.3	1.3	16.0
	36.20	1	1.3	1.3	17.3
	36.60	1	1.3	1.3	18.7
	36.80	2	2.7	2.7	21.3
	37.00	3	4.0	4.0	25.3
	38.40	1	1.3	1.3	26.7
	38.50	1	1.3	1.3	28.0
	39.00	1	1.3	1.3	29.3
	39.20	1	1.3	1.3	30.7
	39.25	1	1.3	1.3	32.0
	39.60	1	1.3	1.3	33.3
	39.80	1	1.3	1.3	34.7
	40.00	4	5.3	5.3	40.0
	40.60	2	2.7	2.7	42.7
	40.80	1	1.3	1.3	44.0
	41.40	1	1.3	1.3	45.3

Weight in pounds

	Frequency	Percent	Valid Percent	Cumulative Percent
42.00	3	4.0	4.0	49.3
42.20	2	2.7	2.7	52.0
42.40	1	1.3	1.3	53.3
43.00	1	1.3	1.3	54.7
43.20	1	1.3	1.3	56.0
43.40	2	2.7	2.7	58.7
43.60	1	1.3	1.3	60.0
43.80	1	1.3	1.3	61.3
44.00	2	2.7	2.7	64.0
44.20	2	2.7	2.7	66.7
44.40	2	2.7	2.7	69.3
45.00	2	2.7	2.7	72.0
45.80	1	1.3	1.3	73.3
46.00	1	1.3	1.3	74.7
46.80	1	1.3	1.3	76.0
47.60	1	1.3	1.3	77.3
48.00	1	1.3	1.3	78.7
48.40	1	1.3	1.3	80.0
48.60	2	2.7	2.7	82.7
49.00	1	1.3	1.3	84.0
53.00	2	2.7	2.7	86.7
53.60	1	1.3	1.3	88.0
53.80	1	1.3	1.3	89.3
54.20	1	1.3	1.3	90.7
55.60	1	1.3	1.3	92.0
58.40	1	1.3	1.3	93.3
58.60	1	1.3	1.3	94.7

Weight in pounds

		Frequency	Percent	Valid Percent	Cumulative Percent
	60.40	1	1.3	1.3	96.0
	64.00	1	1.3	1.3	97.3
	70.20	1	1.3	1.3	98.7
	116.80	1	1.3	1.3	100.0
	Total	75	100.0	100.0	

Height in inches

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	31.200	1	1.3	1.3	1.3
	32.600	1	1.3	1.3	2.7
	38.000	1	1.3	1.3	4.0
	38.500	1	1.3	1.3	5.3
	38.650	1	1.3	1.3	6.7
	38.750	1	1.3	1.3	8.0
	38.980	1	1.3	1.3	9.3
	39.000	5	6.7	6.7	16.0
	39.370	1	1.3	1.3	17.3
	39.500	3	4.0	4.0	21.3
	39.570	1	1.3	1.3	22.7
	39.700	1	1.3	1.3	24.0
	39.750	1	1.3	1.3	25.3
	39.760	1	1.3	1.3	26.7
	40.000	2	2.7	2.7	29.3
	40.160	1	1.3	1.3	30.7
	40.940	1	1.3	1.3	32.0
	41.000	3	4.0	4.0	36.0

Height in inches

	Frequency	Percent	Valid Percent	Cumulative Percent
41.250	1	1.3	1.3	37.3
41.300	1	1.3	1.3	38.7
41.500	1	1.3	1.3	40.0
41.540	2	2.7	2.7	42.7
41.730	3	4.0	4.0	46.7
41.740	1	1.3	1.3	48.0
41.750	1	1.3	1.3	49.3
42.000	5	6.7	6.7	56.0
42.250	1	1.3	1.3	57.3
42.625	1	1.3	1.3	58.7
42.750	1	1.3	1.3	60.0
42.875	1	1.3	1.3	61.3
42.900	1	1.3	1.3	62.7
43.000	3	4.0	4.0	66.7
43.500	3	4.0	4.0	70.7
44.000	4	5.3	5.3	76.0
44.250	1	1.3	1.3	77.3
44.500	1	1.3	1.3	78.7
44.750	1	1.3	1.3	80.0
45.000	5	6.7	6.7	86.7
45.500	1	1.3	1.3	88.0
45.670	2	2.7	2.7	90.7
47.500	1	1.3	1.3	92.0
48.000	1	1.3	1.3	93.3
48.030	1	1.3	1.3	94.7
48.230	1	1.3	1.3	96.0
49.600	1	1.3	1.3	97.3

Height in inches

	Frequency	Percent	Valid Percent	Cumulative Percent
50.000	1	1.3	1.3	98.7
51.770	1	1.3	1.3	100.0
Total	75	100.0	100.0	

Time in exam room

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10	1	1.3	1.4	1.4
	15	3	4.0	4.2	5.6
	17	1	1.3	1.4	7.0
	20	3	4.0	4.2	11.3
	25	5	6.7	7.0	18.3
	30	22	29.3	31.0	49.3
	32	1	1.3	1.4	50.7
	35	1	1.3	1.4	52.1
	37	1	1.3	1.4	53.5
	40	5	6.7	7.0	60.6
	45	8	10.7	11.3	71.8
	50	1	1.3	1.4	73.2
	60	12	16.0	16.9	90.1
	68	1	1.3	1.4	91.5
	70	1	1.3	1.4	93.0
	80	2	2.7	2.8	95.8
	81	1	1.3	1.4	97.2
	90	2	2.7	2.8	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		

Time in exam room

	Frequency	Percent	Valid Percent	Cumulative Percent
Total	75	100.0		

Currently taking prescription medication

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	61	81.3	81.3	81.3
	Yes	14	18.7	18.7	100.0
	Total	75	100.0	100.0	

Currently in daycare

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	65	86.7	86.7	86.7
	Yes	10	13.3	13.3	100.0
	Total	75	100.0	100.0	

Number of shots

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	12	16.0	16.0	16.0
	2	6	8.0	8.0	24.0
	3	35	46.7	46.7	70.7
	4	16	21.3	21.3	92.0
	5	6	8.0	8.0	100.0
	Total	75	100.0	100.0	

Heart rate before shots

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	55	1	1.3	1.4	1.4
	64	1	1.3	1.4	2.7
	66	3	4.0	4.1	6.8
	76	1	1.3	1.4	8.1
	77	1	1.3	1.4	9.5
	78	1	1.3	1.4	10.8
	80	1	1.3	1.4	12.2
	82	3	4.0	4.1	16.2
	85	1	1.3	1.4	17.6
	86	2	2.7	2.7	20.3
	87	2	2.7	2.7	23.0
	89	1	1.3	1.4	24.3
	91	1	1.3	1.4	25.7
	92	1	1.3	1.4	27.0
	93	2	2.7	2.7	29.7
	94	2	2.7	2.7	32.4
	95	1	1.3	1.4	33.8
	96	3	4.0	4.1	37.8
	97	2	2.7	2.7	40.5
	98	2	2.7	2.7	43.2
	99	2	2.7	2.7	45.9
	100	6	8.0	8.1	54.1
	101	1	1.3	1.4	55.4
	102	2	2.7	2.7	58.1
	103	3	4.0	4.1	62.2
	104	2	2.7	2.7	64.9
	105	1	1.3	1.4	66.2

Heart rate before shots

		Frequency	Percent	Valid Percent	Cumulative Percent
	106	2	2.7	2.7	68.9
	108	2	2.7	2.7	71.6
	109	2	2.7	2.7	74.3
	110	4	5.3	5.4	79.7
	111	1	1.3	1.4	81.1
	112	1	1.3	1.4	82.4
	113	3	4.0	4.1	86.5
	115	1	1.3	1.4	87.8
	117	1	1.3	1.4	89.2
	118	1	1.3	1.4	90.5
	120	1	1.3	1.4	91.9
	121	1	1.3	1.4	93.2
	128	1	1.3	1.4	94.6
	129	1	1.3	1.4	95.9
	131	1	1.3	1.4	97.3
	143	1	1.3	1.4	98.6
	144	1	1.3	1.4	100.0
	Total	74	98.7	100.0	
Missing	System	1	1.3		
Total		75	100.0		

Heart rate immediately after shots

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	59	1	1.3	1.3	1.3
	63	1	1.3	1.3	2.7
	65	1	1.3	1.3	4.0
	67	1	1.3	1.3	5.3
	73	2	2.7	2.7	8.0
	83	1	1.3	1.3	9.3
	85	1	1.3	1.3	10.7
	86	2	2.7	2.7	13.3
	87	1	1.3	1.3	14.7
	88	2	2.7	2.7	17.3
	90	1	1.3	1.3	18.7
	92	1	1.3	1.3	20.0
	94	1	1.3	1.3	21.3
	95	1	1.3	1.3	22.7
	96	2	2.7	2.7	25.3
	98	1	1.3	1.3	26.7
	99	4	5.3	5.3	32.0
	100	2	2.7	2.7	34.7
	101	1	1.3	1.3	36.0
	102	1	1.3	1.3	37.3
	105	2	2.7	2.7	40.0
	106	2	2.7	2.7	42.7
	107	2	2.7	2.7	45.3
	108	1	1.3	1.3	46.7
	109	1	1.3	1.3	48.0
	111	2	2.7	2.7	50.7
	112	2	2.7	2.7	53.3

Heart rate immediately after shots

	Frequency	Percent	Valid Percent	Cumulative Percent
113	2	2.7	2.7	56.0
114	2	2.7	2.7	58.7
115	2	2.7	2.7	61.3
120	1	1.3	1.3	62.7
121	2	2.7	2.7	65.3
122	3	4.0	4.0	69.3
123	1	1.3	1.3	70.7
124	1	1.3	1.3	72.0
126	1	1.3	1.3	73.3
127	1	1.3	1.3	74.7
131	1	1.3	1.3	76.0
134	3	4.0	4.0	80.0
138	1	1.3	1.3	81.3
140	2	2.7	2.7	84.0
141	1	1.3	1.3	85.3
142	3	4.0	4.0	89.3
144	1	1.3	1.3	90.7
150	3	4.0	4.0	94.7
151	1	1.3	1.3	96.0
153	1	1.3	1.3	97.3
160	1	1.3	1.3	98.7
162	1	1.3	1.3	100.0
Total	75	100.0	100.0	

Heart rate five minutes after shots

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	48	1	1.3	1.3	1.3
	55	1	1.3	1.3	2.7
	63	1	1.3	1.3	4.0
	67	1	1.3	1.3	5.3
	71	2	2.7	2.7	8.0
	72	1	1.3	1.3	9.3
	74	1	1.3	1.3	10.7
	76	2	2.7	2.7	13.3
	82	2	2.7	2.7	16.0
	85	1	1.3	1.3	17.3
	88	1	1.3	1.3	18.7
	89	1	1.3	1.3	20.0
	91	2	2.7	2.7	22.7
	92	1	1.3	1.3	24.0
	93	1	1.3	1.3	25.3
	94	1	1.3	1.3	26.7
	95	3	4.0	4.0	30.7
	96	2	2.7	2.7	33.3
	97	3	4.0	4.0	37.3
	98	5	6.7	6.7	44.0
	99	1	1.3	1.3	45.3
	100	3	4.0	4.0	49.3
	102	3	4.0	4.0	53.3
	103	4	5.3	5.3	58.7
	104	3	4.0	4.0	62.7
	105	1	1.3	1.3	64.0
	106	1	1.3	1.3	65.3

Heart rate five minutes after shots

	Frequency	Percent	Valid Percent	Cumulative Percent
107	1	1.3	1.3	66.7
108	3	4.0	4.0	70.7
109	3	4.0	4.0	74.7
110	1	1.3	1.3	76.0
111	1	1.3	1.3	77.3
112	1	1.3	1.3	78.7
114	1	1.3	1.3	80.0
115	1	1.3	1.3	81.3
116	2	2.7	2.7	84.0
117	1	1.3	1.3	85.3
118	2	2.7	2.7	88.0
120	1	1.3	1.3	89.3
122	2	2.7	2.7	92.0
123	2	2.7	2.7	94.7
126	1	1.3	1.3	96.0
130	1	1.3	1.3	97.3
132	1	1.3	1.3	98.7
152	1	1.3	1.3	100.0
Total	75	100.0	100.0	

HR change from immediate to 5 minutes after

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-89.00	1	1.3	1.3	1.3
	-77.00	1	1.3	1.3	2.7
	-58.00	2	2.7	2.7	5.3
	-45.00	1	1.3	1.3	6.7
	-43.00	3	4.0	4.0	10.7
	-42.00	1	1.3	1.3	12.0
	-41.00	1	1.3	1.3	13.3
	-40.00	1	1.3	1.3	14.7
	-38.00	1	1.3	1.3	16.0
	-36.00	1	1.3	1.3	17.3
	-34.00	2	2.7	2.7	20.0
	-33.00	1	1.3	1.3	21.3
	-32.00	2	2.7	2.7	24.0
	-31.00	1	1.3	1.3	25.3
	-30.00	1	1.3	1.3	26.7
	-27.00	4	5.3	5.3	32.0
	-26.00	1	1.3	1.3	33.3
	-23.00	3	4.0	4.0	37.3
	-21.00	1	1.3	1.3	38.7
	-19.00	1	1.3	1.3	40.0
	-18.00	2	2.7	2.7	42.7
	-15.00	1	1.3	1.3	44.0
	-14.00	1	1.3	1.3	45.3
	-13.00	1	1.3	1.3	46.7
	-12.00	1	1.3	1.3	48.0
	-10.00	3	4.0	4.0	52.0
	-8.00	2	2.7	2.7	54.7

HR change from immediate to 5 minutes after

	Frequency	Percent	Valid Percent	Cumulative Percent
-6.00	1	1.3	1.3	56.0
-5.00	4	5.3	5.3	61.3
-4.00	1	1.3	1.3	62.7
-3.00	1	1.3	1.3	64.0
-1.00	2	2.7	2.7	66.7
.00	1	1.3	1.3	68.0
1.00	1	1.3	1.3	69.3
2.00	3	4.0	4.0	73.3
4.00	2	2.7	2.7	76.0
5.00	2	2.7	2.7	78.7
7.00	1	1.3	1.3	80.0
8.00	2	2.7	2.7	82.7
11.00	1	1.3	1.3	84.0
14.00	1	1.3	1.3	85.3
15.00	1	1.3	1.3	86.7
16.00	1	1.3	1.3	88.0
20.00	1	1.3	1.3	89.3
22.00	1	1.3	1.3	90.7
24.00	3	4.0	4.0	94.7
36.00	1	1.3	1.3	96.0
38.00	1	1.3	1.3	97.3
45.00	1	1.3	1.3	98.7
57.00	1	1.3	1.3	100.0
Total	75	100.0	100.0	

HR change from pre shot to 5 min after

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-73.00	1	1.3	1.4	1.4
	-52.00	1	1.3	1.4	2.7
	-50.00	1	1.3	1.4	4.1
	-48.00	1	1.3	1.4	5.4
	-37.00	1	1.3	1.4	6.8
	-36.00	1	1.3	1.4	8.1
	-31.00	1	1.3	1.4	9.5
	-23.00	2	2.7	2.7	12.2
	-21.00	1	1.3	1.4	13.5
	-20.00	2	2.7	2.7	16.2
	-16.00	2	2.7	2.7	18.9
	-15.00	1	1.3	1.4	20.3
	-13.00	1	1.3	1.4	21.6
	-11.00	2	2.7	2.7	24.3
	-9.00	3	4.0	4.1	28.4
	-7.00	1	1.3	1.4	29.7
	-6.00	1	1.3	1.4	31.1
	-5.00	3	4.0	4.1	35.1
	-3.00	1	1.3	1.4	36.5
	-2.00	3	4.0	4.1	40.5
	-1.00	3	4.0	4.1	44.6
	.00	1	1.3	1.4	45.9
	1.00	1	1.3	1.4	47.3
	2.00	2	2.7	2.7	50.0
	3.00	6	8.0	8.1	58.1
	4.00	1	1.3	1.4	59.5
	7.00	1	1.3	1.4	60.8

HR change from pre shot to 5 min after

		Frequency	Percent	Valid Percent	Cumulative Percent
	8.00	3	4.0	4.1	64.9
	9.00	1	1.3	1.4	66.2
	10.00	1	1.3	1.4	67.6
	11.00	2	2.7	2.7	70.3
	12.00	4	5.3	5.4	75.7
	14.00	3	4.0	4.1	79.7
	15.00	1	1.3	1.4	81.1
	16.00	1	1.3	1.4	82.4
	19.00	1	1.3	1.4	83.8
	20.00	2	2.7	2.7	86.5
	21.00	1	1.3	1.4	87.8
	22.00	1	1.3	1.4	89.2
	24.00	2	2.7	2.7	91.9
	31.00	1	1.3	1.4	93.2
	36.00	2	2.7	2.7	95.9
	46.00	1	1.3	1.4	97.3
	48.00	2	2.7	2.7	100.0
	Total	74	98.7	100.0	
Missing	System	1	1.3		
Total		75	100.0		

Rating on the Wong Baker Pain Scale

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No pain	11	14.7	15.7	15.7
	Hurts little bit	4	5.3	5.7	21.4
	Hurts little more	2	2.7	2.9	24.3
	Hurts even more	6	8.0	8.6	32.9
	Hurts whole lot	11	14.7	15.7	48.6
	Hurts worst	36	48.0	51.4	100.0
	Total	70	93.3	100.0	
Missing	System	5	6.7		
Total		75	100.0		

Nurse

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	16	21.3	21.3	21.3
	2	26	34.7	34.7	56.0
	3	1	1.3	1.3	57.3
	4	4	5.3	5.3	62.7
	11	6	8.0	8.0	70.7
	12	8	10.7	10.7	81.3
	13	9	12.0	12.0	93.3
	14	1	1.3	1.3	94.7
	15	2	2.7	2.7	97.3
	16	1	1.3	1.3	98.7
	17	1	1.3	1.3	100.0
	Total	75	100.0	100.0	

How upset was this child after getting the shot?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	19	25.3	25.7	25.7
	2	18	24.0	24.3	50.0
	3	17	22.7	23.0	73.0
	4	7	9.3	9.5	82.4
	5	9	12.0	12.2	94.6
	Very much	4	5.3	5.4	100.0
	Total	74	98.7	100.0	
Missing	System	1	1.3		
Total		75	100.0		

How hard was this child crying during the shot?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	18	24.0	24.3	24.3
	2	13	17.3	17.6	41.9
	3	12	16.0	16.2	58.1
	4	15	20.0	20.3	78.4
	5	9	12.0	12.2	90.5
	Very much	7	9.3	9.5	100.0
	Total	74	98.7	100.0	
Missing	System	1	1.3		
Total		75	100.0		

Compared to other children, what was this child's pain reaction like?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	20	26.7	27.0	27.0
	2	13	17.3	17.6	44.6
	3	18	24.0	24.3	68.9
	4	16	21.3	21.6	90.5
	5	2	2.7	2.7	93.2
	Very much	5	6.7	6.8	100.0
	Total	74	98.7	100.0	
Missing	System	1	1.3		
Total		75	100.0		

How afraid was this child during the shot?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	15	20.0	20.3	20.3
	2	18	24.0	24.3	44.6
	3	10	13.3	13.5	58.1
	4	18	24.0	24.3	82.4
	5	5	6.7	6.8	89.2
	Very much	8	10.7	10.8	100.0
	Total	74	98.7	100.0	
Missing	System	1	1.3		
Total		75	100.0		

How much did the art-light picture distract this child?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	12	16.0	26.1	26.1
	2	11	14.7	23.9	50.0
	3	6	8.0	13.0	63.0
	4	3	4.0	6.5	69.6
	5	9	12.0	19.6	89.1
	Very much	5	6.7	10.9	100.0
	Total	46	61.3	100.0	
Missing	System	29	38.7		
Total		75	100.0		

How upset was your child after getting the shot?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	9	12.0	12.0	12.0
	2	11	14.7	14.7	26.7
	3	10	13.3	13.3	40.0
	4	16	21.3	21.3	61.3
	5	12	16.0	16.0	77.3
	Very much	17	22.7	22.7	100.0
	Total	75	100.0	100.0	

Compared to other painful things that have happened to your child, how painful was this shot?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	6	8.0	8.0	8.0
	2	16	21.3	21.3	29.3
	3	12	16.0	16.0	45.3
	4	13	17.3	17.3	62.7
	5	13	17.3	17.3	80.0
	Very much	15	20.0	20.0	100.0
	Total	75	100.0	100.0	

How hard was your child crying during the shot?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	16	21.3	21.3	21.3
	2	10	13.3	13.3	34.7
	3	11	14.7	14.7	49.3
	4	11	14.7	14.7	64.0
	5	9	12.0	12.0	76.0
	Very much	18	24.0	24.0	100.0
	Total	75	100.0	100.0	

How strongly did you have to hold your child?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	13	17.3	17.3	17.3
	2	16	21.3	21.3	38.7
	3	17	22.7	22.7	61.3
	4	8	10.7	10.7	72.0
	5	7	9.3	9.3	81.3
	Very much	14	18.7	18.7	100.0
	Total	75	100.0	100.0	

In the past when your child had a shot, did your child have any bad experiences because of the shot?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not applicable	60	80.0	81.1	81.1
	Not at all	14	18.7	18.9	100.0
	Total	74	98.7	100.0	
Missing	System	1	1.3		
Total		75	100.0		

How much did the art-light picture distract your child?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not applicable	1	1.3	2.0	2.0
	Not at all	15	20.0	29.4	31.4
	2	9	12.0	17.6	49.0
	3	5	6.7	9.8	58.8
	4	10	13.3	19.6	78.4
	5	5	6.7	9.8	88.2
	Very much	6	8.0	11.8	100.0
	Total	51	68.0	100.0	
Missing	System	24	32.0		
Total		75	100.0		

```
CORRELATIONS
  /VARIABLES=  numshots condition
  /PRINT=TWOTAIL NOSIG
  /MISSING=PAIRWISE.
```

Correlations

```
[DataSet1] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Final_Data_SPSS.sav
```

Correlations

		Number of shots	Condition
Number of shots	Pearson Correlation	1	-.045
	Sig. (2-tailed)		.698
	N	75	75
Condition	Pearson Correlation	-.045	1
	Sig. (2-tailed)	.698	
	N	75	75

```
GLM Hrbefore HRafter HR5min BY condition WITH Age
/WSFACTOR=Time 3 Polynomial
/MEASURE=HR
/CONTRAST(condition)=Simple(1)
/METHOD=SSTYPE(3)
/SAVE=ZRESID
/PLOT=PROFILE(Time*condition)
/EMMEANS=TABLES(Time) WITH(Age=MEAN)
/EMMEANS=TABLES(condition*Time) WITH(Age=
/PRINT=DESCRIPTIVE ETASQ TEST(MMATRIX)
/CRITERIA=ALPHA(.05)
/WSDESIGN=Time
/DESIGN=Age condition.
```

General Linear Model

```
[DataSet1] C:\Users\clements\Dropbox\
```

Within-Subjects Factors

Measure: HR

Time	Dependent Variable
1	Hrbefore
2	HRafter
3	HR5min

Between-Subjects Factors

		Value Label	N
Condition	1	Control	25
	2	Movie	26
	3	Picture	23

Descriptive Statistics

	Condition	Mean	Std. Deviation	N
Heart rate before shots	Control	102.80	19.253	25
	Movie	100.50	14.687	26
	Picture	94.78	16.240	23
	Total	99.50	16.921	74
Heart rate immediately after shots	Control	114.16	24.688	25
	Movie	114.15	24.989	26
	Picture	108.52	23.300	23
	Total	112.41	24.181	74
Heart rate five minutes after shots	Control	96.16	17.630	25
	Movie	102.15	20.501	26
	Picture	101.52	14.860	23
	Total	99.93	17.891	74

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Time	Pillai's Trace	.144	5.826[b]	2.000	69.000	.005	.144
	Wilks' Lambda	.856	5.826[b]	2.000	69.000	.005	.144
	Hotelling's Trace	.169	5.826[b]	2.000	69.000	.005	.144
	Roy's Largest Root	.169	5.826[b]	2.000	69.000	.005	.144
Time * Age	Pillai's Trace	.097	3.693[b]	2.000	69.000	.030	.097
	Wilks' Lambda	.903	3.693[b]	2.000	69.000	.030	.097
	Hotelling's Trace	.107	3.693[b]	2.000	69.000	.030	.097
	Roy's Largest Root	.107	3.693[b]	2.000	69.000	.030	.097
Time * condition	Pillai's Trace	.063	1.144	4.000	140.000	.339	.032
	Wilks' Lambda	.937	1.144[b]	4.000	138.000	.338	.032
	Hotelling's Trace	.067	1.145	4.000	136.000	.338	.033
	Roy's Largest Root	.066	2.294[c]	2.000	70.000	.108	.062

a. Design: Intercept + Age + condition
Within Subjects Design: Time

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Mauchly's Test of Sphericity[a]

Measure: HR

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	.956	3.129	2	.209	.958	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + Age + condition
Within Subjects Design: Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: HR

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	3401.978	2	1700.989	6.221	.003	.082
	Greenhouse-Geisser	3401.978	1.915	1776.396	6.221	.003	.082
	Huynh-Feldt	3401.978	2.000	1700.989	6.221	.003	.082
	Lower-bound	3401.978	1.000	3401.978	6.221	.015	.082
Time * Age	Sphericity Assumed	2153.689	2	1076.845	3.938	.022	.053
	Greenhouse-Geisser	2153.689	1.915	1124.583	3.938	.023	.053
	Huynh-Feldt	2153.689	2.000	1076.845	3.938	.022	.053
	Lower-bound	2153.689	1.000	2153.689	3.938	.051	.053
Time * condition	Sphericity Assumed	1234.183	4	308.546	1.128	.346	.031
	Greenhouse-Geisser	1234.183	3.830	322.224	1.128	.345	.031
	Huynh-Feldt	1234.183	4.000	308.546	1.128	.346	.031
	Lower-bound	1234.183	2.000	617.092	1.128	.329	.031

Tests of Within-Subjects Effects

Measure: HR

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Error(Time)	Sphericity Assumed	38278.364	140	273.417			
	Greenhouse-Geisser	38278.364	134.057	285.538			
	Huynh-Feldt	38278.364	140.000	273.417			
	Lower-bound	38278.364	70.000	546.834			

Tests of Within-Subjects Contrasts

Measure: HR

Source	Time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Linear	9.434	1	9.434	.039	.844	.001
	Quadratic	3392.545	1	3392.545	11.163	.001	.138
Time * Age	Linear	6.767	1	6.767	.028	.868	.000
	Quadratic	2146.922	1	2146.922	7.064	.010	.092
Time * condition	Linear	1108.069	2	554.034	2.281	.110	.061
	Quadratic	126.114	2	63.057	.207	.813	.006
Error(Time)	Linear	17004.273	70	242.918			
	Quadratic	21274.091	70	303.916			

Tests of Between-Subjects Effects

Measure: HR

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	79872.031	1	79872.031	139.400	.000	.666
Age	4557.519	1	4557.519	7.954	.006	.102
condition	155.556	2	77.778	.136	.873	.004
Error	40107.809	70	572.969			

Transformation Coefficients (M Matrix)

Average

Measure: HR

Transformed Variable: AVERAGE

Heart rate before shots	.577
Heart rate immediately after shots	.577
Heart rate five minutes after shots	.577

Time[a]

Measure: HR

	Time	
Dependent Variable	Linear	Quadratic
Heart rate before shots	-.707	.408
Heart rate immediately after shots	.000	-.816
Heart rate five minutes after shots	.707	.408

a. The contrasts for the within subjects factors are:
Time: Polynomial contrast

Custom Hypothesis Tests

Transformation Coefficients (M Matrix)

Measure: HR

Transformed Variable: AVERAGE

Heart rate before shots	.333
Heart rate immediately after shots	.333
Heart rate five minutes after shots	.333

Contrast Results (K Matrix)

Condition Simple Contrast[a]			Averaged Variable HR
Level 2 vs. Level 1	Contrast Estimate		-.012
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-.012
	Std. Error		3.896
	Sig.		.997
	95% Confidence Interval for Difference	Lower Bound	-7.783
		Upper Bound	7.758
Level 3 vs. Level 1	Contrast Estimate		-1.837
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-1.837
	Std. Error		4.006
	Sig.		.648
	95% Confidence Interval for Difference	Lower Bound	-9.828
		Upper Bound	6.153

a. Reference category = 1

Test Results

Measure: HR

Transformed Variable: AVERAGE

Source	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	51.852	2	25.926	.136	.873	.004
Error	13369.270	70	190.990			

Estimated Marginal Means

1. Time

Transformation Coefficients (M Matrix)

Measure: HR

Dependent Variable	Time		
	1	2	3
Heart rate before shots	1	0	0
Heart rate immediately after shots	0	1	0
Heart rate five minutes after shots	0	0	1

Estimates

Measure: HR

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	99.381[a]	1.956	95.481	103.282
2	112.364[a]	2.650	107.078	117.649
3	99.970[a]	2.080	95.822	104.117

a. Covariates appearing in the model are evaluated at the following values: Age = 4.459.

2. Condition * Time

Transformation Coefficients (M Matrix)

Measure: HR

Dependent Variable	Time		
	1	2	3
Heart rate before shots	1	0	0
Heart rate immediately after shots	0	1	0
Heart rate five minutes after shots	0	0	1

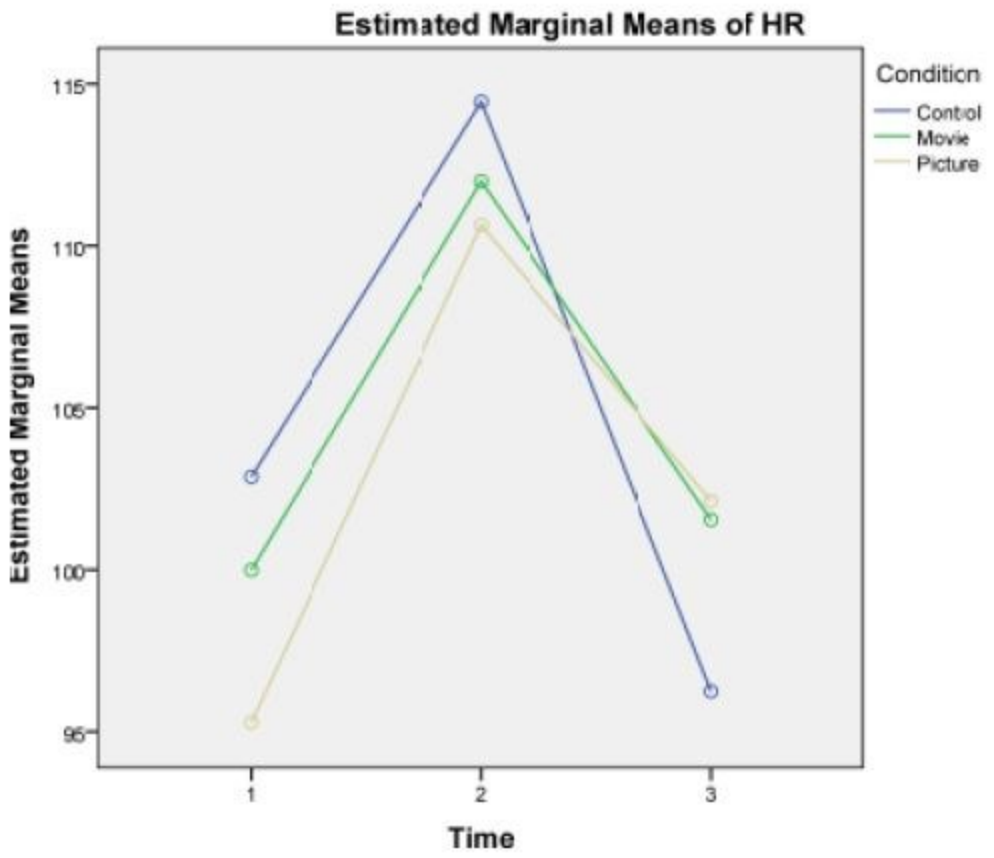
Estimates

Measure: HR

Condition	Time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control	1	102.869[a]	3.361	96.166	109.572
	2	114.452[a]	4.554	105.369	123.535
	3	96.243[a]	3.574	89.115	103.371
Movie	1	99.989[a]	3.328	93.350	106.627
	2	111.999[a]	4.510	103.003	120.994
	3	101.539[a]	3.540	94.480	108.599
Picture	1	95.285[a]	3.534	88.238	102.333
	2	110.641[a]	4.789	101.090	120.191
	3	102.126[a]	3.758	94.631	109.621

a. Covariates appearing in the model are evaluated at the following values: Age = 4.459.

Profile Plots



Covariates appearing in the model are evaluated at the following values: Age = 4.459

```
UNIANOVA  NurseTot BY condition numshots Age
  /RANDOM=Age
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
```

Univariate Analysis of Variance

```
[DataSet1] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Final_Data_SPSS.sav
```

Between-Subjects Factors

		Value Label	N
Condition	1	Control	24
	2	Movie	27
	3	Picture	23
Number of shots	1		12
	2		6
	3		35
	4		16
	5		5
Age	4.0		47
	5.0		21
	6.0		6

Descriptive Statistics

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Condition	Number of shots	Age	Mean	Std. Deviation	N
Control	1	4.0	8.0000	5.65685	2
		6.0	5.0000	1.41421	2
		Total	6.5000	3.78594	4
	2	4.0	15.5000	3.53553	2
		Total	15.5000	3.53553	2
	3	4.0	13.0000	8.31865	6
		5.0	12.5000	4.43471	4
		6.0	5.0000	.	1
		Total	12.0909	6.78903	11
	4	4.0	14.2000	1.92354	5
		Total	14.2000	1.92354	5

Descriptive Statistics

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Condition	Number of shots	Age	Mean	Std. Deviation	N
	5	4.0	16.0000	.	1
		5.0	8.0000	.	1
		Total	12.0000	5.65685	2
	Total	4.0	13.2500	5.67450	16
		5.0	11.6000	4.33590	5
		6.0	5.0000	1.00000	3
		Total	11.8750	5.64387	24
Movie	1	4.0	9.0000	.	1
		5.0	4.0000	.	1
		Total	6.5000	3.53553	2
	2	4.0	10.0000	2.82843	2
		5.0	6.0000	.	1
		Total	8.6667	3.05505	3
	3	4.0	15.2308	4.78111	13
		5.0	9.2500	4.78714	4
		Total	13.8235	5.31784	17
	4	4.0	10.0000	2.82843	2
		5.0	9.0000	2.82843	2
		Total	9.5000	2.38048	4
	5	4.0	15.0000	.	1
		Total	15.0000	.	1
	Total	4.0	13.7895	4.70908	19
		5.0	8.1250	3.87068	8
		Total	12.1111	5.13160	27
Picture	1	4.0	19.0000	.	1
		5.0	9.6667	8.96289	3

Descriptive Statistics

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Condition	Number of shots	Age	Mean	Std. Deviation	N
		6.0	6.5000	3.53553	2
		Total	10.1667	7.46771	6
	2	6.0	4.0000	.	1
		Total	4.0000	.	1
	3	4.0	12.1667	7.13909	6
		5.0	13.0000	.	1
		Total	12.2857	6.52468	7
	4	4.0	10.2500	5.67891	4
		5.0	8.6667	4.72582	3
		Total	9.5714	4.92805	7
	5	4.0	13.0000	.	1
		5.0	17.0000	.	1
		Total	15.0000	2.82843	2
	Total	4.0	12.1667	6.13238	12
		5.0	10.6250	6.16297	8
		6.0	5.6667	2.88675	3
		Total	10.7826	6.02236	23
Total	1	4.0	11.0000	6.27163	4
		5.0	8.2500	7.84750	4
		6.0	5.7500	2.36291	4
		Total	8.3333	5.83615	12
	2	4.0	12.7500	4.11299	4
		5.0	6.0000	.	1
		6.0	4.0000	.	1
		Total	10.1667	5.15429	6

Descriptive Statistics

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Condition	Number of shots	Age	Mean	Std. Deviation	N
	3	4.0	13.9600	6.19462	25
		5.0	11.1111	4.37163	9
		6.0	5.0000	.	1
		Total	12.9714	5.92346	35
	4	4.0	12.0000	4.04969	11
		5.0	8.8000	3.63318	5
		Total	11.0000	4.09878	16
	5	4.0	14.6667	1.52753	3
		5.0	12.5000	6.36396	2
		Total	13.8000	3.56371	5
	Total	4.0	13.1915	5.34724	47
		5.0	9.9048	4.94879	21
		6.0	5.3333	1.96638	6
		Total	11.6216	5.53866	74

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Total first 4 items on Nurs

F	df1	df2	Sig.
2.155	27	46	.011

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + condition + numshots + Age + condition * numshots + condition * Age + numshots * Age + condition * numshots * Age

Tests of Between-Subjects Effects

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	Hypothesis	2714.066	1	2714.066	25.776	.037	.928
	Error	210.220	1.997	105.293[a]			
condition	Hypothesis	31.184	2	15.592	1.080	.558	.677
	Error	14.884	1.031	14.434[b]			
numshots	Hypothesis	55.554	4	13.888	1.475	.466	.777
	Error	15.911	1.690	9.417[c]			
Age	Hypothesis	192.362	2	96.181	14.541	.670	.995
	Error	1.006	.152	6.614[d]			
condition * numshots	Hypothesis	154.676	7	22.097	.926	.602	.742
	Error	53.742	2.251	23.875[e]			
condition * Age	Hypothesis	50.655	3	16.885	.687	.618	.410
	Error	73.028	2.973	24.565[f]			
numshots * Age	Hypothesis	60.930	5	12.186	.487	.775	.402
	Error	90.655	3.623	25.024[g]			
condition * numshots * Age	Hypothesis	73.760	3	24.587	.806	.497	.050
	Error	1402.774	46	30.495[h]			

Condition

a. 1.095 MS(Age) + .005 MS(condition * Age) - .134 MS(numshots * Age) - .076 MS(condition * numshots * Age) + .110 MS(Error)

b. 1.347 MS(condition * Age) - .384 MS(condition * numshots * Age) + .037 MS(Error)

c. 1.217 MS(numshots * Age) - .205 MS(condition * numshots * Age) - .012 MS(Error)

d. .957 MS(condition * Age) + .895 MS(numshots * Age) - .936 MS(condition * numshots * Age) + .084 MS(Error)

e. 1.120 MS(condition * numshots * Age) - .120 MS(Error)

f. 1.004 MS(condition * numshots * Age) - .004 MS(Error)

g. .926 MS(condition * numshots * Age) + .074 MS(Error)

h. MS(Error)

Expected Mean Squares[a,b]

Source	Variance Component					
	Var(Age)	Var(condition * Age)	Var(numshots * Age)	Var(condition * numshots * Age)	Var(Error)	Quadratic Term
Intercept	10.189	3.855	2.412	1.365	1.000	Intercept, condition, numshots, condition * numshots
condition	.000	4.929	.000	1.788	1.000	condition, condition * numshots
numshots	.000	.000	3.469	1.704	1.000	numshots, condition * numshots
Age	9.301	3.502	2.551	1.575	1.000	
condition * numshots	.000	.000	.000	2.070	1.000	condition * numshots
condition * Age	.000	3.660	.000	1.854	1.000	
numshots * Age	.000	.000	2.850	1.711	1.000	
condition * numshots * Age	.000	.000	.000	1.847	1.000	
Error	.000	.000	.000	.000	1.000	

a. For each source, the expected mean square equals the sum of the coefficients in the cells times the variance components, plus a quadratic term involving effects in the Quadratic Term cell.

b. Expected Mean Squares are based on the Type III Sums of Squares.

Estimated Marginal Means

1. Condition

Dependent Variable: Total first 4 items on Nurse Survey (higher = mor

Condition	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control	10.800[a]	1.388	8.006	13.594
Movie	9.720[a]	1.481	6.739	12.701
Picture	11.325[a]	1.417	8.473	14.177

a. Based on modified population marginal mean.

2. Number of shots

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distre

Number of shots	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	8.738[a]	1.734	5.247	12.229
2	8.875[a]	2.391	4.062	13.688
3	11.450[a]	1.346	8.741	14.159
4	10.423[a]	1.475	7.455	13.392
5	13.800[a]	2.470	8.829	18.771

a. Based on modified population marginal mean.

3. Age

Dependent Variable: Total first 4 items on Nurse Survey (higher =

Age	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
4.0	12.882[a]	1.106	10.656	15.108
5.0	9.708[a]	1.426	6.838	12.578
6.0	5.125[a]	2.391	.312	9.938

a. Based on modified population marginal mean.

4. Condition * Number of shots

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Condition	Number of shots	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control	1	6.500[a]	2.761	.942	12.058
	2	15.500[a]	3.905	7.640	23.360
	3	10.167	2.191	5.757	14.577
	4	14.200[a]	2.470	9.229	19.171
	5	12.000[a]	3.905	4.140	19.860
Movie	1	6.500[a]	3.905	-1.360	14.360
	2	8.000[a]	3.382	1.193	14.807
	3	12.240[a]	1.579	9.063	15.418
	4	9.500[a]	2.761	3.942	15.058
	5	15.000[a]	5.522	3.884	26.116
Picture	1	11.722	2.492	6.705	16.739
	2	4.000[a]	5.522	-7.116	15.116
	3	12.583[a]	2.982	6.580	18.586
	4	9.458[a]	2.109	5.213	13.703
	5	15.000[a]	3.905	7.140	22.860

a. Based on modified population marginal mean.

5. Condition * Age

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distres

Condition	Age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control	4.0	13.340	1.699	9.920	16.760
	5.0	10.250[a]	3.087	4.036	16.464
	6.0	5.000[a]	3.382	-1.807	11.807
Movie	4.0	11.846	1.937	7.947	15.746
	5.0	7.063[a]	2.289	2.454	11.671
	6.0	.[b]	.	.	.
Picture	4.0	13.604[a]	2.146	9.284	17.924
	5.0	12.083[a]	2.254	7.545	16.621
	6.0	5.250[a]	3.382	-1.557	12.057

a. Based on modified population marginal mean.

b. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

6. Number of shots * Age

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Number of shots	Age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	4.0	12.000	2.910	6.142	17.858
	5.0	6.833[a]	3.188	.416	13.251
	6.0	5.750[a]	2.761	.192	11.308
2	4.0	12.750[a]	2.761	7.192	18.308
	5.0	6.000[a]	5.522	-5.116	17.116
	6.0	4.000[a]	5.522	-7.116	15.116
3	4.0	13.466	1.179	11.093	15.839
	5.0	11.583	2.254	7.045	16.121
	6.0	5.000[a]	5.522	-6.116	16.116
4	4.0	11.483	1.794	7.872	15.095
	5.0	8.833[a]	2.521	3.760	13.907
	6.0	.[b]	.	.	.
5	4.0	14.667	3.188	8.249	21.084
	5.0	12.500[a]	3.905	4.640	20.360
	6.0	.[b]	.	.	.

a. Based on modified population marginal mean.

b. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

7. Condition * Number of shots * Age

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Condition	Number of shots	Age	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Control	1	4.0	8.000	3.905	.140	15.860
		5.0	.[a]	.	.	.
		6.0	5.000	3.905	-2.860	12.860
	2	4.0	15.500	3.905	7.640	23.360
		5.0	.[a]	.	.	.
		6.0	.[a]	.	.	.
	3	4.0	13.000	2.254	8.462	17.538
		5.0	12.500	2.761	6.942	18.058
		6.0	5.000	5.522	-6.116	16.116
	4	4.0	14.200	2.470	9.229	19.171
		5.0	.[a]	.	.	.
		6.0	.[a]	.	.	.
	5	4.0	16.000	5.522	4.884	27.116
		5.0	8.000	5.522	-3.116	19.116
		6.0	.[a]	.	.	.
Movie	1	4.0	9.000	5.522	-2.116	20.116
		5.0	4.000	5.522	-7.116	15.116
		6.0	.[a]	.	.	.
	2	4.0	10.000	3.905	2.140	17.860
		5.0	6.000	5.522	-5.116	17.116
		6.0	.[a]	.	.	.
	3	4.0	15.231	1.532	12.148	18.314
		5.0	9.250	2.761	3.692	14.808
		6.0	.[a]	.	.	.

7. Condition * Number of shots * Age

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Condition	Number of shots	Age	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
	4	4.0	10.000	3.905	2.140	17.860
		5.0	9.000	3.905	1.140	16.860
		6.0	.[a]	.	.	.
	5	4.0	15.000	5.522	3.884	26.116
		5.0	.[a]	.	.	.
		6.0	.[a]	.	.	.
Picture	1	4.0	19.000	5.522	7.884	30.116
		5.0	9.667	3.188	3.249	16.084
		6.0	6.500	3.905	-1.360	14.360
	2	4.0	.[a]	.	.	.
		5.0	.[a]	.	.	.
		6.0	4.000	5.522	-7.116	15.116
	3	4.0	12.167	2.254	7.629	16.705
		5.0	13.000	5.522	1.884	24.116
		6.0	.[a]	.	.	.
	4	4.0	10.250	2.761	4.692	15.808
		5.0	8.667	3.188	2.249	15.084
		6.0	.[a]	.	.	.
	5	4.0	13.000	5.522	1.884	24.116
		5.0	17.000	5.522	5.884	28.116
		6.0	.[a]	.	.	.

a. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

Post Hoc Tests

Condition

Multiple Comparisons

Dependent Variable: Total first 4 items on Nurse Survey (higher = more distress)

Tukey HSD

(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control	Movie	-.2361	1.54922	.987	-3.9881	3.5158
	Picture	1.0924	1.61137	.777	-2.8101	4.9948
Movie	Control	.2361	1.54922	.987	-3.5158	3.9881
	Picture	1.3285	1.56695	.675	-2.4664	5.1234
Picture	Control	-1.0924	1.61137	.777	-4.9948	2.8101
	Movie	-1.3285	1.56695	.675	-5.1234	2.4664

Based on observed means.
The error term is Mean Square(Error) = 30.495.

Homogeneous Subsets

Total first 4 items on Nurse Survey (higher = more distress)

Tukey HSD[a,b,c]

Condition	N	Subset 1
Picture	23	10.7826
Control	24	11.8750
Movie	27	12.1111
Sig.		.679

Means for groups in homogeneous subsets are displayed.
Based on observed means.
The error term is Mean Square (Error) = 30.495.

a. Uses Harmonic Mean Sample Size = 24.554.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

Univariate Analysis of Variance

[DataSet1] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Final_Data_SPSS.sav

Between-Subjects Factors

		Value Label	N
Condition	1	Control	25
	2	Movie	27
	3	Picture	23
Number of shots	1		12
	2		6
	3		35
	4		16
	5		6
Age	4.0		47
	5.0		22
	6.0		6

Descriptive Statistics

Dependent Variable: Total first four items on Parent Survey (higher = more distres

Condition	Number of shots	Age	Mean	Std. Deviation	N
Control	1	4.0	12.0000	1.41421	2
		6.0	6.0000	1.41421	2
		Total	9.0000	3.65148	4
	2	4.0	20.0000	4.24264	2
		Total	20.0000	4.24264	2
	3	4.0	15.1667	7.08284	6
		5.0	16.2500	3.20156	4
		6.0	7.0000	.	1
		Total	14.8182	5.92989	11
	4	4.0	18.0000	3.00000	5
		Total	18.0000	3.00000	5
	5	4.0	19.0000	.	1
		5.0	15.5000	6.36396	2
		Total	16.6667	4.93288	3
	Total	4.0	16.5000	5.16398	16
		5.0	16.0000	3.79473	6
		6.0	6.3333	1.15470	3
		Total	15.1600	5.55788	25
Movie	1	4.0	5.0000	.	1
		5.0	4.0000	.	1
		Total	4.5000	.70711	2
	2	4.0	17.0000	4.24264	2
		5.0	18.0000	.	1
		Total	17.3333	3.05505	3

Descriptive Statistics

Dependent Variable: Total first four items on Parent Survey (higher = more distres

Condition	Number of shots	Age	Mean	Std. Deviation	N
	3	4.0	17.2308	5.21462	13
		5.0	12.0000	3.55903	4
		Total	16.0000	5.29150	17
	4	4.0	12.5000	7.77817	2
		5.0	19.5000	.70711	2
		Total	16.0000	6.05530	4
	5	4.0	23.0000	.	1
		Total	23.0000	.	1
	Total	4.0	16.3684	5.86146	19
		5.0	13.6250	5.73056	8
		Total	15.5556	5.85290	27
Picture	1	4.0	16.0000	.	1
		5.0	11.0000	5.29150	3
		6.0	6.0000	1.41421	2
		Total	10.1667	5.07609	6
	2	6.0	4.0000	.	1
		Total	4.0000	.	1
	3	4.0	14.3333	3.66970	6
		5.0	16.0000	.	1
		Total	14.5714	3.40867	7
	4	4.0	11.7500	5.37742	4
		5.0	9.0000	7.81025	3
		Total	10.5714	6.07885	7
	5	4.0	17.0000	.	1
		5.0	24.0000	.	1
		Total	20.5000	4.94975	2

Descriptive Statistics

Dependent Variable: Total first four items on Parent Survey (higher = more distres

Condition	Number of shots	Age	Mean	Std. Deviation	N
	Total	4.0	13.8333	4.13045	12
		5.0	12.5000	7.23089	8
		6.0	5.3333	1.52753	3
		Total	12.2609	5.76996	23
Total	1	4.0	11.2500	4.64579	4
		5.0	9.2500	5.56028	4
		6.0	6.0000	1.15470	4
		Total	8.8333	4.44836	12
	2	4.0	18.5000	3.87298	4
		5.0	18.0000	.	1
		6.0	4.0000	.	1
		Total	16.0000	6.60303	6
	3	4.0	16.0400	5.34228	25
		5.0	14.3333	3.67423	9
		6.0	7.0000	.	1
		Total	15.3429	5.09869	35
	4	4.0	14.7273	5.31208	11
		5.0	13.2000	7.98123	5
		Total	14.2500	6.02771	16
	5	4.0	19.6667	3.05505	3
		5.0	18.3333	6.65833	3
		Total	19.0000	4.69042	6
	Total	4.0	15.7660	5.24700	47
		5.0	13.8636	5.81701	22
		6.0	5.8333	1.32916	6
		Total	14.4133	5.83580	75

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Total first four items on P

F	df1	df2	Sig.
1.757	27	47	.044

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + condition + numshots + Age + condition * numshots + condition * Age + numshots * Age + condition * numshots * Age

Tests of Between-Subjects Effects

Dependent Variable: Total first four items on Parent Survey (higher = more distress)

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	Hypothesis	5305.293	1	5305.293	64.824	.018	.972
	Error	154.030	1.882	81.841[a]			
condition	Hypothesis	4.934	2	.	.	.	.
	Error	.	.[b]	.			
numshots	Hypothesis	324.670	4	.	.	.	.
	Error	.	.[b]	.			
Age	Hypothesis	154.297	2	.	.	.	.
	Error	.	.[b]	.			
condition * numshots	Hypothesis	260.372	7	37.196	.691	.694	.640
	Error	146.342	2.717	53.857[c]			
condition * Age	Hypothesis	16.478	3	5.493	.108	.950	.098
	Error	152.442	2.984	51.089[d]			

Tests of Between-Subjects Effects

Dependent Variable: Total first four items on Parent Survey (higher = more distress)

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
numshots * Age	Hypothesis	37.312	5	7.462	.153	.966	.190
	Error	159.512	3.275	48.705[e]			
condition * numshots * Age	Hypothesis	152.824	3	50.941	2.069	.117	.117
	Error	1157.474	47	24.627[f]			

a. 1.093 MS(Age) + .012 MS(condition * Age) - .124 MS(numshots * Age) - .079 MS(condition * numshots * Age) + .099 MS(Error)

b. Cannot compute the error degrees of freedom using Satterthwaite's method.

c. 1.111 MS(condition * numshots * Age) - .111 MS(Error)

d. 1.006 MS(condition * numshots * Age) - .006 MS(Error)

e. .915 MS(condition * numshots * Age) + .085 MS(Error)

f. MS(Error)

Expected Mean Squares[a,b]

Source	Variance Component					
	Var(Age)	Var(condition * Age)	Var(numshots * Age)	Var(condition * numshots * Age)	Var(Error)	Quadratic Term
Intercept	10.777	4.078	2.552	1.443	1.000	Intercept, condition, numshots, condition * numshots
condition	.000	5.097	.000	1.865	1.000	condition, condition * numshots
numshots	.000	.000	3.529	1.728	1.000	numshots, condition * numshots
Age	9.863	3.692	2.667	1.637	1.000	
condition * numshots	.000	.000	.000	2.112	1.000	condition * numshots
condition * Age	.000	3.770	.000	1.912	1.000	
numshots * Age	.000	.000	2.917	1.740	1.000	
condition * numshots * Age	.000	.000	.000	1.902	1.000	
Error	.000	.000	.000	.000	1.000	

a. For each source, the expected mean square equals the sum of the coefficients in the cells times the variance components, plus a quadratic term involving effects in the Quadratic Term cell.

b. Expected Mean Squares are based on the Type III Sums of Squares.

Estimated Marginal Means

1. Condition

Dependent Variable: Total first four items on Parent Survey (higher = r

Condition	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control	14.324[a]	1.185	11.941	16.707
Movie	14.248[a]	1.331	11.570	16.926
Picture	12.908[a]	1.273	10.347	15.470

a. Based on modified population marginal mean.

2. Number of shots

Dependent Variable: Total first four items on Parent Survey (higher = more di

Number of shots	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	8.571[a]	1.559	5.436	11.707
2	14.750[a]	2.149	10.427	19.073
3	13.997[a]	1.209	11.564	16.430
4	14.150[a]	1.325	11.484	16.816
5	19.700[a]	2.105	15.464	23.936

a. Based on modified population marginal mean.

3. Age

Dependent Variable: Total first four items on Parent Survey (highe

Age	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
4.0	15.570[a]	.994	13.571	17.569
5.0	14.525[a]	1.232	12.046	17.004
6.0	5.750[a]	2.149	1.427	10.073

a. Based on modified population marginal mean.

4. Condition * Number of shots

Dependent Variable: Total first four items on Parent Survey (higher = more distress)

Condition	Number of shots	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control	1	9.000[a]	2.481	4.008	13.992
	2	20.000[a]	3.509	12.941	27.059
	3	12.806	1.969	8.845	16.766
	4	18.000[a]	2.219	13.535	22.465
	5	17.250[a]	3.039	11.136	23.364
Movie	1	4.500[a]	3.509	-2.559	11.559
	2	17.500[a]	3.039	11.386	23.614
	3	14.615[a]	1.419	11.761	17.469
	4	16.000[a]	2.481	11.008	20.992
	5	23.000[a]	4.963	13.017	32.983
Picture	1	11.000	2.240	6.494	15.506
	2	4.000[a]	4.963	-5.983	13.983
	3	15.167[a]	2.680	9.775	20.558
	4	10.375[a]	1.895	6.563	14.187
	5	20.500[a]	3.509	13.441	27.559

a. Based on modified population marginal mean.

5. Condition * Age

Dependent Variable: Total first four items on Parent Survey (higher = more dist

Condition	Age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control	4.0	16.833	1.527	13.762	19.905
	5.0	15.875[a]	2.149	11.552	20.198
	6.0	6.500[a]	3.039	.386	12.614
Movie	4.0	14.946	1.741	11.444	18.449
	5.0	13.375[a]	2.057	9.236	17.514
	6.0	.[b]	.	.	.
Picture	4.0	14.771[a]	1.929	10.891	18.651
	5.0	15.000[a]	2.026	10.924	19.076
	6.0	5.000[a]	3.039	-1.114	11.114

a. Based on modified population marginal mean.

b. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

6. Number of shots * Age

Dependent Variable: Total first four items on Parent Survey (higher = more distress)

Number of shots	Age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	4.0	11.000	2.616	5.738	16.262
	5.0	7.500[a]	2.865	1.736	13.264
	6.0	6.000[a]	2.481	1.008	10.992
2	4.0	18.500[a]	2.481	13.508	23.492
	5.0	18.000[a]	4.963	8.017	27.983
	6.0	4.000[a]	4.963	-5.983	13.983
3	4.0	15.577	1.060	13.445	17.708
	5.0	14.750	2.026	10.674	18.826
	6.0	7.000[a]	4.963	-2.983	16.983
4	4.0	14.083	1.612	10.840	17.327
	5.0	14.250[a]	2.265	9.693	18.807
	6.0	.[b]	.	.	.
5	4.0	19.667	2.865	13.903	25.431
	5.0	19.750[a]	3.039	13.636	25.864
	6.0	.[b]	.	.	.

a. Based on modified population marginal mean.

b. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

7. Condition * Number of shots * Age

Dependent Variable: Total first four items on Parent Survey (higher = more distress)

Condition	Number of shots	Age	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Control	1	4.0	12.000	3.509	4.941	19.059
		5.0	.[a]	.	.	.
		6.0	6.000	3.509	-1.059	13.059
	2	4.0	20.000	3.509	12.941	27.059
		5.0	.[a]	.	.	.
		6.0	.[a]	.	.	.
	3	4.0	15.167	2.026	11.091	19.242
		5.0	16.250	2.481	11.258	21.242
		6.0	7.000	4.963	-2.983	16.983
	4	4.0	18.000	2.219	13.535	22.465
		5.0	.[a]	.	.	.
		6.0	.[a]	.	.	.
	5	4.0	19.000	4.963	9.017	28.983
		5.0	15.500	3.509	8.441	22.559
		6.0	.[a]	.	.	.
Movie	1	4.0	5.000	4.963	-4.983	14.983
		5.0	4.000	4.963	-5.983	13.983
		6.0	.[a]	.	.	.
	2	4.0	17.000	3.509	9.941	24.059
		5.0	18.000	4.963	8.017	27.983
		6.0	.[a]	.	.	.
	3	4.0	17.231	1.376	14.462	20.000
		5.0	12.000	2.481	7.008	16.992
		6.0	.[a]	.	.	.

7. Condition * Number of shots * Age

Dependent Variable: Total first four items on Parent Survey (higher = more distress)

Condition	Number of shots	Age	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
	4	4.0	12.500	3.509	5.441	19.559
		5.0	19.500	3.509	12.441	26.559
		6.0	.[a]	.	.	.
	5	4.0	23.000	4.963	13.017	32.983
		5.0	.[a]	.	.	.
		6.0	.[a]	.	.	.
Picture	1	4.0	16.000	4.963	6.017	25.983
		5.0	11.000	2.865	5.236	16.764
		6.0	6.000	3.509	-1.059	13.059
	2	4.0	.[a]	.	.	.
		5.0	.[a]	.	.	.
		6.0	4.000	4.963	-5.983	13.983
	3	4.0	14.333	2.026	10.258	18.409
		5.0	16.000	4.963	6.017	25.983
		6.0	.[a]	.	.	.
	4	4.0	11.750	2.481	6.758	16.742
		5.0	9.000	2.865	3.236	14.764
		6.0	.[a]	.	.	.
	5	4.0	17.000	4.963	7.017	26.983
		5.0	24.000	4.963	14.017	33.983
		6.0	.[a]	.	.	.

a. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

Post Hoc Tests

Condition

Multiple Comparisons

Dependent Variable: Total first four items on Parent Survey (higher = more distress)

Tukey HSD

(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control	Movie	-.3956	1.37739	.956	-3.7290	2.9379
	Picture	2.8991	1.43382	.118	-.5709	6.3691
Movie	Control	.3956	1.37739	.956	-2.9379	3.7290
	Picture	3.2947	1.40814	.060	-.1132	6.7026
Picture	Control	-2.8991	1.43382	.118	-6.3691	.5709
	Movie	-3.2947	1.40814	.060	-6.7026	.1132

Based on observed means.
The error term is Mean Square(Error) = 24.627.

Homogeneous Subsets

Total first four items on Parent Survey (higher = more distress)

Tukey HSD[a,b,c]

Condition	N	Subset 1
Picture	23	12.2609
Control	25	15.1600
Movie	27	15.5556
Sig.		.060

Means for groups in homogeneous subsets are displayed.
Based on observed means.
The error term is Mean Square (Error) = 24.627.

a. Uses Harmonic Mean Sample Size = 24.893.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

Univariate Analysis of Variance

[DataSet1] C:\Users\clements\Dropbox\Research\Dutro Rae\Rae_Dutro_Final_Data_SPSS.sav

Between-Subjects Factors

		Value Label	N
Condition	1	Control	23
	2	Movie	26
	3	Picture	21
Number of shots	1		11
	2		5
	3		33
	4		15
	5		6
Age	4.0		46
	5.0		21
	6.0		3

Descriptive Statistics

Dependent Variable: Rating on the Wong Baker Pain Scale

Condition	Number of shots	Age	Mean	Std. Deviation	N
Control	1	4.0	4.50	.707	2
		6.0	3.00	.	1
		Total	4.00	1.000	3
	2	4.0	5.00	.000	2
		Total	5.00	.000	2
	3	4.0	4.33	.516	6
		5.0	3.25	2.363	4
		Total	3.90	1.524	10
	4	4.0	4.60	.548	5
		Total	4.60	.548	5
	5	4.0	.00	.	1
		5.0	.00	.000	2
		Total	.00	.000	3
	Total	4.0	4.25	1.238	16
		5.0	2.17	2.483	6
		6.0	3.00	.	1
		Total	3.65	1.824	23
Movie	1	4.0	.00	.	1
		5.0	.00	.	1
		Total	.00	.000	2
	2	4.0	5.00	.000	2
		5.0	5.00	.	1
		Total	5.00	.000	3
	3	4.0	4.58	.793	12
		5.0	3.50	2.380	4
		Total	4.31	1.352	16

Descriptive Statistics

Dependent Variable: Rating on the Wong Baker Pain Scale

Condition	Number of shots	Age	Mean	Std. Deviation	N
	4	4.0	1.50	.707	2
		5.0	2.50	3.536	2
		Total	2.00	2.160	4
	5	4.0	.00	.	1
		Total	.00	.	1
	Total	4.0	3.78	1.833	18
		5.0	3.00	2.507	8
		Total	3.54	2.044	26
Picture	1	4.0	5.00	.	1
		5.0	3.33	2.887	3
		6.0	1.00	.000	2
		Total	2.83	2.401	6
	3	4.0	4.50	.837	6
		5.0	4.00	.	1
		Total	4.43	.787	7
	4	4.0	3.50	1.915	4
		5.0	1.00	1.414	2
		Total	2.67	2.066	6
	5	4.0	5.00	.	1
		5.0	5.00	.	1
		Total	5.00	.000	2
	Total	4.0	4.25	1.288	12
		5.0	3.00	2.309	7
		6.0	1.00	.000	2
		Total	3.52	1.887	21

Descriptive Statistics

Dependent Variable: Rating on the Wong Baker Pain Scale

Condition	Number of shots	Age	Mean	Std. Deviation	N
Total	1	4.0	3.50	2.380	4
		5.0	2.50	2.887	4
		6.0	1.67	1.155	3
		Total	2.64	2.248	11
	2	4.0	5.00	.000	4
		5.0	5.00	.	1
		Total	5.00	.000	5
	3	4.0	4.50	.722	24
		5.0	3.44	2.068	9
		Total	4.21	1.293	33
	4	4.0	3.64	1.629	11
		5.0	1.75	2.363	4
		Total	3.13	1.959	15
	5	4.0	1.67	2.887	3
		5.0	1.67	2.887	3
		Total	1.67	2.582	6
	Total	4.0	4.07	1.497	46
		5.0	2.76	2.343	21
		6.0	1.67	1.155	3
		Total	3.57	1.900	70

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Rating on the Wong Bake

F	df1	df2	Sig.
3.715	25	44	.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + condition + numshots + Age + condition * numshots + condition * Age + numshots * Age + condition * numshots * Age

Tests of Between-Subjects Effects

Dependent Variable: Rating on the Wong Baker Pain Scale

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	Hypothesis	243.180	1	243.180	36.279	.030	.950
	Error	12.791	1.908	6.703[a]			
condition	Hypothesis	17.972	2	8.986	5.464	.196	.874
	Error	2.588	1.574	1.645[b]			
numshots	Hypothesis	44.523	4	.	.	.	.
	Error	.	.[c]	.			
Age	Hypothesis	11.681	2	5.840	15.439	.770	.997
	Error	.034	.089	.378[d]			
condition * numshots	Hypothesis	45.701	7	6.529	3.727	.204	.920
	Error	3.965	2.263	1.752[e]			
condition * Age	Hypothesis	5.013	3	1.671	.932	.517	.463
	Error	5.806	3.237	1.793[f]			

Tests of Between-Subjects Effects

Dependent Variable: Rating on the Wong Baker Pain Scale

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
numshots * Age	Hypothesis	1.617	4	.404	.224	.911	.198
	Error	6.544	3.624	1.806[g]			
condition * numshots * Age	Hypothesis	5.355	3	1.785	.874	.462	.056
	Error	89.867	44	2.042[h]			

a. 1.175 MS(Age) - .024 MS(condition * Age) - .100 MS(numshots * Age) - .102 MS(condition * numshots * Age) + .052 MS(Error)

b. 1.309 MS(condition * Age) - .343 MS(condition * numshots * Age) + .035 MS(Error)

c. Cannot compute the error degrees of freedom using Satterthwaite's method.

d. .912 MS(condition * Age) + .945 MS(numshots * Age) - .862 MS(condition * numshots * Age) + .006 MS(Error)

e. 1.129 MS(condition * numshots * Age) - .129 MS(Error)

f. .967 MS(condition * numshots * Age) + .033 MS(Error)

g. .920 MS(condition * numshots * Age) + .080 MS(Error)

h. MS(Error)

Expected Mean Squares[a,b]

Source	Variance Component					
	Var(Age)	Var(condition * Age)	Var(numshots * Age)	Var(condition * numshots * Age)	Var(Error)	Quadratic Term
Intercept	10.578	3.774	3.148	1.525	1.000	Intercept, condition, numshots, condition * numshots
condition	.000	4.718	.000	1.704	1.000	condition, condition * numshots
numshots	.000	.000	4.088	1.824	1.000	numshots, condition * numshots
Age	9.005	3.287	2.945	1.641	1.000	
condition * numshots	.000	.000	.000	2.086	1.000	condition * numshots
condition * Age	.000	3.606	.000	1.787	1.000	
numshots * Age	.000	.000	3.118	1.699	1.000	
condition * numshots * Age	.000	.000	.000	1.847	1.000	
Error	.000	.000	.000	.000	1.000	

a. For each source, the expected mean square equals the sum of the coefficients in the cells times the variance components, plus a quadratic term involving effects in the Quadratic Term cell.

b. Expected Mean Squares are based on the Type III Sums of Squares.

Estimated Marginal Means

1. Condition

Dependent Variable: Rating on the Wong Baker Pain Scale

Condition	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control	3.085[a]	.362	2.355	3.816
Movie	2.454[a]	.384	1.681	3.227
Picture	3.593[a]	.381	2.825	4.360

a. Based on modified population marginal mean.

2. Number of shots

Dependent Variable: Rating on the Wong Baker Pain Scale

Number of shots	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	2.405[a]	.471	1.455	3.355
2	5.000[a]	.674	3.642	6.358
3	4.028[a]	.330	3.363	4.692
4	2.620[a]	.399	1.816	3.424
5	2.000[a]	.606	.778	3.222

a. Based on modified population marginal mean.

3. Age

Dependent Variable: Rating on the Wong Baker Pain Scale

Age	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
4.0	3.394[a]	.286	2.817	3.971
5.0	2.758[a]	.360	2.033	3.483
6.0	2.000[a]	.875	.236	3.764

a. Based on modified population marginal mean.

4. Condition * Number of shots

Dependent Variable: Rating on the Wong Baker Pain Scale

Condition	Number of shots	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control	1	3.750[a]	.875	1.986	5.514
	2	5.000[a]	1.011	2.963	7.037
	3	3.792[a]	.461	2.862	4.721
	4	4.600[a]	.639	3.312	5.888
	5	-1.031E-013[a]	.875	-1.764	1.764
Movie	1	-1.003E-013[a]	1.011	-2.037	2.037
	2	5.000[a]	.875	3.236	6.764
	3	4.042[a]	.413	3.210	4.873
	4	2.000[a]	.715	.560	3.440
	5	1.049E-013[a]	1.429	-2.880	2.880
Picture	1	3.111	.645	1.811	4.411
	2	.[b]	.	.	.
	3	4.250[a]	.772	2.694	5.806
	4	2.250[a]	.619	1.003	3.497
	5	5.000[a]	1.011	2.963	7.037

a. Based on modified population marginal mean.

b. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

5. Condition * Age

Dependent Variable: Rating on the Wong Baker Pain Scale

Condition	Age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control	4.0	3.687	.440	2.800	4.573
	5.0	1.625[a]	.619	.378	2.872
	6.0	3.000[a]	1.429	.120	5.880
Movie	4.0	2.217	.502	1.205	3.228
	5.0	2.750[a]	.592	1.556	3.944
	6.0	.[b]	.	.	.
Picture	4.0	4.500[a]	.555	3.381	5.619
	5.0	3.333[a]	.601	2.121	4.545
	6.0	1.000[a]	1.011	-1.037	3.037

a. Based on modified population marginal mean.

b. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

6. Number of shots * Age

Dependent Variable: Rating on the Wong Baker Pain Scale

Number of shots	Age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	4.0	3.167	.753	1.649	4.685
	5.0	1.667[a]	.825	.004	3.330
	6.0	2.000[a]	.875	.236	3.764
2	4.0	5.000[a]	.715	3.560	6.440
	5.0	5.000[a]	1.429	2.120	7.880
	6.0	.[b]	.	.	.
3	4.0	4.472	.308	3.852	5.092
	5.0	3.583	.583	2.407	4.759
	6.0	.[b]	.	.	.
4	4.0	3.200	.464	2.264	4.136
	5.0	1.750[a]	.715	.310	3.190
	6.0	.[b]	.	.	.
5	4.0	1.667	.825	.004	3.330
	5.0	2.500[a]	.875	.736	4.264
	6.0	.[b]	.	.	.

a. Based on modified population marginal mean.

b. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

7. Condition * Number of shots * Age

Dependent Variable: Rating on the Wong Baker Pain Scale

Condition	Number of shots	Age	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Control	1	4.0	4.500	1.011	2.463	6.537
		5.0	.[a]	.	.	.
		6.0	3.000	1.429	.120	5.880
	2	4.0	5.000	1.011	2.963	7.037
		5.0	.[a]	.	.	.
		6.0	.[a]	.	.	.
	3	4.0	4.333	.583	3.157	5.509
		5.0	3.250	.715	1.810	4.690
		6.0	.[a]	.	.	.
	4	4.0	4.600	.639	3.312	5.888
		5.0	.[a]	.	.	.
		6.0	.[a]	.	.	.
	5	4.0	-1.031E-013	1.429	-2.880	2.880
		5.0	-1.031E-013	1.011	-2.037	2.037
		6.0	.[a]	.	.	.
Movie	1	4.0	1.009E-013	1.429	-2.880	2.880
		5.0	-1.016E-013	1.429	-2.880	2.880
		6.0	.[a]	.	.	.
	2	4.0	5.000	1.011	2.963	7.037
		5.0	5.000	1.429	2.120	7.880
		6.0	.[a]	.	.	.
	3	4.0	4.583	.413	3.752	5.415
		5.0	3.500	.715	2.060	4.940
		6.0	.[a]	.	.	.

7. Condition * Number of shots * Age

Dependent Variable: Rating on the Wong Baker Pain Scale

Condition	Number of shots	Age	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
	4	4.0	1.500	1.011	-.537	3.537
		5.0	2.500	1.011	.463	4.537
		6.0	.[a]	.	.	.
	5	4.0	1.049E-013	1.429	-2.880	2.880
		5.0	.[a]	.	.	.
		6.0	.[a]	.	.	.
Picture	1	4.0	5.000	1.429	2.120	7.880
		5.0	3.333	.825	1.670	4.996
		6.0	1.000	1.011	-1.037	3.037
	2	4.0	.[a]	.	.	.
		5.0	.[a]	.	.	.
		6.0	.[a]	.	.	.
	3	4.0	4.500	.583	3.324	5.676
		5.0	4.000	1.429	1.120	6.880
		6.0	.[a]	.	.	.
	4	4.0	3.500	.715	2.060	4.940
		5.0	1.000	1.011	-1.037	3.037
		6.0	.[a]	.	.	.
	5	4.0	5.000	1.429	2.120	7.880
		5.0	5.000	1.429	2.120	7.880
		6.0	.[a]	.	.	.

a. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

Post Hoc Tests

Condition

Multiple Comparisons

Dependent Variable: Rating on the Wong Baker Pain Scale

Tukey HSD

(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control	Movie	.11	.409	.958	-.88	1.11
	Picture	.13	.431	.952	-.92	1.17
Movie	Control	-.11	.409	.958	-1.11	.88
	Picture	.01	.419	.999	-1.00	1.03
Picture	Control	-.13	.431	.952	-1.17	.92
	Movie	-.01	.419	.999	-1.03	1.00

Based on observed means.
The error term is Mean Square(Error) = 2.042.

Homogeneous Subsets

Rating on the Wong Baker Pain Scale

Tukey HSD[a,b,c]

Condition	N	Subset 1
Picture	21	3.52
Movie	26	3.54
Control	23	3.65
Sig.		.950

Means for groups in homogeneous subsets are displayed.
Based on observed means.
The error term is Mean Square (Error) = 2.042.

a. Uses Harmonic Mean Sample Size = 23.156.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.