SELF-SELECTED DISTRACTION FOR ACUTE PROCEDURAL PAIN
IN ADOLESCENTS:
AN INTERVENTION FEASIBILITY STUDY

A Dissertation Presented
by
DEBRA A. JEFFS

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DEDICATION

To my husband and soulmate, Bill, who has devoted his life to helping, encouraging, supporting, and loving me.

To our loving, dear children, Jennifer and Brandon, who bring me such joy and happiness, focus me on balancing life, and teach me what is truly important.

To my caring, helpful parents, Jim and Helen McCallen, who have supported my educational endeavors through the years.
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Abstract

Self-Selected Distraction for Acute Procedural Pain in Adolescents: An Intervention Feasibility Study

September 2004

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Purpose

This feasibility study evaluated all phases of the planned main study. The study tested the effect of self-selected distraction on acute pain perception in adolescents undergoing allergy skin testing. Distraction is a cognitive-behavioral nonpharmacologic nursing intervention used to divert attention from painful stimuli, which is supported by the gate control theory and distraction framework. A developmental model of adolescence provided a framework for testing self-selected distraction with adolescents for whom choice and control are important developmental concerns.

Specific Aims

What is the effect of distraction on acute procedural pain perception in adolescents? Specifically, what is the effect of self-selected distraction, rather than nurse-selected distraction, on acute procedural pain perception? What is the relationship between level of engagement with the distraction and perception of pain? How does anxiety interact with the effect of distraction on pain perception?
Method  The study utilized a post-test, experimental design with random assignment to three groups: self-selected distraction, nurse-selected distraction, and usual care. Adolescents in the self-selected group chose a videotape, music CD, or book-on-cassette from a researcher-developed media library. The sample included 32 adolescents ages 11 to 17 years. Pain perception was measured by the Adolescent Pediatric Pain Tool and the FACES pain scale. Investigator-developed pre- and post-allergy testing questionnaires measured demographic data, “needle” anxiety, engagement in the distraction, and perceived effectiveness of distraction. Pre-testing anxiety was measured by the Spielberger State Anxiety Inventory.

Results  The feasibility study piloted the analysis planned for the main study. No statistically significant differences were found among the three groups on pain perception. An unanticipated finding resulted in a trend toward the highest pain ratings for the self-selected distraction group during the more painful allergy testing phase. Greater level of engagement in the distraction was related to lower pain ratings. Higher levels of anxiety were correlated with higher pain ratings.

Implications  The planned main study was not conducted based on the results of the feasibility study. The small effect size increased the proposed sample size. Matching coping style with choice of nonpharmacologic interventions is recommended for future research.

Keywords: acute pain, adolescence, allergy testing, anxiety, distraction, gate control theory
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CHAPTER I

THE PROBLEM

Painful experiences in childhood cause children much physical and emotional distress. Pain from healthcare procedures, such as routine immunizations, allergy desensitization, and venipuncture, is relatively common in children. Children describe painful healthcare procedures as the most distressing aspect of illness and hospitalization (Acute Pain Management Guideline Panel, 1992a, b). Fear and anxiety can occur with just one traumatic painful healthcare experience (Bowman, 1996; Fanurik, Koh, Schmitz, & Brown, 1997). Although younger children usually exhibit more distress in response to painful procedures, preschoolers and adolescents may experience more anxiety prior to the procedure (Broome, 1990). Procedural pain has been recognized as harmful and, for the most part, preventable (Bowman, 1996).

According to federal guidelines set forth by the Agency for Healthcare Research and Quality (AHRQ), acute pain management should be based on the understanding that children will receive the best level of pain relief that can safely be provided. Acute pain management includes both pharmacologic and nonpharmacologic interventions, and combining both is recommended to promote the most effective management of children's pain (Acute Pain Management Guideline Panel, 1992a). Nonpharmacologic interventions, along with pharmacologic agents, can help diminish pain associated with healthcare procedures (McCarthy, Cool, Petersen, & Bruene, 1996; Pederson, 1996a). Older children and adolescents might find nonpharmacologic interventions, such as distraction, alone beneficial for procedures that are not extremely painful (Acute Pain Management Guideline Panel, 1992b).
Nonpharmacologic Interventions

Nonpharmacologic interventions for pain management have been defined in various ways. These interventions have been categorized as cognitive-behavioral strategies and as physical agents by the Acute Pain Management Guideline Panel (1992a). Cognitive-behavioral strategies include preparatory information, relaxation, guided imagery, hypnosis, distraction, music, and biofeedback, while physical agents include heat or cold application, massage, and transcutaneous electrical nerve stimulation (TENS). Nonpharmacologic interventions have also been classified into three categories: sensory, cognitive, and cognitive-behavioral interventions (Vessey & Carlson, 1996). Sensory interventions include heat, cold, massage, swaddling, sucking, and TENS. Cognitive interventions involve the use of hypnosis, imagery, thought stopping, humor, and preparatory sensory information, while cognitive-behavioral strategies include distraction, play therapy, biofeedback, relaxation, and modeling. Nonpharmacologic interventions include strategies to use prior to the procedure, such as preparatory sensory information, and those during the procedure, such as distraction and imagery (Broome, 1990; McCarthy, Cool, & Hanrahan, 1998). Distraction, a shifting of focus from the painful stimulus to other internal or external stimuli, is the most common cognitive-behavioral intervention used with children experiencing procedural pain (Blount, Schaen, & Cohen, 1999; McCaffery & Beebe, 1989).

The benefit of implementing nonpharmacologic interventions can be demonstrated through outcomes research efforts. In describing the role of nurses in outcomes research, Broome (1999) has called for a link between implementing interventions and evaluating their effectiveness using a framework such as the nursing
diagnosis, nursing intervention, and nursing outcome taxonomies. Although a multidisciplinary effort is involved in the achievement of most outcomes, there must be a direct link between the outcome and the chosen intervention (Broome, 1999). Distraction is among the nursing interventions to achieve outcomes related to pain level and disruptive effects of pain (Johnson, Bulechek, Dochterman, Maas, & Moorhead, 2001). By studying the effect of nursing interventions on patient outcomes, nurses can document that their role is essential to improving health care.

In clinical practice, nurses do not always use nonpharmacologic interventions for a number of reasons. In a study examining pediatric nurses’ use of nonpharmacologic techniques, Pederson and Harbaugh (1995) found factors, such as lack of time and heavy workload, interfered with implementation of these interventions. Other research has suggested that nurses may not be knowledgeable about the benefits of nonpharmacologic interventions (Hamers, Abu-Saad, Halfens, & Schumacher, 1994). Knowledge deficiencies related to pain were identified in several areas including nonpharmacologic pain interventions in studies of nurses in various countries (Manworren, 2000; Salantera & Lauri, 2000; Twycross, 2002). In a survey of 47 national pediatric centers, some nonpharmacologic interventions, such as providing information before procedures, were identified as being used more frequently than others, such as distraction, which require more time and training (McCarthy et al., 1996). Another study found that while nonpharmacologic interventions were rarely implemented in practice, distraction and relaxation were reported by nurses as those most frequently used (Jacob & Puntillo, 1999). Research linking specific
nonpharmacologic interventions, such as distraction, to positive outcomes related to pain can provide evidence of the benefits of these interventions.

In a thorough review of various nonpharmacologic interventions used with children of all developmental levels, Vessey and Carlson (1996) noted that little research has been done testing different approaches with children. Additionally, Pederson and Harbaugh (1995) have recommended studying the effectiveness of nonpharmacologic interventions on positive patient outcomes, including comfort, mobility, and recovery. However, current empirical knowledge of the effectiveness of nonpharmacologic interventions with a positive outcome on pain is limited.

Relaxation, imagery, and distraction in children and adolescents undergoing lumbar puncture and cardiac catheterization have been studied (Broome, Lillis, McGahee, & Bates, 1992; Broome, Rehwaldt, & Fogg, 1998; Pederson, 1995, 1996b). Distraction has also been studied in children experiencing common, painful procedures of short duration, such as venipuncture (Carlson, Broome, & Vessey, 2000; Vessey, Carlson, & McGill, 1994) and immunization (Bowen & Dammeyer, 1999; French, Painter, & Coury, 1994; Megel, Houser, & Gleaves, 1998; Sparks, 2001). In addition, facilitated tucking, rocking, and pacifiers in healthy newborns during heelstick blood sampling (Campos, 1994; Corff, Seideman, Venkataraman, Lutes, & Yates, 1995) and decorated bandages in preschoolers during fingerstick (Johnston, Stevens, & Arbess, 1993) have been evaluated. Use of cold therapy during intramuscular injections (Ebner, 1996) and transcutaneous electrical nerve stimulation (TENS) during dental cavity preparation (Harvey & Elliott, 1995), two other common childhood procedures, have also been investigated. However, results of studies have been equivocal, and
none of the nonpharmacologic interventions have been studied during allergy skin testing, a commonly performed healthcare procedure.

Allergy Skin Testing

Children undergo allergy skin testing to detect and identify allergens precipitating allergic reactions. Allergens are associated with the development of allergic rhinitis and asthma, two common chronic respiratory conditions that interfere with sleep, intellectual functioning, and recreational activities (Holgate, 1999; Holt, Macaubas, Stumbles, & Sly, 1999; Platts-Mills, Sporik, Chapman, & Heyman, 1995). Asthma, the most common chronic childhood illness, is one of the priorities targeted in the Healthy People 2010 initiative (http://www.health.gov/healthypeople/). The incidence of asthma and allergic rhinitis has been increasing steadily over the past two decades (Middleton et al., 1998). The incidence of asthma, which affects 4.8 million or almost 7% of children under 18 years of age, rose 75% between 1980 and 1994 (Centers for Disease Control and Prevention, 1998). Allergic rhinitis, which affects approximately 10-20% of the general population, is the sixth most common chronic illness overall (Middleton et al., 1998; Palakanis, Corren, & Prenner, 1997; Platts-Mills, Vaughan, Blumenthal, Squillace, & Sporik, 2001). Furthermore, individuals with allergic rhinitis have a greater likelihood of developing asthma (Braunstahl & Hellings, 2003). In response to this increased incidence, the amount of allergy testing has risen accordingly. While prevalence and mortality of asthma among adolescents is increasing, many cases remain under-diagnosed and under-treated (Kulig, 2000). Since allergy care begins with an accurate diagnosis, it is important to gain the child’s
cooperation and agreement to participate in the allergy testing. Allergy testing is performed by a series of intradermal scratches, punctures, or injections.

Unfortunately, investigations of the pain incurred during allergy skin testing are scant, and the few studies conducted have excluded adolescents. One study measured only anticipatory pain and fear ratings prior to allergy skin testing in children aged three to twelve but did not include adolescents (Carr, Lemanek, & Armstrong, 1998). Two other studies investigated use of a pharmacologic intervention, eutectic mixture of local anesthetics (EMLA) cream, in children and adults undergoing allergy skin testing but found interference with the testing results (Sicherer & Eggleston, 1997; Wolf, Shier, Lampl, & Schwartz, 1994). Nonpharmacologic interventions can offer pain reduction without the adverse effects of a pharmacologic agent. However, there is no literature on investigations of nonpharmacologic interventions, such as distraction, conducted during allergy skin testing. Compared to other painful healthcare procedures, allergy testing is unique because multiple, repetitive painful stimuli are applied sequentially. Studies of nonpharmacologic interventions, such as distraction, during allergy skin testing could extend knowledge of their effectiveness to a different type of painful procedure.

Distraction

Distraction is the most easily implemented nonpharmacologic technique to use during painful procedures (Fanurik et al., 1997). Studies have found distraction to be an effective intervention in reducing pain perception and distress in children and adults during various painful healthcare procedures (Bowen & Dammeyer, 1999; Cason & Grissom, 1997; Cohen, Blount, Cohen, Schaan, & Zaff, 1999; Fowler-Kerry & Lander,
1987; French et al., 1994; Megel et al., 1998; Sparks, 2001; Vessey et al., 1994). In a meta-analysis of 26 studies, children's self-reported pain and observed behavioral distress were significantly decreased when distraction was implemented (Kleiber & Harper, 1999). In other reviews, Lambert (1999) and Powers (1999) also found support for use of cognitive-behavioral therapies, including distraction, for procedure-related pain. However, disparity still exists in the findings of distraction studies. Some investigations have found no significant effect using distraction during painful procedures (Arts et al., 1994; Carlson et al., 2000).

While Vessey and Carlson (1996) noted that nonpharmacologic interventions, such as distraction, are highly effective for adolescents, few studies of distraction have included adolescents, and none have exclusively studied adolescents. Yet, age-related differences in reports of pain have been found (Carlson et al., 2000) as well as age-related differences in treatment effects (Vessey et al., 1994). In contrast, no age-related treatment effect was found across one particular developmental level, in this case, the preschool period (Sparks, 2001). The uniqueness of adolescence, a developmental level bridging childhood and adulthood, may require unique strategies to reduce pain, especially distraction techniques chosen by the individuals themselves.

Knowledge of self-selected distraction is lacking. None of the distraction studies investigated the use of a self-selected distraction intervention, one which is chosen by the individual as a meaningful distractor, compared to a distractor chosen by the nurse. Yet, encouraging the individual to choose the desired distraction technique is one of the components of the intervention, distraction (Mobily, Herr, & Kelley, 1993). Research on more effective and efficient methods of distraction to be used with
children and adolescents as they undergo painful healthcare procedures has been recommended (Blount et al., 1999). Self-selected distraction is congruent with the adolescent developmental level by allowing the adolescent choice and control.

**Anxiety as related to Pain and Distraction**

Many studies of nonpharmacologic interventions, including distraction, have examined the relationship between anxiety and pain perception and found, not surprisingly, a positive correlation (Lander & Fowler-Kerry, 1993; Pederson, 1995, 1996b). However, the relationship between the child’s or adolescent’s anxiety level and the effectiveness of the distraction intervention has not been explored. Anxiety may influence efficient performance of tasks by limiting the amount of resources available for processing (Keogh & French, 1997). Thus, ability to engage in and remain engaged in the distraction intervention may be influenced by the child’s anxiety level.

**Purpose**

The purpose of this study was to test a self-selected distraction intervention and evaluate its effect on acute pain perception among adolescents undergoing allergy skin testing, a commonly performed healthcare procedure. With the current emphasis in health care on evidence-based practice, cost containment, and patient satisfaction, empirical knowledge of the effectiveness of nonpharmacologic interventions, such as distraction, in reducing acute pain is essential. The following research questions were posed for this study.
**Research Questions**

1. What is the effect of a nursing intervention, distraction, on the perception of acute procedural pain among adolescents as they undergo allergy skin testing?

2. Specifically, what is the effect of self-selected distraction, rather than nurse-selected distraction, on acute pain perception among adolescents undergoing allergy testing?

3. What is the relationship between level of engagement in the distraction activity and perception of acute procedural pain in adolescents?

4. How does anxiety interact with the effect of distraction on acute procedural pain perception in adolescents undergoing allergy testing?

**Feasibility Study**

Two phases of this study were planned: a pilot/feasibility study and the main study. The purpose of the feasibility study was to pilot test all phases of the study including the intervention and to pre-test the data collection instruments. Piloting allows a researcher to run a small-scale test of the study and determine the study’s feasibility, while pre-testing involves an initial testing of an instrument with just a few subjects (Jacobson, 1997). The purpose of pre-testing was to evaluate the questionnaires and pain scales for use with adolescents experiencing allergy skin testing, as well as directions for completing the questionnaires. Sampling and group assignment procedures were also evaluated for appropriateness in the feasibility study. The actual testing of the implementation of the distraction intervention was undertaken.
The purposes of the feasibility study were to:

1. determine the overall feasibility of conducting the main study,
2. test the implementation of the distraction intervention,
3. identify any problems in the design of the main study,
4. determine the sample size needed for the main study based on effect sizes of the feasibility study,
5. determine which pain instrument better contributed to measurement of allergy testing-related pain,
6. examine validity and reliability of the instruments, including the researcher-developed questionnaires,
7. identify videotapes, music CDs, and books-on-cassette for the media library to be used in the main study, and
8. refine the plan for data analysis.

Theoretical Frameworks

The integration of three theoretical frameworks related to pain: a children's developmental model, the gate control theory, and a framework for distraction, provided a foundation for this study. Each framework offers a unique perspective which together captures the multi-faceted aspects of distraction as an intervention, and specifically self-selected distraction, in reducing acute procedural pain perception in a population within the developmental stage of adolescence. Since the gate control theory and distraction framework were based on pain experiences of adults, a developmental model offers insight into the uniqueness of the pain experience for the child or adolescent.
A developmental model of the child’s pain experience as proposed by Stevens, Hunsberger, and Browne (1987) provides a foundation for understanding the adolescent’s allergy testing-related pain and underlies the notion of a self-selected distraction intervention. The stage of growth and development can influence the child’s response to pain and use of nonpharmacologic interventions to ameliorate pain. Adolescence can be broadly defined as the period from age ten through twenty-one years divided into three phases: early adolescence (ten to thirteen years), middle adolescence (fourteen to seventeen years), and late adolescence (eighteen to twenty-one years) (Neinstein, 1996). Individuals in the adolescent developmental stage are beginning to think more abstractly and, therefore, are able to understand concepts such as pain and anxiety and utilize a self-selected distraction strategy. Issues of control and choice, which are important to adolescents’ psychosocial development, are incorporated into a self-selected distraction intervention.

The gate control theory (Melzack & Wall, 1965) offers explanations for the pain experience of allergy testing, anxiety associated with pain, and the use of nonpharmacologic interventions, such as distraction, to reduce pain perception. Descending control of pain is exerted by impulses originating in the cerebral cortex, thalamus, and brainstem together with the effects of neurotransmitters, such as serotonin, noradrenaline, and endogenous opioids mediated via descending pathways from the brain (Stamford, 1995).

Specifically related to distraction, McCaul and Malott (1984) have proposed a theoretical framework offering an explanation for the effectiveness of distraction as a strategy for reducing pain perception. Distraction interventions which require more
attentional capacity, or engaging and focusing on a task, are proposed to be more effective, thus lending support for a self-selected distraction intervention. A distraction chosen by the individual should have significance for that individual and thus thoroughly engage the person and place an optimal demand on attentional capacity rather than a distraction chosen by another individual, such as the nurse performing the allergy testing, which may have less meaning for the individual. Additionally, this theoretical framework supports distraction's effectiveness with less intense stimuli, such as allergy skin testing, rather than severe painful stimuli.

Assumptions

Several assumptions underlie the research study. Self-selected distraction is an engaging, absorbing distraction, one capable of capturing and holding the person's attention. Adolescents can engage in a distraction intervention. Adolescence begins at approximately age eleven with the beginning of pubescent-related physical, cognitive, and psychosocial changes. Adolescents are capable of correctly and accurately answering a written questionnaire. Adolescents are beginning to think abstractly; thus they can conceptualize the pain experience, quantify it, and describe the experience using standardized instruments. An individual's pain perception can be measured and quantified through self-report pain scales and word descriptions. Allergy skin testing is a low painful stimulus, but multiple and sequential in nature, resulting in some degree of pain being perceived by the individual. Anxiety is an affective component of pain perception. Through a controlled experimental design using random assignment to groups with adequate sample size, the effect of a distraction intervention on acute procedural pain perception can be determined.
Operational Definitions

Adolescents: Children from the age of eleven through and including seventeen years, not cognitively developmentally delayed.

Allergy Testing: A series of scratches, scrapes, punctures, or injections of food and environmental allergens, excluding bee venom, performed without local anesthesia, analgesia, or sedation. Phase I allergy testing consists of multiple lancet- and-droplet or Greer Derma-Pik pricks usually of the forearms. Phase II allergy testing consists of multiple intradermal injections usually of the upper arms.

Anxiety: A transitory feeling of uneasiness with activation of the autonomic nervous system in response to the perceived stressful event, i.e. allergy skin testing (adapted from the North American Nursing Diagnosis Association nursing diagnosis and Spielberger’s definition of state anxiety); as measured by the State Anxiety inventory of the State Trait Anxiety Inventory (STAI).

Distraction: A cognitive-behavioral nonpharmacologic intervention; a diverting, shifting, or focusing of attention away from the painful stimulus to other internal or external stimuli.

Level of engagement: The ability to stay focused on the distraction intervention and remain distracted from the painful stimuli as measured by self-report on the Post-testing Questionnaire.

Nurse-selected distraction: An audio-visual medium, such as a videotape, chosen as a distraction intervention by the nurse. In this study, a nursing recruitment videotape designed for adolescents was chosen as the nurse-selected distraction.
**Pain:** An unpleasant sensory and emotional experience arising from the actual tissue damage associated with the allergy skin testing as reported by the individual experiencing the allergy testing (adapted from definitions of the International Association for the Study of Pain and the North American Nursing Diagnosis Association); as measured by the Adolescent Pediatric Pain Tool (APPT) and the FACES pain scale.

**Self-selected distraction:** Any type of audio-visual medium, such as a videotape, book-on-cassette, or music compact disc (CD), chosen as a distraction intervention by the adolescent from a library compiled by the investigator (for the feasibility study) and from a library compiled from the adolescents’ choices indicated in the feasibility study (for the main study).

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CHAPTER II
THEORETICAL FRAMEWORK

The integration of three theoretical frameworks related to pain: a children’s developmental model proposed by Stevens, Hunsberger and Browne (1987), the gate control theory (Melzack & Wall, 1965, 1983), and a framework for distraction (McCaul & Malott, 1984) provided a guide for this study. While the study did not test any of the theoretical frameworks, each framework offers a unique perspective which provided a foundation for testing the distraction intervention in the adolescent population. Firstly, a developmental framework for the adolescent is important because the concept of pain and specific pain management interventions differ depending upon the developmental level of the child. Secondly, the gate control theory provides information for understanding the concept of pain as a physical and emotional experience and the action of nonpharmacologic interventions to reduce pain perception. Finally, a framework for distraction can offer specific information about this particular nonpharmacologic intervention in reducing pain. Since the gate control theory and framework for distraction were based on pain experiences of adults, a developmental model offers insight into the uniqueness of the pain experience for the developing child or adolescent.

On a purely theoretical level, these theories also articulate. The gate control theory and distraction theory are considered systems theories, while the developmental model is a stage theory. Both systems theories and stage theories are classified under the broader category of structuralism (Slife & Williams, 1995). All three of these theories are considered examples of structuralist theories. According to Slife and
Williams, structuralism refers to a group of several theories with a common underlying assumption that phenomena in the world arise from some unseen, underlying structure and that the understanding of phenomena can only occur through an understanding of its structure. These authors explain that the structure of the system or the stage is not directly accessible but governs the understanding of behaviors that comprise the system or stage. Furthermore, once within a particular developmental stage, the model operates very much like a systems theory because multiple input that must be processed enters the system of the individual. The three theories then offer unique, yet articulating explanations. Through the integration of these frameworks, this study tested a distraction intervention that builds on previous knowledge regarding the acute pain experience of adolescents.

**Developmental Model**

Much knowledge has been gained about the development of the child and adolescent, and therefore, information is voluminous on the topic of child/adolescent development. This discussion offers a brief overview of developmental knowledge that is relevant to adolescents and pain. A theoretical model adapted from Stevens, Hunsberger, and Browne (1987) offers an explanation for integrating the developmental level of the adolescent in understanding the pain experience. This current study is limited to the adolescent population therefore adolescence is the developmental level of focus.

Contemporary developmentalists broadly define adolescence as a period of gradual transition from childhood to adulthood including ages ten to twenty-one years divided into early, middle, and late adolescence and which reflects dynamic,
interrelated rather than unidimensional developmental changes (Lerner, Freund, DeStefanis, & Habermas, 2001; Neinstein, 1996; Spear, 2000). Based on Stevens, Hunsberger, and Browne's model, the interrelated components of the developmental level influence the pain experience: physiological (the physical sensation of pain related to tissue damage), cognitive and emotional/psychosocial (both influence the individual's perception of the unpleasant sensation), and experiential (the attributing of meaning to the experience and comprised of past painful experiences, cultural influences, and the quality of the parent-child relationship). (See Figure 1.)

The physiological component of the pain experience is activated by the repetitive application of the painful allergy testing stimuli and influenced by differences in maturity of the frontal cortex, descending control mechanisms, and nociceptive processes, thus affecting the adolescent's perception of pain (Goldberg, Maurer, & Lewis, 2001; Stevens et al., 1987; Vessey & Carlson, 1996).

Neurophysiologically, in contrast to adults, adolescents demonstrated greater activation of various brain regions, specifically the amygdala, anterior cingulate cortex, and orbitofrontal cortex, in response to emotionally evocative stimuli (Monk et al., 2003). This may have implications for adolescents' responses to the affective dimension of pain, such as pain anxiety, which may be unique based on neurological developmental considerations. Furthermore, while developmental improvements in attentional processing occur across childhood (Taylor & Khan, 2000), goal-directed, attention-demanding tasks of adolescents in the context of emotional stimuli did not
result in adult-like orbitofrontal cortex activation (Monk et al.), suggesting that a neurophysiological basis exists for needing to select adolescent-specific distraction interventions.

Figure 1. Developmental Framework of the Child's Pain Experience adapted from Stevens, Hunsberger, and Browne

Perception of pain also relates to the cognitive stage of development. Cognitive ability can influence understanding and description of the pain experience (Franck, Greenberg, & Stevens, 2000). Cognitive development will be considered because adolescents in the study will be asked to choose the distractor, engage in the self-selected distraction, which is employed by the adolescent and not the nurse, and independently and retrospectively describe their pain perception.

Within Stevens, Hunsberger, and Browne’s developmental model, Piaget’s theory can provide a context in which the adolescents’ cognitive development is considered. The formal operations stage of four progressive stages of cognitive development constitutes a particular kind of thought process and begins at about age...
eleven to twelve years (Beilin, 1992; Inhelder & Piaget, 1958). Whereas agreement exists about the age at which formal operations begins, controversy surrounds the age at which formal operations are persistently used in cognition. While Piaget had proposed that the stage of formal operations reaches a state of equilibrium by age fourteen or fifteen, others disagree, suggesting that complete, consistent use of formal operations may not even occur among all adults (Bradmetz, 1999; Miazga, 2000; Moshman, 1999; Sinnott, 1975; Tomlinson-Keasey, 1972). Piaget himself noted differences among adolescents of various cultures and in later writings, suggested that formal operational reasoning and logic is probably attained between ages fifteen to twenty years according to aptitude and professional specialization (Piaget, 1972). Regression can occur due to illness, pain, and anxiety related to the painful experience and may interfere with the individual’s cognitive ability. Because of this disparity in cognitive ability, the adolescent must be approached as a beginning abstract thinker who is able to think concretely on a regular, everyday basis.

Perceptions of pain by children in various stages of cognitive development suggest an increasingly more complex understanding of pain (Hurley & Whelan, 1988). With their expanding cognitive ability, adolescents are beginning to think and reason abstractly and can communicate pain in more abstract terms (Gaffney & Dunne, 1986; Hurley & Whelan, 1988). They are beginning to understand psychological causes of pain, the need for healthcare procedures, and subsequently, the mind-body effects and time-limited nature of pain (Franck et al., 2000; Gaffney & Dunne, 1987; Harbeck & Peterson, 1992; Hurley & Whelan, 1988). Adolescents are able to think spontaneously, engage in hypothetico-deductive reasoning, understand and construct
theories, and generate new possibilities based on a systematic second-order logical structure (Inhelder & Piaget, 1958; Moshman, 1999; Piaget, 1972). However, while they are beginning to problem-solve on a more adult-like level, adolescents do not have the coping mechanisms or life experiences to constitute mature responses (Hurley & Whalen, 1988; Twycross, 1998).

Since development is thought of as multidimensional, the perception of pain is also influenced by the individual’s emotional or psychosocial development. Erikson (1966) identified the psychosocial crisis for the adolescent as identity vs. role confusion or identity diffusion. In the search for their own unique identity formation, adolescents face a formidable task of making choices and commitments with sometimes life-long consequences (Erikson, 1968). Erikson explains that in the trying on of the changing identity and through the pursuit of a new sense of continuity and sameness, everyday choices are made concerning clothing, speaking, and gesturing. Thus, according to Erikson, the making of the everyday choices facilitates the formation of the new adult identity from the previous childhood one.

Erikson’s work has been extended by Marcia who distinguished four identity statuses reflecting progressive developmental shifts within adolescence: foreclosure, diffusion, moratorium, and achievement (Bilsker & Marcia, 1991; Waterman, 1982). Psychological well-being has been correlated with the four identity statuses (Meeus, 1996). Varying degrees of two key adolescent developmental tasks, exploration and commitment, comprise each of the four identity statuses. The processes underlying identity development, exploration and commitment, involve both cognitive and affective components (Marcia, 1989). The relationship between formal operations and
identity formation has been explored recently (Klaczynski, Fauth, & Swanger, 1998). Rational processing was found to be correlated with identity formation, formal operations and critical thinking. According to Klaczynski et al., making future-oriented decisions based on rational processing, as well as formal operational thinking may serve as important prerequisites for identity formation of adolescence.

Emanating from this pursuit of identity and the physiologic changes of puberty, issues of privacy and self-control become important to adolescents and may influence their response to pain (Cronau & Brown, 1998; Hurley & Whelan, 1988). Adolescents desire a sense of control and autonomy; losing self-control and the fear of losing self-control become part of the pain experience (Vessey & Carlson, 1996). This may be reflected in decreased overt manifestations of pain (Franck et al., 2000). Adolescents may not verbalize their pain due to a variety of reasons, such as embarrassment, being perceived as a younger child, fears of addiction to medication, and assumptions about the healthcare professional as “knowing best.”

As adolescents experience new mental capabilities and increased social cognition, they think about others’ thinking about them (Offer & Schonert-Reichl, 1992). These developmental changes may also contribute to decreased verbalizations of both physical and emotional pain during adolescence. The new ways of thinking enable the adolescent to put on an external façade and hide true yet fragile, internal feelings. This may confound pain assessment because outward behavior may belie self-report of pain. But the decreased verbalization does not imply less pain is experienced (LeBaron & Zeltzer, 1984). In fact, the abstract thinking of adolescents
may actually increase sensitivity to the painful stimulus by attributing meaning to the
pain (Stevens et al., 1987).

The experiential component of the developmental model offers insight into the
adolescent’s attributing of meaning to the painful experience. The memory of past
painful experiences, cultural influences, and the quality of the parent-adolescent
relationship contribute to the experiential component of pain. Children who have
undergone repeated painful procedures may be more sensitized to pain rather than
desensitized (Twycross, 1998). Adolescents can integrate past experiences into the
current painful event leading to anticipatory anxiety based on prior negative
experiences. Yet in studies including adolescents, prior painful experience has not
consistently contributed to the present pain experience (Cheung, Foster, & Hester,

The quality of the parent-adolescent relationship also contributes to the
experiential component of the pain experience. Research has been undertaken in two
areas related to the parent-adolescent relationship: the influence of parenting style and
conflict between the parent and adolescent. The literature on adolescence over the past
twenty-five years has modified the notion of adolescence as a time of “storm and
stress” (Arnett, 1999; Gecas & Seff, 1990; Lerner & Galambos, 1998; Offer &
Schonert-Reichl, 1992). Instead evidence suggests that adolescence is a period of more
moderate upheaval with individual and cultural differences. Conflict with parents,
mood disruptions, and risk-taking behavior usually do characterize adolescence to a
certain extent (Arnett, 1999). Yet the majority of adolescents, approximately 75-80%,
transition relatively smoothly from childhood to adulthood (Henricson & Roker, 2000; Offer & Schonert-Reichl, 1992).

While indeed parent-adolescent conflict exists, the nature of the conflict is minor and arises over everyday issues, choices and decisions, such as appearance, chores, and privileges (Arnett, 1999; Lerner & Galambos, 1998). For the most part the quality of the parent-adolescent relationship reflects shared values and similar beliefs in the context of mutually positive feelings (Galambos, 1992; Henricson & Roker, 2000; Offer & Schonert-Reichl, 1992). Peers may influence adolescents’ appearance and recreational activities, but parents have a stronger influence on adolescents’ major values, such as religious beliefs, educational goals, and occupational aspirations (Gecas & Seff, 1990).

Parent-adolescent conflict can be a source of significant stress for both adolescent and parent due to its frequency and fervor, especially in early adolescence; however, the long-term relationship is not usually negatively affected or disrupted as change in the relationship transforms over time (Arnett, 1999; Galambos, 1992; Henricson & Roker, 2000; Laursen, Coy, & Collins, 1998). Instead the outcome of the relationship may be positive because individuation and autonomy are promoted within the context of a warm relationship (Arnett, 1999). Overall conflict and frequency of parent-adolescent conflicts decrease through the adolescent years with a slight increase in affective intensity from early- to mid-adolescence (Laursen et al., 1998). Mother-adolescent conflict is more typical than father-adolescent conflict, probably related to greater maternal involvement in the adolescent’s everyday life, and mother-daughter conflict...
conflict is more usual than either mother-son or father-adolescent (Henricson & Roker, 2000; Laursen et al., 1998).

This trajectory for the majority of adolescents that is not shared by approximately 20-25% of youth indicates education, guidance, and support are needed for parents prior to the beginning of adolescence since the nature of the parent-child relationship is established by adolescence (Gecas & Seff, 1990; Henricson & Roker, 2000; Rueter & Conger, 1995; Caughlin & Malis, 2004). A family atmosphere of warmth and support has been shown to contribute to less parent-adolescent conflict and to promote adolescent adjustment, while hostile and coercive relationships continue to deteriorate over time (Rueter & Conger, 1995; Yau & Smetana, 1996). Long-standing, unresolved disputes can weaken the parent-adolescent bond. Additionally, a demand/withdraw communication style on the part of the parent, which involves a pattern of criticism at times and avoidance of adolescent-initiated dialogue at other times, has been linked to negative health behaviors in the adolescent, such as substance abuse (Caughlin & Malis, 2004).

Maladjustment in adolescence manifests as internalizing symptoms, such as anxiety, depression, and weight-related concerns, especially in girls, and externalizing symptoms, such as delinquency, aggression, and substance abuse, especially in boys; although delinquency has increased among female adolescents (Buist, Dekovic, Meeus, & van Aken, 2004; Lerner & Galambos, 1998; Offer & Schonert-Reichl, 1992). Psychological control involving parental over-control of the adolescents' personal and private domain has been linked to internalizing psychological symptoms (Hasebe, Nucci, & Nucci, 2004). Reciprocity in the parent-adolescent relationship has
been recognized as an important factor contributing to adolescent development (Barber, 1994; Buist et al., 2004; Gecas & Seff, 1990). Adolescent problem behaviors may elicit parental reactions that may include use of ineffective parenting strategies.

Parenting styles have also contributed to adolescent adjustment. In the early 1990s Baumrind identified four styles of parenting: authoritative, authoritarian, permissive, and neglectful (Bednar & Fisher, 2003; Henricson & Roker, 2000; Suldo & Huebner, 2004). Authoritative parenting, which consists of warmth, monitoring, support, acceptance, involvement, and high expectations for behavior, has resulted in the most positive adolescent outcomes including self-reliance, self-confidence, and social competence. Adolescents of authoritative parents are more likely to seek parent input rather than peer involvement in moral and informational decision-making (Bednar & Fisher, 2003). Furthermore, parental warmth, behavioral but not psychological control, and monitoring have been linked to deterring problem behaviors in adolescents (Fletcher, Steinberg, & Williams-Wheeler, 2004; Hasebe et al., 2004). Optimal adolescent adjustment is promoted by parents encouraging age-appropriate autonomy while maintaining close family ties; thus the role of parents is central to adolescent development (Lerner & Galambos, 1998; Lerner et al., 2001).

Diversity and congruence regarding adolescent development including the parent-adolescent relationship exist within and between all ethnic, racial, and cultural groups (Lerner & Galambos, 1998), thus indicating that culture can also influence the experiential component of the pain experience. Ethnic identity indicates identification with a cultural group and may involve choice of affiliation (Herman, 2004). Since ethnic identity significantly impacts self-identity, identity development may be more
challenging for adolescents of ethnic or racial minority groups, and may be especially
difficult for those who are multiracial (Spencer & Markstrom-Adams, 1990; Herman,
2004). There may be less exploration involved in identity development in these
adolescents leading to foreclosure, which may be adaptive in some communities with
clearly defined social roles (Spencer & Markstrom-Adams, 1990). Identity
development in some groups may be linked to coping style, such as African American
males who may develop an ultra-masculine identity and exhibit aggressive coping
strategies in response to environmental stressors (Lerner et al., 2001). While
differences were found between cultures in preferred use of coping strategies,
adolescents from various cultural backgrounds indicate that they cope with high
anxiety by using an avoidance coping strategy.

Positive peer relationships have been identified across all ethnic groups but
also show a relationship to socioeconomic status (Kuperminc, Blatt, Shahar, Henrich,
& Leadbeater, 2004). Furthermore, declines in the quality of the parent-adolescent
relationship have been found across all ethnic groups; specifically African Americans
girls reported less positive parent-adolescent relationships (Kuperminc et al., 2004;
Smetana, Metzger, & Campione-Barr, 2004). The nature of parent-adolescent conflict
is related to everyday issues across cultural groups with lower levels of conflict
reported by African American and Hispanic males (Barber, 1994; Molina & Chassin,
1996; Yau & Smetana, 1996). A supportive relationship with father regardless of
father’s presence in the home was associated with positive African American
adolescent adjustment especially in male adolescents (Smetana et al., 2004;
Zimmerman, Salem, & Maton, 1995).
While differences in school achievement are noted in some ethnic groups of adolescents, various other problem behaviors of adolescence such as depression, anxiety, and delinquency exist across ethnic or racial groups (Kuperminc et al., 2004). For example, substance abuse may be more prevalent in the Native American adolescent communities, but alcohol use less so among African American youth (Lerner & Galambos, 1998). A pattern of parental psychological over-control of the personal domain was related to increased internalizing symptoms in Japanese adolescents (Hasebe et al., 2004). On the other hand, parental monitoring was related to decreased externalizing symptoms including delinquency in urban African American adolescents (Richards, Miller, O'Donnell, Wasserman, & Colder, 2004). Improved quality of the parent-adolescent relationship was associated with fewer internalizing problems, especially for Latino youth, as well as fewer externalizing problems across all groups (Kuperminc et al., 2004). Increased quality of peer relationships was related to decreases in externalizing problems for African American and Latino youth.

Thus, the quality of the parent-adolescent relationship and cultural/ethnic variations in adolescent development have implications for pain assessment and management in adolescents. Just as sameness and variability exist across gender and cultural/ethnic groups in internalizing and externalizing symptoms, so might response to physical pain, especially in pain intensity rating and the way of expressing pain. Cultural and ethnic differences were not found in observed and reported pain and pain-related anxiety or pain response in some children and adolescents (Pfefferbaum, Adams, & Aceves, 1990; Savedra, Tesler, Ward, & Wegner, 1988). Furthermore, the
literature informing nurses about cultural and ethnic variations that might influence
decision-making in the care of children and adolescents in pain is scarce (Abu-Saad &
Hamers, 1997).

The parent-child relationship influences the adolescent’s pain experience.
Since the majority of adolescents turn to their parents for assistance and guidance in
important matters and for help with personal problems (Bednar & Fisher, 2003; Offer
& Schonert-Reichl, 1992), parental involvement in adolescent pain management is a
useful strategy. Adolescents experiencing acute traumatic injury perceived parental
presence as helpful in decreasing pain intensity (Crandall, Miaskowski, Kools, &
Savedra, 2002). Holding mother’s hand was a preferred coping and pain reduction
strategy for adolescents experiencing treatment-related pain (Weekes, Kagan, James,
& Seboni, 1993). Assessing the quality of the parent-adolescent relationship may be an
important first step in nursing care because adolescents experiencing more
externalizing symptoms may instead turn to peers for support, rather than to parents,
even if peer support is negatively oriented (Bednar & Fisher, 2003). Thus the presence
of parent, mother or father, might be a useful pain management strategy as long as the
quality of the parent-adolescent relationship is not disrupted. Chronic pain in
adolescents has been associated with increased parental stress and dysfunctions in
parent-child interactions and may require specific interventions unique to the nature of
chronic pain (Eccleston, Crombez, Scotford, Clinch, & Connell, 2004; Hunfeld et al.,
2001).

Coping responses and strategies of adolescents vary. Anxiety is associated with
acute pain in adolescents and both anxiety and depression with chronic pain (Crandall
et al., 2002; Eccleston et al., 2004; Harma, Kaltiala-Heino, Rimpela, & Rantanen, 2002; LaMontagne, Hepworth, & Salisbury, 2001). Girls express more anxiety, somatic complaints, irritability, and depression (Offer & Schonert-Reichl, 1992), and this may hold true when experiencing physical pain. Increases in anxiety found in adolescent girls and use of more emotion-based coping strategies including social support, while boys use of problem-focused coping, may have implications for pain-related anxiety and effective coping strategies to use when experiencing pain (Byrne, 2000). Feelings of lack of control may further intensify pain perception. Therefore, nonpharmacologic interventions can be effective with adolescents by promoting a feeling of self-control (Vessey & Carlson, 1996). The nurse needs to assist the adolescent in gaining control of emotional expression and in doing so, reduce anxiety and increase pain tolerance (Favaloro, 1988). In gaining control, some adolescents cope with pain by attending to the pain source, while others prefer distraction from the pain (Frank et al., 2000).

Distraction interventions using media such as music or video viewing during painful healthcare procedures are especially congruent with the adolescent developmental level because media is especially important to adolescents. Adolescents use media not only for entertainment, but also actively use and interpret media to reflect important aspects of themselves and make sense of their world contributing to socialization and identify formation (Arnett, Larson, & Offer, 1995). Through diverse selection of media reflecting individual preferences and personalities, adolescents also use media for sensation-seeking, coping with negative emotions, and identification with the youth culture (Arnett, 1995). Self-selected distraction using media choices is
especially congruent with adolescents’ everyday lives in which solitary media choices, especially related to music listening, allow for coping with stress and negative emotions (Larson, 1995). Selection from among media choices is influenced by motivation and impacts cognitive, affective, and behavioral interaction or engagement with the chosen media (Steele & Brown, 1995).

This current study examines the effects of a specific nursing intervention, self-selected distraction, as a cognitive-behavioral strategy, which is consistent with the adolescent’s cognitive and psychosocial development, on the outcome of reduced pain perception during the neurophysiological-sensory experience of allergy skin testing. Since maintaining a sense of self-control and making everyday choices are important developmental tasks of adolescence, self-selected distraction is congruent with an adolescent developmental framework. Self-selected distraction allows for choice and independence and might offer the adolescent a way to increase self-control and also reduce anxiety associated with the painful experience. Anxiety, an emotional influence on the individual’s pain experience, is examined in relationship to its effect on pain perception and engagement in the distraction intervention.

Gate Control Theory

A second theoretical framework, the gate control theory, is useful for describing the physiological and cognitive-affective components of the pain of allergy skin testing and the effect of nonpharmacologic interventions on acute pain perception. According to the gate control theory of pain mechanisms, acute pain occurs when specialized nerve endings, nociceptors, in the skin and viscera are activated by noxious or painful stimuli, such as the repeated scratching and puncturing of the skin during
allergy testing. These painful impulses are conveyed via small, afferent myelinated A-delta and unmyelinated C fibers to the dorsal horn of the spinal cord (Davis, 1993; Melzack, 1982; Melzack & Wall, 1965, 1983; Wall, 1978). The substantia gelatinosa in the dorsal horn of the spinal cord acts as a gate control system. This gate control system in the dorsal horn serves to control the transmission of nerve impulses from peripheral nerves to the central nervous system. The gate position depends on whether impulses are carried on small or large fibers. Sharp, painful nerve impulses carried by small fibers maintain the gate in an open position. However, competing impulses conveyed by large, A-beta fibers, such as through tactile pressure, can override the pain messages received in the dorsal horn, close the gate, and block the pain. It is this mechanism which explains such nonpharmacologic interventions as application of heat, cold, pressure, or electrical stimulation (Davis, 1993; Vessey & Carlson, 1996).

Other nonpharmacologic strategies, such as distraction, are explained through the process of descending control rather than ascending transmission. Descending control systems are integral to the gate control theory. The central control trigger or central biasing mechanism: cerebral cortex, thalamus and brain stem, acts upon the gate control system through descending impulses (Melzack, 1982; Stamford, 1995; Wall, 1978). Stimulation within these areas of the brain, as mediated by activation of brainstem cells, has been shown to inhibit nociceptive dorsal horn cells. Stimulus intensity may activate different areas of the central control system and be a factor in pain perception.

The central control concept has been expanded to that of a “neuromatrix”, a widely distributed neural network in the brain that is genetically determined, modified
by sensory inputs and experience, and influenced by the stress regulation systems, as well as by cognitive and affective components (Loeser & Melzack, 1999; Melzack, 1990, 1993, 1999). Through this central control or neuromatrix, an affective dimension is added to the pain experience extending the meaning of pain to more than just sensory stimulation and sometimes beyond the existence of actual sensory stimuli, as in phantom limb pain (Loeser & Melzack, 1999; Melzack, 1990). Emotions, attention, culture, prior pain experiences, and learned behaviors can activate descending efferent nerve fibers and exert control over sensory input (Melzack, 1982; Melzack & Wall, 1965, 1983). Some emotions, such as anxiety, can keep the gate open to painful stimuli (Davis, 1993; Melzack & Wall, 1965, 1983) and might interact with the effectiveness of a pain treatment. Multiple pain treatments can change the inputs, influence the neuromatrix, and modify the output of the neuromatrix (Loeser & Melzack, 1999).

Transmitters and receptors. Neurotransmitters, such as monoamines (dopamine, noradrenalin, serotonin), substance P, corticotropin-releasing factor, and endogenous opioids (endorphins and enkephalin) also play a role in descending pain control (Sluka & Rees, 1997; Stamford, 1995). The three main neurotransmitters involved in the process of descending inhibition of pain are noradrenalin, serotonin, and endogenous opioids. Noradrenalin’s action is inhibitory upon nociceptive transmission; spinal adrenoreceptors mediate inhibition of ascending spinal nociceptive cells. Serotonin, acting as an inhibitory transmitter, is involved in central-induced analgesia. The endogenous opioids affect both ascending and descending mediation of pain at the brainstem and spinal cord levels. For example, endorphins,
released by a signal from the brain, are believed to alter the nociceptor impulses by binding to specific opioid receptors in the brain and spinal cord and blocking the transmission of the pain impulse.

Gamma-aminobutyric acid (GABA) is also involved in descending control at both the brainstem and spinal levels (Dickenson, 2002). Additionally, calcium channels release peptides and glutamate, the major transmitter in afferent A and C fibers, into the spinal dorsal horn during inflammation leading to activation of glutamate receptor sites, which contributes to prolonging and amplifying incoming pain impulse transmission through increased spinal neuronal response. The gate control theory provides a foundation for understanding roles of transmitters and receptors in pain perception and subsequent treatment.

**Brain mapping.** Research in recent years has been conducted to study the areas of the brain associated with the sensory, cognitive, and affective dimensions of pain, as well as the effects of attention, distraction, imagery and other pain treatments on pain perception. Through the use of positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), "brain mapping" is underway allowing researchers a picture of the pain neuromatrix. In one study, subjective pain reports were correlated with blood flow changes in various areas of the brain during an acute pain experience (Derbyshire et al., 1997). As the pain intensity increased, an increasing number of brain areas became active while others became less active. Rather than one central pain center in the brain, these findings and others suggest that cognition, attention, motor function, emotionality, and sensory localization are interrelated and incorporated in pain processing throughout a network of brain regions, including
primarily the anterior cingulate cortex (ACC), as well as the insula, primary and second somatosensory cortices, posterior parietal and prefrontal cortices, thalamus, periaqueductal grey, amygdala, and cerebellum (Davis, 2000; Derbyshire et al., 1997; Helmchen, Mohr, Erdmann, Petersen, & Nitschke, 2003; Petrovic, Petersson, Hansson, & Ingvar, 2002; Peyron, Laurent, & Garcia-Larrea, 2000). Also, pain-related anxiety demonstrated increased pain intensity and activation of the hippocampus (Ploghaus et al., 2001).

Activation of brain regions in response to pain suggests that these brain responses reflect simultaneous sensory, cognitive, and affective dimensions of pain and pain control (Petrovic et al., 2002; Peyron et al., 2000). Many of the same areas of the brain respond both to pain itself as well as pain treatment. Additionally, areas of attentional control overlap with pain regions.

Studies have explored brain areas involved in cognitive demands during pain experiences (Petrovic & Ingvar, 2002). Various areas of the brain have been activated or deactivated by increased or decreased attention toward pain. In one study, hypnotic suggestions, but not hypnosis induction, altered perception of pain affect and activation within some pain-related brain areas (Rainville, Duncan, Price, Carrier, & Bushnell, 1997). The researchers proposed that the anterior cingulate pain-related activation is linked to emotional and behavioral reactions to pain. In another study, pain intensity and pain unpleasantness perception were rated lower during a memory-demanding, attentional task while certain brain areas demonstrated increases or decreases in activity in relation to pain and performance of the attentional task (Petrovic, Petersson, Ghatan, Stone-Elander, & Ingvar, 2000).
Specifically activation in the periaqueductal grey increased during distraction from pain versus attention to the pain, which correlated with decreased pain intensity perception suggesting that this area is involved in descending pain control (Tracey et al., 2002). Attention directed away from painful stimuli by a cognitive task resulted in modulation of pain indicated by lower self-report pain intensity with increased activation of the cognitive division of the ACC and orbitofrontal cortex and significant decreased activation of the affective division of the ACC, thalamus, and insula; in contrast the hippocampus was activated during attention to the painful stimuli (Bantick et al., 2002). Regions of the ACC are involved in both pain and attentional processes (Frankenstein, Richter, McIntyre, & Remy, 2001).

Areas of the brain, which are active during the baseline awake brain state to monitor the environment and gather information, have shown a reduction in activity as the focus of attention on centrally-presented stimuli increases (Raichle, 2000) or in anticipation of pain (Porro et al., 2002). The changes in the brain related to anticipation of pain suggested top-down, attentional mechanisms rather than diffuse arousal were involved and were not explained by conditioning or memory. Decreased anxiety associated with task performance has also resulted in less brain activity in these regions. Furthermore, changes in brain activity were correlated with improved task performance. In a study of pain interrupting cognitive task performance, various areas of the brain activated during task performance demonstrated increased activity when pain was introduced, including areas that are not part of the pain matrix (Remy, Frankenstein, Mincic, Tomanek, & Stroman, 2003). These changes could reflect additional effort necessary to focus on and perform the task in the presence of pain.
This knowledge has implications for studies of pain, anxiety and other emotions, in understanding the multidimensionality of pain, as well as distraction, imagery and other nonpharmacologic interventions to alleviate pain. With more attention devoted to the processing of the distraction intervention during the painful procedure in this current study, less monitoring of the environment and attending to the pain was proposed. Participants with less anxiety were expected to report even greater attending to the distraction intervention.

In summary, by reducing anxiety through increased knowledge and control over the painful experience, inhibitory signals from the central control system can close the gate to pain perception (Davis, 1993). Developmentally-appropriate information provided prior to a painful procedure has been suggested to help reduce anxiety by eliminating fear of the unknown (Broome, 1990; McCarthy et al., 1996). However, focused attention on the source of the pain continuously during the painful procedure might increase the pain perception by increasing attention to the painful stimulus. As the pain rises during the painful event by increasing attention to the painful stimulus, so too anxiety might rise leading to even increased pain perception. Developmentally-appropriate strategies are needed to decrease anxiety and the perception of pain experienced during the procedure (Broome, 1990; McCarthy et al., 1996). By providing a combination of interventions: information before the painful procedure to decrease anxiety and distraction during the procedure to decrease attention to the painful stimulus, pain associated with the procedure can be ameliorated. Competing, descending impulses, such as through distraction during the painful event, may divert the adolescent’s attention away from the painful stimulus.
and decrease pain perception as the efferent nerve impulses close the gate to the incoming painful impulses.

Central Control Trigger:
Diverting attention through distraction:
Competing Stimuli

Large Diameter Fibers:
No Competing Stimuli

Gate Control System:
Gate Closed → Decreased Pain Perception

Small Diameter Fibers:
Pain stimuli from allergy skin testing procedure

Figure 2. The Gate Control Theory: Mediated Painful Stimuli

Framework for Distraction

Distraction is a deliberate or unconscious redirecting or diverting of attention from a central task that serves to focus the individual’s attention, such as pain perception, to another unrelated activity or situation (McCaul & Malott, 1984). Avoidance of attending to the central task, such as pain, serves to distract the self from awareness of the task. This diversion from awareness of the task allows for a partial disconnection of the self from the reality of the situation. Furthermore, attentional capacity is limited; therefore, as distraction competes for part or all of that attention, less focus, attention and concentration are available for the central task, i.e. pain. However, distraction, as an acute procedural pain management intervention, could also be viewed as engagement in a central task. Upon the initiation of a painful stimulus, attention could be so focused on the central task such as, listening to music, that less attending to the pain occurs. Less attentional capacity might be available to direct the person away from this central task to the pain as distractor.
As a pain control measure, distraction is “an active process of diverting attention from the hurt, pain, fear, and anxiety to something incompatible with those experiences” (Blount, Schaeen, & Cohen, 1999, p.151). Eccleston (1995a) suggests that since pain processing is a conscious, controlled attentional task, tasks competing with it must demand higher controlled attention in order to block pain processing. Exploring the theoretical basis for the effectiveness of distraction as an intervention to reduce acute procedural pain is useful in understanding the results of research studies and in explaining the benefits of distraction to nurses in clinical practice.

A theoretical framework for the effectiveness of distraction as a pain reduction intervention has been proposed by McCaul and Malott (1984). Based on a sensory-affect model of pain, this framework proposes that cognitive interpretation of the painful stimuli is a determinant of the degree of distress perceived. Since the pain experience depends on information processing, distraction may interrupt this process. Distraction is defined in this framework as a directing of one’s attention away from sensations or emotional reactions produced by noxious stimuli and blocking of one’s awareness of the painful stimulus and its effects. The framework proposes four principles related to distraction and pain.

The first two principles concern the effect of distraction on distress and the concept of attentional capacity. McCaul and Malott (1984) propose that these principles are based on the premise that pain perception is a controlled, not automatic, process. In other words, pain perception is a result of not just sensory stimuli but includes an affective component. Thus, the brain’s controlled processing of pain is a vital part of the pain perception not just the automatic process of nerve impulse
transmission. Distraction, too, involves controlled processing and must require enough of one's attentional capacity, leaving less capacity for controlled processing of pain.

Thus, the first principle concludes that distraction through performance in an attentionally demanding task will result in less distress to a painful stimulus. The second principle states that distraction strategies requiring greater attentional capacity will be more effective. Bush (1987) recommends engaging all senses when employing distraction as an intervention to reduce pain.

Attentional capacity implies a limit to the attention that is available to be directed to a task. Performing one task interferes with the performing of the other when the same attentional pathways are shared (Ruff & Rothbart, 1996). McCaul and Malott's theoretical framework of distraction in reducing pain is based on this dual-task theory of attention. Distraction may be effective in altering pain perception as it competes with nociceptive input for limited attentional capacity (Eccleston, 1995b). By denying the allocation of attentional resources to nociception as the individual engages in a distraction task, pain could be displaced from awareness. Focused attention on the distractor is desirable to promote sustained engagement with the task throughout the painful procedure.

However, because focused attention is rarely complete, distraction may not always be completely effective. The third and fourth principles of the McCaul and Malott framework are based on the limitations inherent in attentional capacity. According to McCaul and Malott (1984), pain stimulus intensity can lessen one's focused attention on the distraction task, draw attention from the distractor, and decrease effectiveness of the distraction. Other cognitive-behavioral strategies might
be needed when attention shifts from the distraction task to the painful stimulus. The third principle then argues that distraction is a more effective intervention with painful stimuli of low intensity. Arntz, Dreessen, and DeJong (1994) agree, noting that distraction might even become impossible with very intense pain. The fourth principle proposes that distraction will be more effective than sensation redefinition with mild pain with the reverse being true for intense painful stimuli (McCaul & Malott, 1984).

In later research, McCaul, Monson, and Maki (1992) further proposed that arousal of pleasant emotions is an important component of distraction’s effectiveness. Pleasant distraction, possibly through a reduction in anxiety, has been suggested as more effective in mediating one’s response to painful stimuli than negative emotions. Eccleston and Crombez (1999) support the notion that pleasant images may have a positive effect on pain perception. They suggest that this occurs because affective responses congruent with the emotional state may be facilitated. Also, emotions, being powerful demands for attention, may displace pain from attention and reduce pain perception.

The effectiveness of distraction on acute pain perception in adolescents experiencing allergy skin testing was evaluated in the current study in relation to the first three principles of the McCaul-Malott framework. Additionally, use of a self-selected versus nurse-selected distraction intervention was evaluated for ability to remain engaged in the distraction and the effect on pain perception. The self-selected intervention was proposed to exert an optimal demand on attentional capacity and hold constant the variable of affect as the chosen distraction intervention was presumed to be one which is engaging for and enjoyed by the adolescent.
Developmentally, congruence exists between the adolescent's increasing attentional, information-processing capacity and use of a self-selected distraction intervention. Sustained attention and increased absorption in relevant tasks are noted in adolescence (Hamilton, 1983). Ability to allocate attention to task demands improves with increasing age of the child (Schiff & Knopf, 1985). Adolescents are able to focus their attention on relevant information despite distracting stimuli more than younger children. Yet, ability to filter out irrelevant, distracting information and keep attention focused on stimuli may not fully develop until early to mid-adolescence when the frontal cortex of the brain reaches adult-like synaptic density (Goldberg et al., 2001). The self-selected distraction intervention may be a more sophisticated distraction that involves more attentional focus and one that is well-suited for adolescence. Level of engagement in the distraction is important to examine in relation to pain perception. The emotional component of the pain response and attentional capacity of the distraction are considered by measuring anxiety and its effect on the distraction and pain perception. Furthermore, preferred coping style is important to consider as it relates to the desire to be distracted from the painful stimulus.

An Integrated Framework

The interface of these three theories provided a framework to guide this present study. Together the theories address the need to consider the multifaceted aspects of pain in adolescents when testing distraction’s effectiveness as a nursing intervention for acute procedural pain. The study examined the effects of a nursing intervention, distraction, which as a cognitive-behavioral strategy is consistent with the adolescent’s cognitive development, and specifically, self-selected distraction, which is consistent
with aspects of the adolescent’s psychosocial development (control and choice) on the outcome of reduced pain perception during the neurophysiological-sensory experience of allergy skin testing. The neurophysiologic features of painful nerve impulse transmission underlie all three theories. The belief that the pain experience is more than automatic nerve impulse transmission underlies all three theories.

As suggested by all three theories, cognitive and affective components, past experience, and attached meaning to pain, all influence the individual’s perception of the pain and were considered in the study. Activation of the brain’s central processing, such as through distraction, to lessen pain perception is suggested by both the gate control and distraction frameworks. Since maintaining a sense of self-control is an important developmental task of adolescence, distraction might offer the adolescent a way to increase self-control and reduce anxiety. The individual’s developmental level can influence the perception of the painful experience and ability to engage in the distraction activity. To be effective, the distraction needs to be attentionally demanding according to the distraction framework, thus one selected by the individual should be engaging and effective in lessening pain perception. The adolescent’s desire for control, choice, privacy, and independence influences the choice of distraction, thus promoting engagement in the distraction intervention and subsequently reducing anxiety, closing the gate to painful nerve impulses, and lessening pain perception.
CHAPTER III
REVIEW OF THE LITERATURE

The literature on pain in children is extensive and has grown considerably over the past three decades. The first published nursing research study on children’s pain in the early 1970’s (Schultz, 1971) began a pattern of examining the child’s pain experience. The research spanning the next thirty-plus years has provided insight into children’s pain perception, assessment of pain in children of various ages, and pharmacologic and nonpharmacologic management of children’s pain. The literature review for this study examines the specific issue of pain in adolescence; pain assessment in adolescents; pain related to the allergy testing procedure; nonpharmacologic interventions implemented with children and adolescents, specifically research on distraction as an intervention; the relationship of anxiety to acute pain and distraction; and the concept of attentional inertia.

Pain in Adolescence

Recent research has been conducted on a variety of pain-related topics in adolescents. Studies of pain in adolescents have reflected great diversity in research interests. These include factors associated with musculoskeletal pain (Eng & Pierrynowski, 1993; Feldman, Shier, Rossignol, & Abenhaim, 2002; Kimming, 1997; Niemi, Levoska, Kemila, Rekola, & Keinanen-Kiukaanniemi, 1996), prevalence of back pain among adolescents (Burton, Clarke, McClune, & Tillotson, 1996; Kimming, 1997; Kujala, Taimela, Oksanen, & Salminen, 1997; Kujala, Taimela, & Viljanen, 1999; Salminen, Erkintalo, Laine, & Pentti, 1995; Taimela, Kujala, Salminen, & Viljanen, 1997), psychosocial factors related to recurrent headache and abdominal pain.

These studies represent a wide range of current research interests utilizing adolescents as participants. Measurement of pain in these studies also varies and presents difficulty in comparisons of findings across studies. Various visual analog scales, researcher-developed questionnaires, and observation-physical evaluation techniques have been used for the most part to measure the pain experience of adolescents. Studies of pain have usually included adolescents in a broader age range rather than limiting the sample exclusively to adolescents. Specifically, the paucity of intervention studies and research of procedure-related pain exclusively in the adolescent population, like the recent study of an information and coping instruction
videotape intervention for adolescents’ postoperative pain and anxiety (LaMontagne, Hepworth, Cohen, & Salisbury, 2003), indicate the need for further investigation in these areas specifically studying adolescents as a unique population.

Pain Assessment in Adolescents

Adolescents are capable of describing pain, their feelings when in pain, and strategies to help relieve pain (Savedra et al., 1988). Savedra’s descriptive study of 156 adolescents ages thirteen to seventeen provided insight into the understanding of pain in this unique developmental period and offered a basis for the development of pain assessment techniques for adolescents. Pain perception has been measured in adolescents using a variety of assessment tools. The same tools that are used for clinical assessment of pain are used for measurement of pain in research studies. Acute illness or injury pain, procedural pain, postoperative pain, and chronic pain may be assessed using these measures.

Self-report is considered the “gold standard” of pain assessment and should provide the most accurate measurement of pain in adolescents (Franck et al., 2000). Pain intensity, a unidimensional aspect of the pain experience, has been measured using verbal rating scales including words such as “no pain,” “mild pain,” “moderate,” or “severe pain,” and using numeric rating scales, with scores from either 0 to 10 or 0 to 100 (Broome, 1991; Katz & Melzack, 1999). A visual analog scale (VAS) is usually a ten centimeter horizontal or vertical line with two end-points labeled “no pain” at one end and “worst pain” at the other end. A VAS can be utilized by older children and adolescents to measure other aspects of discomfort, such as anxiety and nausea (Merkel & Malviya, 2000).
Measures of pain intensity have been developed specifically for use with children and adolescents. The Oucher has been developed for use in children ages three to twelve years and has been tested for validity and test-retest reliability (Aradine, Beyer, & Tompkins, 1988; Beyer, Denyes, & Villarruel, 1992). Ethnic versions of the Oucher have been developed and tested for construct validity (Beyer & Knott, 1998). The Word Graphic Rating scale, the Wong-Baker FACES Rating Scale (Wong & Baker, 1988) and the Coloured Analog Scale (McGrath et al., 1996) are other measures. In a study evaluating the reliability and validity of the Wong-Baker FACES Rating Scale and the Word Descriptor Scale, the tools were found to be valid and reliable for measuring pain intensity in children ages four through eighteen (Keck, Gerkensmeyer, Joyce, Schade, 1996). In studies comparing rating scales, children of all ages, including adolescents, preferred the FACES scale (Keck et al., 1996; Wong & Baker, 1988). Faces-type scales measure not only a sensory component of pain but also an affective component (Chambers & Craig, 1998; Chambers, Giesbrecht, Craig, Bennett, & Huntsman, 1999; McGrath et al., 1996). Children over the age of eight are capable of differentiating and rating the sensory and affective components of pain (Jedlinsky, McCarthy, & Michel, 1999).

Evidence exists for use of the visual analog scale (VAS) as a ratio scale measure of pain rather than an interval scale (Price, McGrath, Rafii, & Buckingham, 1983). A study using heat experimentation enabled a comparison of various temperatures of unpleasant sensation in terms of a ratio. The observed values coincided with the predicted values representing a true ratio scale. A ratio scale property of the scale enables meaningful comparison of pain ratings across different
groups of patients and even within one individual. A faces pain measure was also
determined to measure pain as a ratio scale in a study of children (Bieri, Reeve,
Champion, Addicoat, & Ziegler, 1990). Rank ordering of the faces as a measure of
pain severity was supported. The intervals between the faces were considered to be
close to equal thus providing initial support for the scale at a ratio level and enabling
parametric statistical analysis of the data.

School-age children and adolescents are capable of providing more detailed
ratings of pain intensity, location, and descriptions of pain quality (Franck et al.,
2000). Pain questionnaires, such as the Pediatric Pain Questionnaire, have been used
with older children and adolescents (Broome, 1991). A word descriptor list of words
that describe the quality of pain is included in the Adolescent Pediatric Pain Tool
(APPT), as well as a visual analog/Word Graphic Rating scale component to measure
pain intensity and a body drawing to measure pain location (Savedra et al., 1993;
Wilkie et al., 1990). The APPT, considered a multidimensional tool, has been tested
for reliability and validity and has been recommended for use in children and
adolescents ages eight to eighteen (Savedra et al., 1993; Savedra, Tesler, Holzemer,
Wilkie, & Ward, 1989; Tesler et al., 1991; Wilkie et al., 1990). The Pain Coping
Questionnaire has also been developed and validated for use with older children and
adolescents with recurrent pain (Reid, Gilbert, & McGrath, 1998). Although not a
measure of pain per se, pain coping has been related to pain intensity and emotional
distress.

Physiologic measures, such as heart rate, blood pressure, and oxygen
saturation, have also been utilized. However, these indicators vary among children and
are not pain-specific but also reflect arousal and anxiety due to stress (Katz & Melzack, 1999; Merkel & Malviya, 2000). These indicators should be used together with others, such as behavioral or self-report tools to assess pain. Behavioral indicators have also been used to assess pain, usually in the young preverbal child, but limitations exist. While behavioral signs are useful adjuncts to self-report and can assist with assessment in the non-verbal patient, one must remember that lack of behavioral indicators does not necessarily mean pain is absent. In addition, behavioral indicators may reflect emotional distress rather than pain (Franck et al., 2000; Tyler, Tu, Douthit, & Chapman, 1993). Tesler, Holzemer, and Savedra (1998) conducted a study to identify post-operative pain behaviors and examine the relationship between self-reported pain and behavioral distress in children and adolescents ages eight to seventeen. The results indicated low correlations between pain reports using the APPT and observed distress. This finding supports previous literature regarding weak relationships between observed distress and actual reports of pain in children. Several tools have been developed to measure behavioral observation of pain, such as the Children’s Hospital of Eastern Ontario Pain Scale (CHEOPS) (Tyler et al., 1993).

Several studies have described the testing of pain assessments tools for use specifically in adolescents. A unique instrument, the Gaston-Johansson Pain-O-Meter, was used to measure the sensory, affective, and intensity components of labor pain in adolescents (Sittner et al., 1998). This objective, reliable measure of pain was recommended for assessing labor pain in adolescents. The APPT was used to measure post-operative pain of adolescents in several studies (Gillies et al., 1997, 1999, 2001; Kotzer, 2000). A large study, $N = 351$, produced normative data for use of the APPT.
in the United Kingdom (UK) and was the first in the UK to report on postoperative adolescent pain (Gillies et al., 1999, 2001). The results revealed that the adolescents had poorly managed postoperative pain and supported the use of the APPT as a valid, reliable measure of pain. In Kotzer's study, post-operative spinal fusion pain did not change significantly over the four day period. The researcher speculated that the APPT may not be sensitive enough to detect subtle changes in the more severe, persistent pain following spinal surgery. Another study examined chronic back pain in sixteen-to eighteen-year-old adolescents and measured pain on a VAS (Staes, Stappaerts, Vertommen, & Nuyens, 2000). An individual horizontal VAS was paired with each of fourteen exertions and movements/positions to determine the perceived influence of those factors on back pain. The results suggested that the VAS was a reliable measure of factors affecting back pain in adolescents.

Recent studies have explored the issue of pain assessment in individuals who are cognitively impaired or unable to communicate verbally (Breau, McGrath, Camfield, Rosmus, & Finley, 2000; Fanurik, Koh, Harrison, Conrad, & Tomerlin, 1998). Preliminary support for the validity and reliability of the Non-Communicating Children's Pain Checklist has been suggested (Breau et al., 2000). A simple numeric rating scale from zero to five was tested in children with cognitive impairment and found to be useful in assessing pain in some of the impaired children (Fanurik et al., 1998).

A survey of nursing practice related to assessment and management of pain in children and adolescents revealed that only 47% of nurses used a numeric rating scale, the most commonly used tool for assessing pain (Jacob & Puntillo, 1999).
Furthermore, one-third of the nurses indicated that they were not using any assessment tool at all. Eighty percent of the nurses reported using behavioral indicators such as crying, vocalization, irritability, screaming, and verbal expression as evidence of pain. Almost 60% of nurses said they used physiologic changes, the second most commonly reported method of identifying pain. Another study found only 36% of nurses stated they used a pain scale specific for children (Colwell, Clark, & Perkins, 1996). These findings are inconsistent with the empirical evidence that psychometrically sound measurements of pain in children and adolescents are available for clinical use. Studies have also demonstrated inconsistency between children’s pain ratings and nurses’ ratings of the child’s pain (Colwell et al., 1996; Demyttenaere, Finley, Johnston, & McGrath, 2001; Romsing, Moller-Sonnergaard, Hertel, & Rasmussen, 1996; Schneider & LoBiondo-Wood, 1992). The inability of nurses to accurately assess children’s pain perception begs for the use of an objective, developmentally-appropriate, measurement tool to better assess and manage pain.

**Pain Associated with Allergy Skin Testing**

The literature on pain associated with allergy skin testing is sparse and what little exists excludes adolescents. Studies of the use of a pharmacologic agent during allergy testing suggest that pain, as measured by pain scales, is a phenomenon associated with the experience (Sicherer & Eggleston, 1997; Wolf et al., 1994). Pain and apprehension associated with intradermal skin testing have led to hesitancy among some parents to consent to their child’s allergy testing (Wolf et al., 1994). This hesitancy to undergo the skin testing can then interfere with the diagnosis and treatment of the allergic condition. Undiagnosed and untreated allergic respiratory
conditions can contribute to chronic nasal inflammation and obstruction, otitis media, permanent changes in the respiratory tract mucosa, and remodeling of the airways leading to reduction in quality of life and expense related to missed school and work time (Ferguson, 1997; Opperwall, 2000). Therefore, implementation of nursing interventions that reduce acute pain during the allergy testing is important to promote agreement and willingness among patients to undergo the testing procedure.

Two studies reported a reduction in pain associated with allergy testing using a pharmacologic agent, EMLA cream. In a study of forty children ages one to nine years undergoing intradermal allergy testing, EMLA was applied prior to allergy testing (Wolf et al., 1994). The EMLA cream was applied in a two millimeter layer and covered with a bio-occlusive dressing or plastic wrap one hour before the initiation of allergy testing. Results indicated that EMLA was a safe, effective method of reducing pain associated with allergy testing in patients one month of age and older. In a study of adults experiencing allergy testing, EMLA cream was again found to significantly reduce pain ratings associated with the procedure (Sicherer & Eggleston, 1997).

While EMLA significantly reduced pain associated with allergy testing, concerns were raised about interference with the allergy test results. Specifically, reduction in flare response to the allergen was found when using the EMLA cream indicating the possibility of false negative responses to the tested allergens (Sicherer & Eggleston, 1997). Additionally, reactions to the EMLA cream or bio-occlusive dressing are concerns (Wolf et al., 1994). In another report unrelated to allergy skin testing, one patient with postherpetic neuralgia developed allergic contact dermatitis
following EMLA cream application (Thakur & Murali, 1995). These concerns have precluded widespread routine use of EMLA cream during allergy skin testing.

With the incidence of allergic response to EMLA, reduction in the flare response to the allergens when using EMLA, and subsequent interference with the allergy test results, nonpharmacologic interventions could offer pain reduction without the adverse effects of a pharmacologic agent and interference with the test results. Yet, no investigations of nonpharmacologic interventions during the allergy skin testing procedure have been undertaken.

**Nonpharmacologic Interventions for Adolescent Procedural Pain**

While several nonpharmacologic interventions, such as distraction, imagery and cold application, have been studied recently in children and adolescents undergoing various healthcare procedures, e.g. venipuncture, lumbar puncture, cardiac catheterization, and injections (Broome et al., 1992; Ebner, 1996; Pederson, 1995, 1996b; Vessey et al., 1994; Wint, Eshelman, Steele, & Guzzetta, 2002), none of these interventions have been studied during allergy testing, which differs from the other procedures because it requires the application of multiple, sequential, repetitive painful stimuli. Several studies of nonpharmacologic interventions have included adolescents, but few have been devoted exclusively to adolescents. Age-related differences in reports of pain have been found (Carlson et al., 2000) as well as differences in treatment effects (Vessey et al., 1994). In contrast, no age-related treatment effect was found across one particular developmental level, the preschooler stage (Sparks, 2001). The uniqueness of adolescence, a developmental level bridging childhood and adulthood, may require unique strategies to reduce pain, especially techniques chosen
by the individuals themselves. Overall, studies of nonpharmacologic interventions have had inconsistent results.

A review of nonpharmacologic interventions found general support for use of these strategies in reducing pain in children and adolescents but recommended further research be conducted (Carlson, 1996). Six of the twenty reviewed studies included adolescents in the sample, but none of the studies were devoted exclusively to adolescents. Additional research on adolescents, as well as on infants and toddlers, was recommended. Carlson suggested that focusing attention away from the painful event reduces distress and pain perception. The findings of this review support the results of an earlier meta-analysis conducted by Broome, Lillis, and Smith (1989), which found significant relationships between nonpharmacologic interventions and pain reduction using behavioral, self-report, and physiologic pain measures.

Self-initiated nonpharmacologic strategies implemented by adolescent females for reducing menstrual discomfort were also studied (Campbell & McGrath, 1999). In a sample of 289 adolescents, 98% reported using at least one nonpharmacologic method. The methods were either recommended by a friend, parent, the media, or self-discovered. Rest and heat were the two most commonly used physically-oriented methods, while distraction and ignoring were the two most common psychologically-oriented methods.

Hypnosis has been identified as helpful in reducing pain and distress associated with painful procedures. In a review of research on hypnosis, Rape and Bush (1994) found this strategy useful in decreasing pain associated with lumbar puncture or bone marrow aspiration in pediatric oncology patients. Zeltzer and LeBaron (1982)
compared the effectiveness of hypnosis and nonhypnotic techniques, including deep breathing and distraction, on reduction of pain and anxiety associated with bone marrow aspiration and lumbar puncture in 33 children and adolescents ages six to seventeen diagnosed with cancer. Pain and anxiety, each self-rated on a scale of one to five, were significantly decreased by hypnosis. Kellerman, Zeltzer, Ellenberg, and Dash (1983) found significant reductions in pain and anxiety among adolescents ($N = 16$) using hypnosis during painful procedures. Another study compared two types of hypnosis: direct versus indirect suggestion in 30 children and adolescents with cancer ages six to sixteen and found significant reductions in pain and anxiety in both groups (Hawkins, Liossi, Ewart, Hatira, & Kosmidis, 1998). Children were classified as low- or high-hypnotizable; hypnotizability was related to the treatment outcomes. In a larger study of 80 children and adolescents with cancer undergoing repeated lumbar punctures, Liossi and Hatira (2003) again found less pain and anxiety following direct and indirect hypnosis interventions with a trained therapist.

Relaxation and imagery were taught to fourteen children and adolescents ages three to fifteen years prior to lumbar puncture (Broome et al., 1992). Children reported consistently lower pain ratings over time as measured by the Wong-Baker FACES Pain Rating scale. In a subsequent study, 28 children and adolescents ages four to eighteen years were taught relaxation, distraction, and imagery for at-home practice prior to lumbar puncture (Broome et al., 1998). Pain perception, as measured by the Oucher pain scale, decreased following the instruction intervention. However, actual use of the nonpharmacologic interventions during the procedures was not evaluated in these studies. In comparison, no statistically significant effects of imagery and
presence were found in a study of 24 children and adolescents ages nine to seventeen years during cardiac catheterization (Pederson, 1995). Lack of consistent pain measures across these studies, as well as small sample sizes, which may have contributed to non-significant findings, limit comparison and generalizability of the findings.

Hand-holding was explored as a coping strategy for twenty adolescents experiencing cancer treatment pain (Weekes et al., 1993). This qualitative study, using a grounded theory methodology, revealed amelioration in pain through hand-holding, preferably mother's, by reducing tension, providing a sense of security, and acting as a distraction. Another qualitative study found that focused parental attention on the child by talking with the child rather than talking around or using small talk had a positive effect on reducing distress during a painful procedure (Naber, Halstead, Broome, & Rehwaldt, 1995). This study used an ethological approach with a group of seventeen children ages four to eighteen years undergoing diagnosis and treatment of leukemia. The researchers suggested that preparation of parents regarding their specific interactions might help the child to cope more effectively.

Application of ice prior to intramuscular injection in 40 injured adolescents aged ten to eighteen years did not reduce injection pain perception (Ebner, 1996). However, distraction from the injection pain was indicated by lower mean pain scores during the simultaneously-performed suturing procedure.

Transcutaneous electrical nerve stimulation (TENS) has been tested during dental procedures and venipuncture. Twenty children and adolescents ages eight to fourteen years were randomly assigned to either an experimental or placebo TENS
group during dental cavity repair preparation (Harvey & Elliott, 1995). Lower pain ratings as measured by a visual analog scale were found in the TENS group. Dental treatment was interrupted in the placebo group due to reports of discomfort. In a much larger study of 514 children and adolescents ages five to seventeen years, TENS was tested against a placebo TENS and a control group during venipuncture (Lander & Fowler-Kerry, 1993). Despite a very large sample, only a small effect size was found. While less pain was reported by children using TENS as measured by a visual analog scale and the Faces Affective Pain Scale, the results, although statistically significant, were not considered clinically significant due to the small effect size. A significant effect of age on the pain ratings was found; pain scores declined progressively with increasing age.

Another early dental study investigated use of an audio-analgesia device among 138 children ages eight to fourteen years during dental procedures (Howitt, 1967). Six groups: music, white sound, white sound with suggestions of analgesia, music with suggestions of analgesia, music-white sound-suggestion combined (all controlled by the child), and control, were compared on pain response threshold and pain tolerance threshold. No differences were found in the combined group over the other groups. The author concluded that suggestion was responsible for the analgesia but had no effect on physiologic measures. Music with suggestion of analgesia had a significant effect on both tolerance and threshold.

Music therapy with imagery and deep breathing was studied for its effect on burn treatment pain in a sample of 25 patients from seven to 83 years of age (Fratianne et al., 2001). The patients acted as their own control group by alternating music
therapy days with no music days. Repeated measures analysis of variance (ANOVA) found a significant decrease in self-reports of pain using the Wong-Baker FACES scale and a visual analog scale before debridement and overall between pre- and post-treatment measures. The investigators suggested that the music therapy became less effective with the increased pain intensity of the debridement process.

Preparation programs implemented prior to lumbar puncture have been tested with small samples of children and adolescents. Thirty children and adolescents ages four to seventeen years (Mansson, Bjorkhem, & Wiebe, 1993) and eight children and adolescents ages six to fourteen years were studied in separate investigations (Pederson, 1996b). Perception of pain as measured by a visual analog scale was not significantly different among the groups. A limitation of these studies of cognitive strategies is the small sample size which may have resulted in low power to detect a significant main effect.

The research on pediatric pain management has evolved to the current level of testing interventions. Unfortunately, most of the studies of nonpharmacologic interventions included small sample sizes and as a result of low power, may not have demonstrated statistically significant findings. None of the nonpharmacologic intervention studies examined pain perception in adolescents during the application of multiple, repetitive, sequential painful stimuli. Testing the effectiveness of distraction in adolescents exclusively during the multiple, repetitive nature of allergy skin testing is an important next step in building nursing science.
Distraction and Acute Procedural Pain

Distraction is one nonpharmacologic nursing intervention recommended for use in managing acute procedural pain (McCloskey & Bulechek, 1996). Through distraction, by removing or shifting the focus from the painful stimulus to other internal or external stimuli (McCaffery & Beebe, 1989), acute pain perception is decreased. Attention to the pain is diverted away by attending to other stimuli. A variety of activities are considered useful as distractions, such as music, play, listening to a story, television, reading, singing, and counting (Mobily et al., 1993; McCloskey & Bulechek, 1996).

Clinical studies. Several studies have found distraction to be an effective intervention in reducing pain perception and distress in children and adults during painful healthcare procedures (Cason & Grissom, 1997; Fowler-Kerry & Lander, 1987; Sparks, 2001; Vessey et al., 1994), yet the results of studies have been equivocal. Little has been studied on implementing distraction exclusively with the adolescent population, which is a unique developmental stage between childhood and adulthood. No studies tested distraction during the commonly performed allergy skin testing procedure. Moreover, no investigations evaluated use of a self-selected distraction intervention versus a nurse-selected one.

In a systematic review of research, Powers (1999) found support for use of cognitive-behavioral therapies, including distraction, for procedure-related pain in children and adolescents and called for more research on application of these interventions as a package either alone or combined with pharmacologic interventions. Some of the reviewed studies utilized very small sample sizes, $N = 3, 4, \text{ or } 5$, and only...
four of the thirteen studies included adolescents. Some studies used distress rather than self-report pain as the dependent variable. Similarly, Lambert (1999) concluded in her review of the literature on distraction, imagery, and hypnosis interventions for managing children’s pain that research supports age-appropriate distraction to reduce pain. She noted that guided imagery and hypnosis are more advanced techniques requiring specialized training but that distraction is a simple intervention that should be incorporated into nursing care of children. More research was recommended to determine which distraction techniques are appropriate and effective for different age groups.

In addition, Kleiber and Harper (1999) conducted a meta-analysis of 26 investigations that studied the effect of distraction on children’s perceived pain and behavioral distress during healthcare procedures. The researchers deliberately chose studies of children from infancy to age twelve years. Two of these studies included adolescents but had mean ages of 6.6 years (Broome et al., 1992) and 10.75 years (Smith, Ackerson, & Blotcky, 1989). Kleiber and Harper (1999) reported overall effect sizes as .62 for pain and .33 for distress indicating that distraction significantly decreased self-reported pain and observed behavioral distress in the sample studies. However, the combined sampling and measurement errors for each were high: almost 35% for pain and 74% for distress. The unexplained variance was speculated as related to moderator variables, such as inconsistencies in the distraction interventions, temperament of the child, prior negative healthcare experiences, and other variations in individual characteristics.
One of the distraction studies in Kleiber and Harper's meta-analysis that included adolescents explored the relationship of fear, behavioral distress, and pain perception in fourteen children undergoing lumbar puncture before and after being taught relaxation and distraction skills (Broome et al., 1992). Pain ratings using the Wong-Baker FACES Scale decreased significantly over time for three consecutive lumbar punctures in twelve of the fourteen participants; two participants' pain ratings remained the same ($t = 3.21, p = .008$). This study did not assess the child's actual use of the interventions during the lumbar puncture but inquired about the practicing of the recommended strategies. It is unclear whether the children actually used the interventions during the lumbar puncture procedures.

In order to evaluate the influence of specific variables on the effectiveness of relaxation, distraction, and imagery in reducing pain perception and behavioral distress during painful procedures, Broome et al. (1998) studied temperament, practice time, preference for an intervention, and perceived effectiveness of the intervention. The sample consisted of 28 children ages four to eighteen years who were taught and practiced distraction, imagery, and relaxation for use during lumbar puncture after initial baseline measures were taken. Again, actual use of the interventions during the procedure was not observed. Significantly lower pain reports using the Oucher pain scale were found over a five month period, $F (1, 27) = 13.05, p < .01$, between pre-(baseline) and post-treatment. In addition, the effectiveness of practicing the interventions was significantly related to decreased pain scores ($r = .52, p < .05$).

While the dimensions of temperament: positive mood, lower activity, less persistence, and lower distractibility were correlated with self-report of pain at baseline, only the
positive mood correlation was sustained over the five month period. The researchers concluded that temperament, as currently defined and measured, may not be a useful predictor of response to nonpharmacologic interventions designed to reduce procedural pain.

Two studies examined the utilization of parents as providers of the distraction intervention (Cavender, Goff, Hollon, & Guzzetta, 2004; Kleiber, Craft-Rosenberg, & Harper, 2001). Parents were instructed and encouraged to engage their preschool or school-age child in distraction during venipuncture or intravenous insertion. Neither study found significant differences between the distraction group and the control group on self-report pain as measured by the FACES or Oucher scale. Sample sizes were almost identical; 43 and 44 respectively.

Studies have evaluated the actual use of a distraction intervention with children during various painful healthcare procedures. The effectiveness of distraction with a kaleidoscope on reducing pain perception during venipuncture was investigated in a study of 100 children ages three to twelve years (Vessey et al., 1994). Age was found to be a significant covariate as a result of multivariate analysis of covariance (MANCOVA), \( p < .001 \). The researchers reported a significant difference between the intervention and control groups on pain ratings using the Wong-Baker FACES Pain Rating Scale and behavioral distress using the CHEOPS. Although the pain rating and distress scores were correlated \( (r = .63, p = .01) \), additional post-hoc testing indicated that while the groups differed on the FACES pain ratings \( (F(1, 95) = 11.50, p = .001) \), the CHEOPS distress scores did not add significantly to differences between the two groups.
Yet, no significant effect was found on pain ratings in children in a large, multi-site replication study involving use of a kaleidoscope during venipuncture or intravenous insertion (Carlson et al., 2000). The investigators suggested several possibilities for the lack of significant findings. The kaleidoscope might not have been a powerful enough distractor to capture and hold the attention of the participants who were seen in busy emergency departments. Emotions associated with the nature of the environment might have interfered with the children’s ability to attend to the distraction. Also, children with chronic illness were included in the sample. These children might have developed other coping strategies which negated the use of the distraction. In addition, since nurses in some of the sites used distraction as part of their “usual care,” only small, if any, differences between groups would be found. The researchers noted that the nature of a large, multi-site study presents difficulty with standardizing interventions, as well as variation in treatments, which could interfere with results.

Studies of distraction during routine immunization injection in infants (Cohen, 2002) and preschoolers (Bowen & Dammeyer, 1999; Cassidy et al., 2002; Cohen, Blount, & Panopoulos, 1997; French et al., 1994; Gonzalez, Routh, & Armstrong, 1993; Manimala, Blount, & Cohen, 2000; Sparks, 2001) have found equivocal results. Cohen reported less infant pain distress as measured by the Modified Behavior Pain Scale, based on the CHEOPS to assess infant injection pain, in the distraction group than the typical care group. No significant differences were found between two distraction groups for pain using the FACES pain scale, Child Facial Coding System, and CHEOPS in a study of five-year-olds receiving routine immunization injections.
(Cassidy et al.). While Gonzalez et al. found less behavioral distress exhibited by the distraction group than the reassurance or control groups, only amount of crying was determined to be the differing behavior. Oucher scale self-report pain ratings and modified Frankl Behavior Rating scale ratings measuring behavioral distress were not significantly different among the groups. Manimala et al. found that the reassurance group required more restraining and exhibited more fear during the injection procedure than the distraction group. Significantly more verbal pain as measured by the Child-Adult Medical Procedure Interaction Scale-revised (CAMPIS-R) was expressed by the children in the control group than by the distraction group.

Three studies used a variation on blowing to distract preschool children from immunization injection pain. In one study, children who were instructed to deep breathe and blow out during the injection had significantly lower behavioral distress scores but not significantly lower self-report pain scores using a visual analog scale (French et al., 1994). Sparks (2001) tested bubble-blowing and touch during immunizations with preschool children and found both distraction techniques significantly reduced self-report pain scores using the Oucher scale. While both treatment groups had significantly lower pain scores than the control group, no significant difference was found between bubble-blowing and touch. In another study, a party blower resulted in significantly less self-rated distress than either a pinwheel or control group in preschoolers receiving immunizations (Bowen & Dammeyer, 1999). The results of these various injection-related studies represent the difficulty in making comparisons across studies when different measures of pain, self-report and behavioral distress, are used to measure the effectiveness of the distraction treatment.
Music is a common medium for distraction; but disparity exists in the findings of studies involving music as a distraction. Music distraction was found to be effective in reducing pain among children ages four to seven years during routine immunization injections (Fowler-Kerry & Lander, 1987). Five groups were tested with either music, suggestion, or both; two control groups were also included. The music group listened to child-suitable, novel music through a headphone. Age was again an important covariate; older children benefited more from the distraction. Pain ratings using a block-designed four-point visual analog scale were significantly lower in the music distraction group, \( F(3, 95) = 4.20, p = .007 \). Suggestion alone and combined with the music had no effect on pain ratings. Malone (1996) also found positive findings with use of music during a variety of needle insertions (venipunctures, heelsticks, intravenous insertion, and injections). Children under the age of seven were divided into the treatment (live music sung by researcher accompanied by guitar) and usual care groups (no music). Significant differences were found in observed behavioral distress; no pain ratings were utilized.

Audiotaped lullabies used with children ages three to six years undergoing routine immunizations had no significant effect on self-reported pain using the Oucher scale or on physiologic measures: heart rate and blood pressure, but did significantly reduce behavioral distress (Megel et al., 1998). The investigators noted that venipunctures and fingersticks that had been performed on the children before the immunization administration but without the benefit of distraction might have interfered with the study’s results. No significant differences in self-reported pain on a numeric scale were found among two music distraction groups and one control group.
of preschoolers undergoing restorative dental treatment (Aitken, Wilson, Coury, & Moursi, 2002). The researchers reported that perhaps the outcome was affected by not allowing for a choice in the music selection.

In contrast to these studies, music distraction was compared to EMLA cream in reducing pain during preoperative intravenous cannulation in a study of children and adolescents ages four to sixteen years (Arts et al., 1994). Music distraction had no significant effect on pain ratings using the Faces Pain Scale and a visual analog toy. In particular, no significant differences were found between the use of EMLA and the music distraction in the adolescent age group. In addition, younger children reported higher pain scores for both interventions.

None of the research on distraction specifically sought to investigate the effectiveness of a self-selected distraction strategy chosen by the participant compared to that chosen by the nurse. Some studies incorporated aspects of self-selected distraction by allowing children to choose from a selection; however, the distraction was not compared to a nurse-selected distraction. Supporting the Arts et al. (1994) study, distraction by videotape was found to be more effective and economical than EMLA cream in reducing distress and improving coping among 39 fourth graders receiving immunization injections (Cohen et al., 1999). The nurse assisted participants with choosing the videotape and coached them throughout the viewing. Visual and verbal cues were provided to encourage viewing of the videotape. Nurse-coached and parent-coached distraction with a cartoon movie were equally more effective than standard care on pain and distress among preschoolers receiving immunizations (Cohen et al., 1997). Another study of cartoon movie distraction found no significant
difference on observed behavioral distress during burn dressing changes in children four- to twelve-years-old (Landolt, Marti, Widmer, & Meuli, 2002). Two groups served as their own controls by assignment to the treatment or no treatment group over six dressing changes. Children were allowed to choose between two different cartoon movies. In comparison to the music distraction studies, these studies used a distraction technique involving both visual and auditory stimuli. Bush (1987) has recommended using a distraction technique that engages multiple senses.

In a study comparing listening to an interactive storybook chosen by the child, watching a cartoon film chosen by the child, and a control condition, observer rating of the child's overall distress during cancer treatment was lower in the story condition using a repeated measures design (Mason, Johnson, & Woolley, 1999). Only seven children ages two and one-half to four and one-half years old participated in the study. Another study related to self-selection combined the use of distraction with EMLA cream during intravenous insertion in children ages two to sixteen (Fanurik, Koh, & Schmitz, 2000). The adolescents in the study listened to music of their own choice through a headset. Pain ratings were not significantly different between the two distraction/no-distraction groups or between the four age groups possibly due to the concurrent EMLA use. Behavioral distress ratings were significantly lower for the distraction group and younger children.

In another study comparing the effect of EMLA cream and distraction, all children, ages four to eight, received a distraction intervention before and during venipuncture and were randomized to either an EMLA or placebo cream group (Lal, McClelland, Phillips, Taub, & Beattie, 2001). The researchers reported that the low
pain scores in both groups and lack of significant difference suggest the effectiveness of distraction possibly without the need for EMLA. However, the sample size was small and may have resulted in inadequate power to detect a significant difference.

Two studies utilizing present-day technology tested interesting distractors. One study tested a virtual reality distraction to reduce chemotherapy-related symptoms while participants underwent intravenous chemotherapy administration (Schneider & Workman, 1999). Although this study did not measure pain as the dependent variable, the unique, interactive nature of the distraction intervention used with pre-adolescents and adolescents made it worthwhile to include in the literature on distraction. Only eleven participants were included in the sample. Participants chose from among three commercially-produced, CD-ROM-based, computer-simulated virtual reality scenarios. While wearing a headset, the participants interacted with the multi-sensory (visual, sound, touch) distraction throughout the chemotherapy treatment. Mean Symptom Distress Scale scores were significantly lower immediately after the intervention in the virtual reality group, but the effect was not sustained over three measures of time using repeated-measures ANOVA. Anxiety as measured by the State-Trait Anxiety Inventory for Children was not affected by the intervention.

The other study examined distress and use of an electronic, voice-activated toy robot that instructed the children ages three to seven to respond to developmentally appropriate tasks by pressing a button associated with the correct response (Pringle et al., 2001). The children received venipunctures or injections in the clinic or at home. Videotaped sessions recorded the child's distress as measured by the Observational Scale of Behavioral Distress. This study also examined engagement by measuring use
of the distractor coded as the child looking at the robot and pressing the buttons. The study employed a multiple baseline design as the sample size was small ($N = 8$), which limited comparison with a no-treatment group. Data analysis was reported qualitatively; the small sample prevented statistical analysis. This study was unique because engagement with the distraction was considered, a multisensory interactive distractor was used, and the distraction intervention was tested in the home environment.

Studies examining the use of distraction as a mediator of pain in the adult population have also reported conflicting findings. Cason and Grissom (1997) found in a study of adults ages 21 to 65 that distraction using a kaleidoscope during phlebotomy resulted in significantly decreased reports of pain using three measures of pain: the Wong-Baker FACES Rating Scale, a numeric visual analog scale (VAS), and the Present Pain Intensity (PPI) scale. Multivariate analysis of covariance found that the distraction group had a significantly lower pain rating than the control group, $F(3, 89) = 55, p = .00$; univariate analysis found a significant difference using the FACES and the PPI. In addition, participants reported that their attention was diverted from the pain through use of the kaleidoscope. The study secondarily found that the use of the FACES scale is a reliable, appropriate measure of pain in adults.

In contrast, another study of 60 adults undergoing cancer-related medical procedures found no statistically significant differences among three groups (Kwekkeboom, 2003). Participants were randomly assigned to one of three groups: a music, book-on-cassette, or usual treatment group. The music and book were chosen from a variety of selections prepared by the researcher. State anxiety, control over pain.
and anxiety, and pain intensity were measured. Post-procedural pain and anxiety scores actually favored the control group. Some participants indicated that they did not want to be distracted and instead wanted to attend to the procedure.

**Laboratory studies.** Several experiments conducted in a laboratory setting found no significant differences between various distraction groups or control groups on pain and distress levels (Duker, van den Bercken, & Fockens, 1999; Hodes, Howland, Lightfoot, & Cleeland, 1990; McCaul & Haugtvedt, 1982; McCaul et al., 1992). Small sample sizes of young adult college students were primarily utilized in the laboratory studies. McCaul and Haugtvedt (1982) conducted a series of experiments to study the differences between attending to the source of pain (based on the work of Leventhal) and distraction from the painful stimulus. The results indicated that distraction may be better for a brief or early period of pain suggesting the effect of distraction might be temporary. However, subjects from both groups reported that they preferred distraction over attending. Similarly, no significant differences were found between focusing and distraction on pain intensity ratings during delivery of electrical shocks (Duker et al., 1999). In two experiments using potassium iontophoresis, the distraction conditions increased pain threshold compared to no distraction (Johnson, Breakwell, Douglas, & Humphries, 1998). Non-significant findings between types of distractors did not provide support for the multiple-resource theory of attention, as predicted; however, low power (.21) may have prevented detection of a possibly existing significant effect.

Laboratory studies of cold-pressor pain have been common. Hodes et al. (1990) found contrary to their hypothesis, no significant differences between high- and low-
difficulty distractions on either pain ratings or pain tolerance. In four related experiments conducted in response to cold-pressor pain, the distraction tasks differed in attentional capacity (McCaul et al., 1992). In the first two experiments, the distraction tasks were considered affectively neutral. However, emotionality was added to the third experiment in support of reducing distress. The more difficult distracting tasks were expected to result in less distress. However, all four experiments failed to support the prediction. The researchers suggested that the more difficult distraction tasks or those more demanding of attention might be more arousing and through this increased arousal, may actually have increased perception of the painful stimulus. Of importance to note, the participants in the study were asked to provide a distress rating throughout the cold-pressor experiment while engaging in the distraction thus, diverting attention back to the painful stimulus. The focusing of attention back to the pain could have interfered with distraction’s effectiveness in this study.

The delayed effects of distraction were studied in another laboratory cold-pressor experiment with 72 undergraduate college students (Christenfeld, 1997). The benefit of distraction on reducing pain perception was hypothesized as based on memory of pain rather than the immediate perceptual experience. In assessing pain during a painful event while supposedly distracted, the pain perception is brought to the individual’s consciousness possibly negating the positive effect of the distraction. This study also evaluated the effectiveness of a high- and low-distraction task, this time, on immediate and delayed reports of pain and the amount of attention given to pain during the experience. In contrast to Hodes et al. (1990) and McCaul et al. (1992),
the findings suggested that the more distracting task did result in less attention to the pain. While there were no significant findings for distraction on the pain ratings, the time of pain ratings, or the amount of attention to pain on the pain ratings, the interaction between distraction and time of pain rating was significant, $F(1, 68) = 4.22, p < .05$. The high-distraction group had significantly lower immediate and delayed pain ratings than the low-distraction group.

The finding of distraction's positive effect on delayed pain ratings is clinically significant because of the memory the pain-distraction experience creates and the timing of assessment of clinical pain. While generalization of findings from a laboratory study to a clinical setting is not possible, the study's findings suggest that pain ratings need to be assessed at a time after the pain experience has occurred. Otherwise, attention will be drawn back to the pain interfering with distraction's effectiveness, if pain is assessed during the painful procedure. This raises questions about the nature of pain memory and the attentional capacity of distraction.

**Engagement.** Eccleston (1995b) has called for measuring both pain perception and task engagement when studying distraction and pain since distraction strategies compete with painful stimuli for attention within the framework of limited attentional resources. Without measuring subjects' engagement in the distraction task, Eccleston suggested that the researcher has no knowledge about whether the subject is actually using the distraction strategy or the extent to which the subject is using the strategy. Therefore, without this information, conclusions about the effectiveness of a distraction intervention can be erroneous.
A few laboratory studies have measured engagement. McCaul and Haugtvedt (1982) asked subjects to rate the extent they distracted themselves on a seven-point scale on a post-experiment questionnaire. This was compared to an identical measure of rating attention to the pain source. One study measured engagement as “attentional consumption” (Stevens, Heise, & Pfost, 1989). Subjects were asked to recall the percentage of time that they used the assigned imagery strategy. The researchers suggested that self-report of attentional consumption may include bias related to expectations about the effectiveness of the strategy. Another study measured absorption in the assigned cognitive strategy (Devine & Spanos, 1990). Subjects self-rated the extent to which they became absorbed in the strategy on a scale of zero (not at all) to four (all of the time). Pain reduction correlated not only with expected pain reduction but also with absorption. Using multiple regression, the researchers found that absorption contributed to prediction of pain reduction after accounting for expectancy.

Clinical versus laboratory findings. Differences between results of the distraction clinical studies and laboratory experiments may be related to the pain source since the laboratory studies utilized cold-pressor pain and the fact that the laboratory pain was avoidable through non-participation in the study. While many clinical studies have demonstrated distraction’s effectiveness in reducing acute pain perception, more research is needed in clinical settings with different populations experiencing various healthcare procedures. Exploration of additional variables, such as self-selection, related to distraction’s effectiveness is needed. This would be congruent with an adolescent developmental framework to allow the adolescent
control and choices in the intervention. Because adolescents were not studied exclusively or included in many of the distraction studies, testing the distraction intervention in the adolescent population would be valuable in extending the implementation of the intervention to that age group.

Investigating the relationship between level of engagement with the distraction intervention and pain perception may offer additional insights into the effectiveness of distraction in reducing acute pain perception. Unfortunately, most clinical studies have not measured engagement with the distraction intervention or accounted for this possible source of variance. Measurement of engagement with the distraction intervention should be included with measurement of pain in clinical studies of distraction for acute procedural pain. Many of the clinical studies of distraction used behavioral distress as the outcome measure; however, behavioral distress has been noted as a possible indicator of such emotions as anxiety and fear and may not accurately reflect self-reported pain (Kleiber & Harper, 1998).

Anxiety as related to Pain and Distraction

Many clinical studies of nonpharmacologic interventions including distraction have examined the relationship of anxiety and pain perception in children and found, not surprisingly, a positive correlation (Lander & Fowler-Kerry, 1993; Mansson et al., 1993; Pederson, 1995, 1996b). State anxiety was significantly correlated with pain intensity and pain affect in a study of the acute pain experience of children and adolescents ages five to seventeen years (Lander & Fowler-Kerry, 1991). Younger children were found to be more anxious and had greater pain intensity. State anxiety was further correlated with previous experience with the painful procedure; anxiety
was lowest for those who either had not undergone venipuncture or had greater than ten experiences. LeBaron and Zeltzer (1984) recommended assessment of both anxiety and pain to more fully understand the pain experience of children. Older children and adolescents are capable of separately self-reporting the affective and sensory components of pain.

Clinical studies, however, have not explored the interaction effect of anxiety and the distraction intervention on pain. Zeltzer and LeBaron (1982) compared the effectiveness of hypnosis and nonhypnotic techniques, including deep breathing and distraction, on reduction of pain and anxiety associated with bone marrow aspiration and lumbar puncture in children and adolescents with cancer. Pain and anxiety, each self-rated on a scale of one to five, were significantly decreased by hypnosis. Nonhypnotic techniques decreased pain during both procedures to a lesser degree and reduced anxiety during lumbar puncture. Another study (Smith, Barabasz, & Barabasz, 1996) examined the effectiveness of hypnosis and distraction in reducing pain, anxiety, and distress scores among 27 three to eight-year-old children undergoing cancer treatment (venipuncture or infusaport access). This study added the feature of identifying high- and low-hypnotizable children and compared them to type of intervention. Hypnosis was significantly more effective than distraction in reducing pain and anxiety in the high-hypnotizable children. Analysis of the interaction of anxiety and the intervention technique on pain reduction was not undertaken in either study.

Anxiety may influence efficient performance of tasks by limiting the amount of resources available for processing (Keogh & French, 1997). The individual’s appraisal
of the situation as possibly threatening primes the attentional system for interruption (Crombez, Eccleston, Baeyens, & Eelen, 1998). Ability to remain engaged in a distraction intervention during a painful experience could be influenced by the child’s anxiety level ultimately affecting effectiveness of the intervention and pain perception.

Anxiety sensitivity, or fear of anxiety-related sensations, has been studied recently as a unique entity of pain perception, especially of affective pain (Keogh & Cochrane, 2002; Muris, Vlaeyen, & Meesters, 2001; Muris, Vlaeyen, Meesters, & Vertongen, 2001). Studies of healthy adolescents and adults have indicated a tendency toward increased pain reports among those with high anxiety sensitivity possibly reflecting a cognitive vulnerability to respond negatively to pain (Keogh & Cochrane, 2002; Muris, Vlaeyen, Meesters, & Vertongen, 2001). Negative interpretation of bodily sensations is a characteristic of anxiety sensitivity-prone individuals. Findings suggest that negative interpretive bias may mediate the relationship between anxiety sensitivity and affective pain (Keogh & Cochrane, 2002). Attentional biases resulting in directing attentional resources toward painful stimuli were not found to mediate pain. While results support anxiety sensitivity as a distinct feature of affective pain, it remains unclear whether anxiety sensitivity is truly unique or is a feature of fear of pain or trait anxiety. Yet fear and anxiety may have different effects on pain. Fear has been shown to result in decreased reactivity to a painful stimulus whereas anxiety increased sensitivity to pain (Rhudy & Meagher, 2000).

Attentional focus, rather than anxiety, was found to influence pain ratings in studies of anxiety, pain and attentional focus in some laboratory studies of adults (Arntz, Dreessen, & De Jong, 1994; Arntz, Dreessen, & Merckelbach, 1991; Janssen
& Arntz, 1996). Attention focused on pain produced significantly higher pain ratings than distraction regardless of type or intensity of anxiety in a laboratory studies. Anxiety was suggested as an important factor in allocation of attentional capacity, leading to increased suffering, directing attention toward pain, and influencing anticipated pain sensations. Therefore, reducing anxiety-related pain was suggested by the researchers as helpful in decreasing the pain response by directing attention away from the pain and improving ability to be distracted from the painful stimuli.

Attentional narrowing can occur when one is anxious and experiencing high stress levels during a central task performance (Janelle, Singer, & Williams, 1999). Increased anxiety was found to interfere with central task performance by increasing susceptibility to environmental distractors and diverting attention from relevant information. Attentional capacity limitations can lead to reduced ability to process task-relevant information when the processing of distractors occurs. The blocking of irrelevant distractors has been proposed as necessary to facilitate central task achievement. In the present study, the central task could be considered the attention to the nurse- or self-selected distraction intervention, and the procedural pain could be considered the distractor from this central task. Anxiety in the adolescent might then increase susceptibility to the pain distractor and lead to diverting of attention from the distraction intervention to the pain. Thus, the ability to remain distracted by the intervention in the face of pain and anxiety warrants exploration.

While distraction is considered a cognitive-behavioral strategy, McCaul et al. (1992) have suggested that an affective component may be important to distraction’s effectiveness. Since positive emotions affect coping in response to painful stimuli, the
effectiveness of distraction might relate to a positive affect. Furthermore, this affective component may be related to a reduction in anxiety resulting from attaching positive emotion to the distraction task. Pleasant distraction tasks which engage a positive affect have been proposed to reduce anxiety and thus distress associated with the painful stimuli.

Pleasant distraction, through arousal of pleasant emotions and a reduction in anxiety, has been suggested as more effective in mediating one’s response to painful stimuli than negative emotions. Eccleston and Crombez (1999) support the notion that pleasant images may have a positive effect on pain perception. They suggested that this occurs because affective responses congruent with the emotional state may be facilitated. In one study, however, pleasant imagery only marginally increased pain threshold suggesting that either the pleasant imagery failed to alter emotionality or the pain tolerance measure itself failed to measure an affective component of pain (Johnson et al., 1998). In contrast, affectively neutral distractors reduced pain intensity ratings of brief pain duration but not pain tolerance in adults experiencing cold-pressor pain (Hodes et al., 1990). The researchers recommended that modifying the affective state may be more effective for pain of a long duration.

In another laboratory study in which adult participants were shown either a humorous, repulsive, or neutral film during cold-pressor pain, a significant increase in pain tolerance was found in both the humorous and repulsive film groups (Weisenberg, Tepper, & Schwarzwald, 1995). Thus, distraction techniques which result in any emotional arousal have been hypothesized as effective. Emotions have been suggested as powerful demands for attention, displacing pain from attention and
reducing pain perception (Eccleston & Crombez, 1999). Yet, this was not the case in a laboratory study of 24 male college students in which negative emotion (frustration, anger) was added to the high-distraction task during cold-pressor pain (McCaul et al., 1992). The effect of negative emotions during distraction did not improve self-reported distress ratings. Furthermore, pleasant rather than anger-based imaging mediated pain tolerance in another laboratory study of 40 college students (Stevens et al., 1989). The researchers examined whether affect or consumption of attention mediates cognitive modification of pain. Highly intense “cognitions” consumed more attention than less intense “cognitions.” But de Wied and Verbaten (2001) suggest that the relationship between affect and attentional mechanisms may be more complex. In a study of 65 male subjects exposed to pleasant, neutral, and unpleasant pictures, highest pain tolerance was found in the positive affect condition. However, in a follow-up study, the content of the unpleasant distraction was determined to be a factor in the effect of the distraction on pain; upon analysis, the content was determined to include bodily images that could evoke pain.

In an early study of distraction in a laboratory setting (Barber & Cooper, 1972), the participants reported that they used their own spontaneous distraction methods and in some cases, they preferred their own over the assigned distractors. This raises questions about the effectiveness of distraction in relationship to being emotionally pleasing for the individual. The study’s investigators recommended that all participants of future studies be asked about their use of any spontaneous distraction techniques. Johnson et al. (1998) support this notion by suggesting that individuals use their own unprompted techniques to cope with painful situations.

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In a recent study, James and Hardardottir (2002) examined the interaction of distraction-attention and trait anxiety on cold pressor pain. Subjects were randomized to six groups (two levels of trait anxiety and three experimental groups: distraction, attention, and undirected). Both the low anxiety group and the distraction group demonstrated increased pain tolerance. Only the high- and low-anxious subjects in the undirected group had an attention-by-anxiety interaction. The low anxious participants in the undirected group had the highest level of pain tolerance across all groups; they also reported significantly greater use of self-initiated strategies to divert attention from pain than the high anxious subjects, further suggesting that anxiety heightens attention to threats including pain. Additionally the undirected group self-reported less affective and evaluative pain; also low anxious subjects reported less evaluative pain. Subjects in the attention group reported more sensory pain than the other two groups. More engaging distraction tasks were suggested as potentially more effective.

Equivocal findings of studies suggest the need for continued investigation into the interrelationship of pain, anxiety, and distraction during painful procedures in the clinical setting. The mechanisms for distraction's effectiveness in altering pain perception are unclear (Johnson et al., 1998). Questions remain whether distraction’s effectiveness results from attentional competition, by reduction in the affective component of pain, or a combination of both. Exploration of emotionality as it relates to distraction and pain response has been recommended for further study by many researchers. The emotional significance of the distractor may be the key to distraction’s effectiveness. In this present study, the positive affect attached to the self-selected distraction is hypothesized as contributing to effectiveness of this distraction
technique. Since presumably the self-selected distraction is engaging and emotionally pleasing, optimal demand is placed on attention. Studying anxiety as it relates to the effect of distraction on acute procedural pain offers valuable insights into the affective dimension of pain.

**Attentional Inertia**

Attentional inertia is a phenomenon described by Anderson and colleagues based on their research of television viewing in infants and toddlers (Richards & Cronise, 2000; Richards & Gibson, 1997), preschoolers (Anderson, Alwitt, Lorch, & Levin, 1979; Anderson & Burns, 1991; Anderson, Choi, & Lorch, 1987; Anderson & Lorch, 1983; Choi & Anderson, 1991), and young adults (Burns & Anderson, 1993). Attentional inertia is described as cognitive or attentional “glue” which sustains attention and resists distraction especially during shifts in the media’s content boundaries (Burns & Anderson, 1993; Choi & Anderson, 1991). Attentional inertia promotes a tendency to persist in television viewing thus reducing distractibility (Anderson et al., 1987; Burns & Anderson, 1993). As the viewer engages in television looking beyond a critical period of fifteen seconds, the viewer is less distracted and less likely to look away from the television program (Anderson et al., 1987). Attentional inertia theory postulates that the longer a “look” at television is maintained, the greater the likelihood that the “look” will be sustained. Attention becomes progressively engaged with increased look duration and has been reflected in progressive declines in heart rate (Richards & Cronise, 2000; Richards & Gibson, 1997).
Attentional inertia maintains cognitive involvement in and continuous attention to the viewing (Anderson & Lorch, 1983). When attention is maintained before television content changes, maintaining attention across changing content is facilitated. Attentional inertia maintains attention to a source of information even across breaks in the continuity of that information. Furthermore, voluntary termination (through a conscious decision to terminate looking) and involuntary termination (through distraction) are resisted as the “look” is sustained (Burns & Anderson, 1993).

Anderson and Lorch (1983) have proposed that the viewer’s attention might differ based on motivational factors, such as whether the viewing is a primary or secondary activity or whether the viewer is searching for information.

The attentional inertia theory has implications for the current study on distraction in adolescents since the adolescents used media as the distraction. Perhaps the longer the adolescent engages in the media, the less likely the individual will be distracted from that engagement to the painful stimuli of the allergy testing procedure. The adolescent may be engaged by the primary task of the self-selected distraction intervention in blocking the awareness of pain. Attentional inertia might be an important factor in explaining the effect of a distraction intervention on pain perception through sustained attention toward the self-selected distraction intervention. By continuing to engage in the distraction intervention, the adolescent may be able to sustain attention to the media despite the pain of the allergy testing procedure. Attentional inertia may be promoted by the use of a self-selected distraction since the media selected will presumably be enjoyed by the adolescent and thus can engage and hold attention through the painful procedure.
Literature Summary

The related literature offers a background for the selection of the nursing intervention, distraction, in relationship to its effect on acute pain perception as a result of the allergy testing procedure. Anxiety is studied as an influencing factor on acute pain perception and engagement in the distraction intervention. Factors related to attentional capacity are explored by examining differences between a self-selected distraction activity and nurse-selected distraction. Adolescence was selected as the population for study to hold constant the broad developmental age, a covariate in distraction research.
CHAPTER IV

METHOD

The design of this study, setting for data collection, sample, and data collection procedure are detailed and presented in this chapter. Descriptions of the data collection instruments are included. The plan for analyzing the data is provided.

The original proposal included plans for a pilot study followed by the main study. This proposal called for more subjects than were actually available to participate in the study due to overestimation of the accessible population. Therefore, the main study could not be conducted; instead the feasibility study was conducted as planned, which was identical to the proposed main study. The original research questions remained unchanged in the study. Data were analyzed as proposed to also pilot test that phase of the study. The results provided an effect size for more accurately calculating the sample size needed for the main study. Instruments were evaluated for validity and reliability for possible future use in the main study.

Design

A three-group, post-test, experimental design was used for this study. Study participants were randomly assigned to one of three groups. Group one, the control group, received usual care during the allergy skin testing procedure. Group two received nurse-selected distraction as an intervention during the allergy testing. Group three participated in a self-selected distraction intervention during the allergy testing procedure. The probability of the groups being equivalent at the beginning of the study in relation to distribution of variables influencing the dependent variable, pain perception, is more likely due to random assignment of the adolescents in the study to
one of three groups (Brink & Wood, 1998). Random assignment also prevents researcher bias since every adolescent in the study had an equal chance of being assigned to one of the groups under study (Polit & Hungler, 1995). Therefore, any difference in the dependent variable, acute pain perception, found following the implementation of the intervention is not likely to be a result of extraneous variables but more likely to be a result of the treatment received (Knapp, 1998).

In this study, the control group was the group who received the usual care an adolescent would receive when undergoing allergy testing. The experimental interventions, distraction chosen by the nurse and distraction chosen by the adolescent, were compared to the control group on perception of pain felt during the allergy testing procedure. Control over variance in this study was increased through enhancement of systematic or experimental variance because the two interventions are different from each other (Brink & Wood, 1998). Although both distraction interventions are aspects of the same cognitive-behavioral strategy, the effect on the dependent variable, perception of pain intensity, should be different for the two strategies because of the two different attentional foci: distraction chosen by the nurse and distraction chosen by the adolescents themselves.

Setting

This investigation was conducted at a general allergy/immunology medical practice affiliated with Albany Medical Center (AMC), the Albany Medical College Allergy, Asthma, and Immunology Center located on Washington Avenue Extension in Albany, New York. The researcher initially proposed to conduct the study at the pediatric allergy/immunology clinic of Massachusetts General Hospital (MGH) in
Boston. Initial support for the conduction of the study at MGH did not come to fruition when the chief nurse researcher resigned her position. Without a liaison and mentor, the researcher was unable to gain access to the institution. The researcher contacted various allergy medical practices throughout the Capital District region of New York State without success in gaining support and access to conduct the study. The medical director of the Allergy, Asthma, and Immunology Center of AMC, Jocelyn Celestin, M.D., demonstrated interest in and support for the study. The researcher met with Dr. Celestin in May 2002 and began data collection at the AMC center in October 2002.

**Sample**

A convenience sample was drawn from all the adolescents scheduled for allergy skin testing at the AMC Allergy, Asthma, and Immunology Center. Adolescents, of both genders and all racial/ethnic groups, ages eleven years through and including seventeen years about to undergo allergy testing were invited to participate in the study. While allergies can develop at any point in one's lifetime, and therefore, allergy testing can be initiated at any time, much of the allergy testing begins in the younger client.

**Criteria for inclusion.** Participants met specific criteria for inclusion in the study. Adolescents age eleven through and including age seventeen were included. This held constant parental presence for all adolescents undergoing allergy testing. At age eighteen and older, the adolescent consents for the allergy testing procedure, and parental presence would be variable.

Initially, only adolescents who were participating in the allergy testing for the first time were to be included. The original intent was to hold constant one extraneous
variable, previous pain memory, for this particular experience. However, the researcher realized that many adolescents had received allergy testing when they were younger. The adolescents, for the most part, reported not remembering the allergy testing experience. Therefore, this inclusion criterion was eliminated from the study to avoid limiting the sample size any further. Other inclusion criteria were ability to read and write in English and ability to respond to the questionnaires and rating scales.

An exclusion criterion was a reported cognitive developmental disability, determined in this study as those adolescents having a Title VIII individualized educational plan (IEP) or a 504 accommodation plan. This was determined on prescreening by asking the parent if the adolescent had an IEP or 504 plan in school. This information was used as a screening device in assessing the participant’s ability to complete the study. Keck et al. (1996) found that children diagnosed as developmentally delayed or learning disabled were unable to use the Word Graphic Rating scale. The researcher believed that cognitive delays might impede the ability to engage in the distraction intervention and complete the data collection instruments. Thus, this exclusion criterion was retained. Some adolescents scheduled for allergy testing were not able to participate in the study due to this criterion. If the parent identified the nature of the IEP or 504 plan as unrelated to a cognitive delay, then an exception was made.

Another exclusion criterion related to the type of allergen tested. Adolescents scheduled for bee venom testing or “building” were excluded from participating in the study. The bee venom testing procedure was quite different from the testing procedure required with other allergens. To avoid introducing a confounding variable related to
the type of allergy testing procedure, the researcher held constant the type of testing and limited the testing to environmental and food allergens.

The researcher initially planned to exclude adolescents who exhibited concomitant physical pain determined by self-report on pre-screening. The researcher initially proposed that pain from another source other than the skin testing might interfere with the perception of the pain from the allergy testing, the ability to engage in the distraction, and the overall effectiveness of the distraction intervention. During the study, this criterion was evaluated on a case-by-case basis. If the adolescent was able to focus on the allergy testing experience and on evaluating just the experience of the allergy testing, then the adolescent was included in the study.

Because members of both genders and all racial/ethnic groups are affected by allergies and attend the AMC Allergy, Asthma, and Immunology Center, it was anticipated that the sample would reflect the center’s demographics. Diligent attempts were made to include adolescents of both genders and all racial/ethnic groups in the sample. No exemptions based on gender or ethnicity were made. The investigator enrolled all adolescents who met the criteria for inclusion and were willing to participate in the study. The small adolescent population at the AMC allergy center did not permit quota sampling, and convenience sampling was used.

Sample size. The proposed sample for this study was determined using power analysis. Power can be determined both a priori and after analysis. To determine an appropriate sample size, four factors must be considered: the level of significance, the power of a test, the effect size, and the population error variance (Hinkle, Wiersma, & Jurs, 1998). Since the goal is to reject a null hypothesis when it is false while
minimizing Type I and Type II errors, determining the power a priori is an important consideration. Without sufficient power, researchers are at high risk of committing a Type II error (Polit & Hungler, 1995).

A factor affecting power is the level of significance. The level of significance for the proposed study was set at .05. The .05 alpha is a conservative, realistic level of significance for this experimental study (Hinkle et al., 1998; Polit, 1996). One could hypothesize that there is only a five percent probability of mistakenly rejecting a true null hypothesis (Type I error) thus accepting that the difference among the pain perception ratings occurred as a result of the distraction interventions rather than by chance alone and incorrectly concluding that a statistically significant difference among the three groups exists.

In determining power, the researcher considers the relationship that exists between alpha and beta. A 4:1 ratio of beta (likelihood of a Type II error) to alpha (probability of a Type I error) has been suggested (Hinkle et al., 1998). Using this ratio, if alpha is set at .05, then beta becomes .20. The power for the proposed study was estimated as 1 - beta or 1 - .20. This calculated power of .80 is also Cohen's standard level (1992). Thus, there is an 80% probability of detecting a significant difference, rejecting the false null hypothesis, and correctly drawing the conclusion about the research findings (Burns, 2000). Otherwise, a Type II error can occur by accepting the false null hypothesis and concluding that the distraction interventions made no difference in acute pain perception of adolescents undergoing allergy testing when they did indeed make a difference.
Effect size, an estimate of the magnitude of the relationship between the variables, was considered to be “medium,” a conservative, yet anticipated realistic expectation of the proposed study. Basing effect size on previous research findings adds credibility to the determination of sample size. In a study comparing distraction and comforting on children’s pain ratings during venipuncture ($N = 100$), Vessey et al. (1994) found an actual effect size of .60 using analysis of variance (ANOVA) indicating a very large effect with an alpha level of .05 and resulting power of .95. The large effect size and sample size contributed to the high power level.

In determining the sample for the main study, the alpha level, effect size, power, and directionality of the statistical test were proposed a priori. As determined by power analysis, a sample size of 156 adolescents (52 per group) was proposed for the main effect (research questions one and two) of the main study based on a medium effect size and .80 power or an 80% probability of detecting a difference among the three groups, if a difference exists, at an alpha level of .05 using a two-tailed test of significance (Burns, 2000; Cohen, 1992).

The researcher intended to approach all adolescents ages eleven through and including age seventeen who were scheduled for allergy skin testing, excluding those scheduled for bee venom testing (See Appendix A, Adolescents Scheduled for Allergy Skin Testing). During a period of more than one year, only 65 adolescents were scheduled for environmental and food allergy testing at the AMC Allergy, Asthma, and Immunology Center. Of this number, eighteen either canceled the allergy testing appointment or did not show for the appointment. Of the 47 who did attend the allergy testing appointment, four were ineligible to participate because they did not meet the
inclusion criteria. Another five participants or parents/guardians refused to participate in the study when invited to do so. One adolescent went to the allergy testing appointment without her parent; therefore, because she could not consent to allergy testing, she was unable to have the testing conducted. The researcher was unable to approach five adolescents scheduled for allergy testing due to illness or prior commitments.

After more than one year of data collection, 32 adolescents actually participated in the study; all participants completed the study. The sample \( N = 32 \) did not meet the proposed 156 subjects for the main study. Based on a projected enrollment rate of approximately 30 participants per year, four additional years of data collection at the AMC allergy center was estimated to obtain the proposed sample size of 156. The researcher did attempt to add other sites in and around the Albany, NY area in an attempt to increase the sample size but was unsuccessful. One problem related to differences in the actual skin testing procedure. One other physician was interested in adding his allergy practice as a second site; however, the allergy testing was conducted differently. This difference in the actual allergy testing procedure would add another confounding variable to the study.

The 32 subjects became the sample for the feasibility study. A random numbers table developed for the research study was used to assign participants to one of three groups: usual care, nurse-selected distraction, and self-selected distraction. Thus, after 32 subjects were enrolled in the study, using the random numbers table, approximately equal group sizes were obtained. Ten subjects had been assigned to groups one and three and twelve to group two. Due to the results of the feasibility...
study and the accessible population, a decision was made to discontinue further data collection. Subject recruitment for the main study was not continued.

**Protection of human subjects.** The researcher received initial approval for conducting the research study from the Worcester University of Massachusetts Medical School Committee for the Protection of Human Subjects in Research on January 29, 2001. Subsequently the researcher received approval from the Albany Medical College Committee on Research Involving Human Subjects on June 18, 2002. The researcher completed all mandated federal education on human subjects protection and the Health Insurance Portability and Accountability Act (HIPAA).

Verbal and written information about the study was provided to both the adolescent and the parent who accompanied the adolescent to the allergy testing appointment. Written permission was obtained from one or both parents or guardians of the study participants at the time of the appointment. Written assent was obtained from the adolescents themselves. Signatures from the parent/guardian and adolescent were obtained on the consent/assent forms. Copies of the consent/assent forms were given to the participants and parents and were placed in the adolescent’s medical record at the AMC allergy center (see Appendix B, Assent/Consent Form).

**Data Collection Procedure**

Data collection began on October 7, 2002 and continued through November 24, 2003. After two months without any adolescents scheduled for allergy testing, data collection was stopped and data analysis was begun.

The researcher approached each adolescent and parent/guardian dyad about participating in the study in the allergy testing procedure room. Prescreening questions
were asked to determine ability to read and write English, presence of concomitant pain, and history of previous allergy testing. The adolescent’s parent/guardian was asked about the existence of an IEP or a 504 accommodation plan. The adolescent’s assent and parental permission to participate in the study were obtained. Participants and their parents were given ample time to read the consent/assent forms; they were informed of the small appreciation gift. Time was allotted to answer any questions about the study. After agreeing to participate in the study, the adolescent completed the Pre-testing Questionnaire and the Spielberger State Anxiety scale and returned them to the researcher for review.

**Assignment to groups.** Upon completion of the Pre-testing Questionnaire and the Spielberger State Anxiety scale, the participant was randomly assigned to one of the three groups using a computer-generated random numbers table, which had been previously developed by a colleague of the researcher. The adolescent opened a sealed envelope that had been prepared in advance with the group assignment number. This ensured double-blind random assignment to groups. At the time of approaching the adolescent about participating in the study and during the time the adolescent completed the State Anxiety scale and Pre-testing Questionnaire, neither the researcher nor the subject knew the group assignment.

**Usual care group.** The adolescents who were randomly assigned to group one, the usual care group, received allergy skin testing performed by the nurse per the usual standard. Allergy testing materials were kept within view of the adolescent; no attempt was made to conceal testing materials. The researcher did not provide a script or prompt the nurses. No additional treatment or interventions were provided. For the
most part, the nurses talked to the adolescents throughout the procedure, usually about the allergy testing procedure itself and the suspected allergens.

**Nurse-selected distraction group.** The adolescents assigned to group two received a distraction intervention during the allergy testing procedure. The adolescent watched a nursing recruitment videotape created for adolescents while listening through headphones. The nursing recruitment videotape provided consistency in the nurse selection and was an easy-to-use distraction intervention. The target audience for both interventions, nurse-selected and self-selected distraction, was the same.

**Self-selected distraction group.** The adolescents assigned to group three received a self-selected distraction intervention. These adolescents watched and/or listened to a videotape, book-on-cassette, or music CD chosen from a library compiled by the investigator (See Appendix C, Library of Audiovisual Media). The researcher developed the library by asking several male and female adolescents of various ages to select popular adolescent choices for the library. If the adolescent was assigned to the self-selected distraction group, the adolescent chose a videotape, music CD, or book-on-cassette after receiving the group assignment. The adolescent listened to the videotape, cassette, or CD through headphones during the allergy testing procedure.

**Distraction interventions.** Adolescents in both intervention groups began engagement in the distraction intervention for a period of at least one minute prior to beginning the allergy testing. Studies have shown that “attentional inertia,” a cognitive attentional “glue” that sustains attention and resists distraction, promotes persistence in television viewing after a period of about fifteen seconds (Anderson et al., 1987; Burns & Anderson, 1993; Choi & Anderson, 1991). Attentional inertia theory
postulates that the longer a “look” at television is maintained, the greater the likelihood that the “look” will be sustained.

The nurses were asked to interfere as little as possible with the distraction intervention while conducting the allergy testing. Unfortunately, while the researcher proposed that none of the allergy testing materials would be within view of the adolescents in the distraction groups, this was not a reality. The nurses were reminded to refrain from interrupting the distraction by talking to the participant and to place the tray of allergens out of view of the adolescent; however, this did not always happen. Additionally for the distraction groups, other clinic staff were asked to refrain from entering the procedure room while the allergy testing was conducted to avoid interference with the adolescents’ engagement in the distraction. Again, unfortunately, the physicians entered the rooms of some participants during the allergy testing.

The adolescents were not required to bring their own audio-visual selections or equipment. The researcher equipped the clinic with a combination thirteen-inch television and videotape player, combination cassette and CD player, and two sets of headphones, which were all donated to the clinic at the conclusion of the study. The library of videotapes, music CDs, and books-on-cassette and the nursing recruitment videotape were all supplied by the researcher. The equipment was kept together on a cart provided by the clinic and wheeled into the allergy testing procedure room for adolescents in the intervention groups. The headphones were cleaned with alcohol wipes between study participants. The equipment was kept in a locked area of the clinic when not in use during the study.
Allergy testing procedure. The clinic nurse provided the usual preparatory information about the allergy testing procedure prior to testing all adolescents and performed the allergy testing procedure per the center’s routine. Throughout the procedure, the investigator unobtrusively observed the allergy testing, participant and parent reactions, and nurse-patient interactions. Additionally, the investigator continued to collect Pre-testing Questionnaire data, such as the number of allergens tested.

All 32 participants in the study received Phase I allergy testing. The nurse wiped the skin, usually of the forearms, with alcohol, labeled the skin with a pen, and pricked the outermost layer using a lancet and droplet-of-allergen technique for the first six participants or an allergen-impregnated Greer DermaPIK prick technique for the remaining participants. A fifteen minute wait period followed with the arms held out still on the table. For groups two and three, the distraction intervention usually continued through the wait period. The distraction intervention was stopped at the end of the wait period while the nurse interpreted the allergy testing results. This entailed taking measurements on the skin around the allergen site. Following the reading of the results, the study participants completed two pain rating forms measuring pain perception felt during the allergy testing and the Post-testing Questionnaire. The Post-testing Questionnaire was different for the usual care group than the two treatment groups. The Post-testing Questionnaire and pain rating forms were given to the investigator upon completion.

The need for Phase II allergy testing was determined by absence of a reaction to the allergens during Phase I allergy testing. Only non-reactant allergens were
retested in Phase II. Twenty-seven of the 32 adolescents who received Phase I testing also received Phase II allergy testing. If Phase II testing was necessary, the nurse prepared the tray of allergen vials with tuberculin syringes in another room, entered the allergy testing procedure room carrying the tray of vials with tuberculin-like syringes, and explained Phase II, the intradermal phase of allergy testing. For those in groups two and three, the distraction intervention was resumed and continued throughout the intradermal phase of testing. The nurse wiped the skin, usually of the upper arm area, with alcohol, labeled the skin, and injected the intradermal layer of the skin with the diluted allergen-filled syringe. Because the arms could be moved immediately after the testing was completed, the distraction intervention was stopped at the conclusion of Phase II testing, and the participant again completed the pain rating forms and Post-testing Questionnaire. The forms were returned to the researcher for review.

At the completion of the allergy testing procedure, a ten dollar gift card to a music store was given to each adolescent in appreciation for participating in the research study. The completed data collection instruments were kept in a locked file cabinet in a secure area separate from the AMC allergy center.

Data Collection Instruments

Two self-report pain rating scales, the Adolescent Pediatric Pain Tool (APPT) and the Wong-Baker FACES Pain Rating Scale, were used to measure the dependent variable, the adolescent’s pain perception of the allergy testing procedure, upon completion of the allergy testing (see Appendix D, Pain Rating Scales). The rating scale scores were used to answer all four research questions. Both the APPT and FACES rating scales are easy-to-use instruments designed to measure self-reported
pain perception. Adams (1989) has recommended that a self-report measure of pain be easy to use, brief, and clear. Adolescents are capable of self-reporting feelings and behaviors across situations (Hymovich, 1997).

Validity of the self-report pain rating scales can be supported by the definition that pain is whatever the individual says it is, existing whenever the individual says it does (McCaffery & Beebe, 1989). The Acute Pain Management Guideline Panel (1992a) has recommended self-report measures be used for assessment of pain whenever possible. According to these federal guidelines, self-report provides the most valid, reliable measure of pain.

**Adolescent Pediatric Pain Tool.** The APPT was designed as a multidimensional, self-report pain instrument measuring pain location, intensity, and quality in children and adolescents ages eight to seventeen years. The one-page, two-sided instrument contains three separately scored components, which are designed to assess each of these three dimensions of pain. Pain location is assessed on a front and back body outline, pain intensity by a straight, horizontal line, 100 millimeter (10 centimeter) word graphic rating scale anchored by “no pain” on one end and “worst possible pain” on the other end, and pain quality by a pain word descriptor list. Fifty-six words in the descriptor list include groups of similar sensory, affective, and evaluative qualities of pain; additional space is available for the children and adolescents to write in their own words.

In this study following the allergy testing procedure and the fifteen minute wait period in Phase I and/or immediately after Phase II testing, the adolescent completed the APPT. First the adolescent indicated the areas where the allergy testing was felt on
the body drawing of page one of the APPT. Next the adolescent selected and marked the point on the Word Graphic Rating scale that best described the pain intensity of the allergy testing procedure. The point on the scale was scored by measuring the distance in centimeters from the left side of the scale to the point marked by the adolescent. This numerical number became one of the two values for the dependent variable, intensity of acute pain perception. Next the adolescent circled words on the word descriptor list that best described the quality of pain associated with the allergy testing or added words not on the list. Scores were tallied from the word descriptor list, which offered additional information about the allergy testing experience. Permission was granted by Marilyn Savedra, one of the APPT authors, to change the wording from present tense to past tense on the APPT because the measurement of pain did not take place during the allergy testing but afterward so that the distraction intervention would not be interrupted.

The APPT, which has undergone extensive testing, is considered one of the most well-developed, valid and reliable measures of pain in older children and adolescents (Hester, 1993). The current AHCPR pain management guidelines recommend the Word Graphic Rating scale as a valid, reliable method of assessing pain in children over the age of seven or eight years (Acute Pain Management Guideline Panel, 1992a). Reliability and validity of the APPT for children ages eight to seventeen years have been tested in several studies of the individual dimensions as well as the entire tool (Savedra et al., 1989; Savedra et al., 1993; Tesler et al., 1991; Wilkie et al., 1990). Content and concurrent validity and alternate forms reliability of the body outline to measure pain location were supported by confirmation of at least
one pain site on 98% and of all pain sites on 80% of the body outlines and by a .83
correlation between pain sites marked on the outline and those based on pointing by
175 hospitalized children (Savedra et al., 1989).

A series of studies with a total multiethnic sample of 1,223 well and
hospitalized children ages eight to seventeen years was conducted to test the Word
Graphic Rating scale and the word descriptor list (Tesler et al., 1991; Wilkie et al.,
1990). Validity, reliability, and sensitivity of the Word Graphic Rating scale to rate
pain intensity have been supported through a series of four studies (Tesler et al., 1991).
Convergent validity was demonstrated by moderate to high Pearson correlations
between five scales tested, $r = .66 - .84$, and among pairs of scores from the scales, $r =
.68 - .97$. Statistically significant decreases in pain ratings over five consecutive
postoperative days, $F(3, 39) = 6.19, p = .002$, supported construct validity for
measurement of postoperative pain intensity. Test-retest reliability was supported by a
high Pearson correlation between two scores of the Word Graphic Rating scale, $r =
.91$.

A series of three tests provided support for validity and reliability of the word
descriptor list (Wilkie et al., 1990). The words selected on the list include pain words
identified by other researchers as well as children and adolescents experiencing pain,
thus providing support for content validity. Concurrent validity was suggested by weak
to moderate significant Pearson correlations of sensory, affective, and evaluative word
scores with pain intensity scores and number of pain sites, $r = .19 - .44, p = .01$. The
sensory, affective, and evaluative word scores were not significantly different for
children with pain related to various medical conditions. A statistically significant
decrease in the selection of sensory and affective words over three consecutive post-operative days provided support for construct validity, $F(2, 26) = 10.04, p < .001$; $F(2, 26) = 12.33, p < .001$; $F(2, 26) = 4.26, p = .02$. Test-retest reliability was supported by statistically significant correlations of word scores at two different times during a period of consistent pain intensity scores, $r = .78 - .97, p < .001$.

The entire APPT and component dimensions, such as the Word Graphic Rating scale, have been used to assess pain in children and adolescents (Gillies et al., 1997, 1999, 2001; Franck et al., 2002; Savedra et al., 1993; Tesler et al., 1998; Van Cleve, Johnson, & Pothier, 1996). The feasibility of using the APPT to assess post-operative pain location, intensity, and quality was validated (Savedra et al., 1993). In another study, while pain intensity scores decreased over three postoperative days, few significant correlations between self-reported pain ratings and observed pain behaviors were found (Tesler et al., 1998), congruent with findings of previous research. In fact, two of the most frequently manifested pain behaviors (lying motionless and calm expression) were observed at times when children reported moderate to severe pain.

The APPT was also used to assess pain related to procedures, in particular venipuncture and intravenous cannulation (Van Cleve et al., 1996). A subgroup of nineteen hospitalized children ages seven to twelve years described pain intensity, location, and quality using the APPT as well as other pain measures. Pain intensity and affective responses were highly correlated, $r = .72, p < .01$. Children were able to identify pain sites as indicated by all markings on the body outlines corresponding to the venipuncture or intravenous cannulation sites. Children could also rate pain intensity as indicated by a full range of pain intensity scores clustered around the
median on the Word Graphic Rating scale, an expected finding for this procedural pain. Additionally, children identified up to 51 words in describing the quality of the pain experience.

In addition, the APPT was found to be both easily understood and completed by postoperative adolescents and easily scored and analyzed by researchers (Gillies et al., 1997; Savedra et al., 1993). In a large study of well children ages eight to seventeen years, the Word Graphic Rating scale was the second choice among five scales for “easiest to use” and “best liked” and the first choice among minority children and hospitalized children (Tesler et al., 1991).

The authors of the APPT have recommended that the scale be tested with other acute pain and also chronic pain conditions and in settings other than hospitals such as outpatient and home settings. Franck et al. (2002) found that the APPT provided for multidimensional assessment of pain in children and young adults with sickle cell disease across three healthcare settings, the inpatient unit, day hospital, and clinic. The APPT was also recently used to assess the recalled acute pain experience of thirteen adolescents following blunt traumatic injury (Crandall et al., 2002).

**FACES pain rating scale.** The Wong-Baker FACES rating scale measures pain intensity on a sensory-affective scale comprised of six cartoon faces ranging from a smiling face (no hurt; coded zero) to a crying face (hurts worst; coded ten; note: child doesn’t have to be crying to feel this bad). The six faces represent six points on a zero to ten-scale with each of the faces representing points: zero, two, four, six, eight, and ten. The individual is asked to choose the face which best describes the painful experience. This format of the FACES rating scale is a reproducible version adapted...
from Wong and coauthors with permission by Purdue Pharmaceuticals and is readily available for distribution.

In this study, immediately following the allergy testing and after completing the APPT, the adolescent circled the “face” on the FACES rating scale that best described the pain felt during the allergy testing procedure. The numerical score corresponding to the face circled became a second score for the dependent variable. In studies comparing pain rating scales, which included adolescents between thirteen and eighteen years of age, the preferred scale was the FACES rating scale, even among the adolescents (Keck et al., 1996; Luffy & Grove, 2003; Wong & Baker, 1988). In this study, the adolescents were asked to indicate their preference for either the APPT Word Graphic Rating scale or the FACES rating scale on the Post-testing Questionnaire.

Reliability and validity of the FACES rating scale have been tested with a sample of 118 children and adolescents ages three to eighteen years undergoing painful procedures (Keck et al., 1996). A low, nonsignificant Pearson correlation, \( r = .20 \) for adolescents, and a significant difference on paired t-tests, \( t = 6.87, p = .001 \), before and after a painful procedure provided support for discriminant validity. Concurrent validity was also supported by a high significant Pearson correlation between the FACES scale and the numeric rating scale, \( r = .81 \) for adolescents, and between the FACES and the Word Graphic Rating scale, \( r = .66 \) for adolescents, both considered valid pain assessment scales. Test-retest reliability of the FACES rating scale was supported by a high significant Pearson correlation, \( r = .93 \) for adolescents, between two measurements performed fifteen minutes apart after the painful procedure.
In a replication of an earlier study by Wong and Baker (1988) comparing the reliability, validity, and preference of pain intensity measures, the Wong-Baker FACES, the Oucher, and a visual analog scale, test-retest agreement was determined to be 37% for the FACES scale and concurrent validity 70% (Luffy & Grove, 2003). Wong and Baker had found comparable validity (64%) but higher reliability (74%). Both studies showed that validity and reliability increased with age. A sample of 100 African-American children and adolescents with sickle cell disease ages three to eighteen were asked to rate two painful procedures from memory; no painful procedures were conducted in the Luffy and Grove study.

Results from two other recent studies have questioned the validity of “smiling” faces scales in measuring pain when compared to pain ratings from other “non-smiling”/neutral faces-type scales (Chambers & Craig, 1998; Chambers et al., 1999). Participants in the studies were children ages five to twelve years; adolescents were not included in the samples. Only one of the studies involved clinical pain from venipuncture; the other study examined hypothetical pain in well children. Pain ratings were significantly higher using the “smiling” faces-type scales compared to the lower pain ratings of the “non-smiling”/neutral faces-type scales during venipuncture (Chambers et al., 1999) and in hypothetical situations involving pain and negative affect (Chambers & Craig, 1998). In contrast, Keck et al. (1996) found the FACES scale to be highly correlated with two visual analog scales including the Word Graphic Rating scale, \( r = 0.79 \) in eight to twelve year-olds; \( r = 0.66 \) in thirteen to eighteen year-olds, providing support for concurrent validity. In this feasibility study prior to rating the allergy testing pain, adolescent participants were instructed that the “smiling” face
on the FACES scale represented no pain at all even if one did not feel like smiling and conversely that the “crying” face represented the most pain possible even if one did not feel like crying.

**State anxiety inventory.** The state anxiety level of the study participants was measured using the State Anxiety scale of the Spielberger State-Trait Anxiety Inventory (STAI). State anxiety measures a transitory emotional state (Grimm, 1997). The State Anxiety scale consists of twenty statements written at a sixth grade reading level that evaluate how respondents feel at the present moment; the statements are rated on a four-point scale best describing the intensity of anxiety (Spielberger, 1983). The rating scale includes four points: one (not at all), two (somewhat), three (moderately so), and four (very much so). Each item is given a weighted score of one to four. The total score on the state anxiety scale can range from a minimum of 20 to a maximum of 80. The scale has been used successfully with junior high and high school students to measure anxiety in research and clinical practice.

State anxiety more than trait anxiety seems to influence an individual’s self-report of pain (Weinberg et al., 2000). In studies of nonpharmacologic interventions for procedural pain, anxiety in children and adolescents has been measured by the State-Trait Anxiety Inventory (STAI) and State-Trait Anxiety Inventory for Children (STAIC) (Lander & Fowler-Kerry, 1993; Pederson, 1995, 1996b).

Support for reliability of the State Anxiety scale has been reported. Test-retest reliability coefficients of .83 to .92 have been reported for the state anxiety subscale and concurrent validity supported by correlating scores with other anxiety scales (Grimm, 1997). However, Spielberger (1983) reported relatively low test-retest
reliability coefficients of .34 for high school females and .62 for high school males after 30 days and .36 for female high school students and .51 for males after 60 days.

According to Spielberger, low stability coefficients would be expected for state anxiety reflecting its contextual nature. Instead, according to Spielberger, measures of internal consistency provide a more meaningful estimate of reliability of the State Anxiety scale than test-retest correlations. Coefficient alpha scores of the State Anxiety scale for a group of 424 tenth-grade students were calculated and reported as .86 for males and .94 for females (Spielberger, 1983). Another measure of internal consistency, the item-remainder correlation, was reported as .55 for the high school students.

Evidence supporting the concurrent, convergent, divergent, and construct validity of the State Anxiety scale has also been reported (Spielberger, 1983). Moderate correlations between trait and state anxiety under varying conditions of stress and moderate correlations with other anxiety measures, as well as differences in mean state anxiety scores under varying stressful conditions provided support for validity of the state anxiety scale.

In this feasibility study, adolescent participants rated how they felt immediately prior to allergy testing after completing the Pre-testing Questionnaire, prior to receiving the group assignment, and before actually beginning the allergy testing procedure. The state anxiety score was used to answer research question four, interaction of anxiety with the effect of distraction on pain perception.

Pre-testing questionnaire. Demographic data, “needle” anxiety, and extraneous variables were measured through use of the Pre-testing Questionnaire, an open-ended
and closed-ended, structured, self-administered questionnaire developed by the researcher for the purposes of this study (see Appendix E, Pre-Testing Questionnaire). The self-administered pre-questionnaire required about five minutes to complete. The adolescent completed the Pre-testing Questionnaire immediately after agreeing to participate in the study and signing the assent form. The participant’s name was not recorded guaranteeing anonymity of recorded data; instead participants were assigned a code number. The investigator reviewed the Pre-testing Questionnaire prior to the beginning of the allergy testing and indicated day of the week, date, and time of the allergy testing and group assignment of the participant.

The demographic variables: age, gender, race/ethnicity were gathered on the Pre-testing Questionnaire. This information provided data about differences in perception of pain as related to gender, ethnicity, or age within the developmental level, adolescence. The extraneous variables, previous experience with injections, knowledge of the present allergy testing, expectations of the procedure, and number of allergens tested, can also potentially affect the pain perception rating and were measured on the Pre-testing Questionnaire. Three items were believed related to anxiety; these items measured ratings of previous experience with injections, “needle” anxiety, and expectations of the allergy testing.

Post-testing questionnaire. The Post-testing Questionnaire, an open-ended and closed-ended, structured, self-administered questionnaire developed by the researcher for the purposes of this study (see Appendix F, Post-Testing Questionnaires), measured the outcome variables related to distraction, perceived level of engagement in the distraction intervention, and perception of the allergy testing experience.
Perceived level of engagement was asked to answer research question three, the relationship between level of engagement with the distraction and perception of pain. Two versions were used: one was completed by participants in group one, the control group, and the other was completed by participants in groups two and three, the distraction intervention groups. The participant’s name was not recorded guaranteeing anonymity of recorded data; a code number was assigned. Completion of the Post-testing Questionnaire took about ten minutes. Participants completed the form following the allergy testing procedure and rating of pain perception using the APPT and FACES pain rating scales.

The Post-testing Questionnaire included an area for the adolescents to list their top three choices of videotapes, music CDs, or books-on-cassette. This information will be valuable for continuing to build a media library that includes popular adolescent music, books, or videotapes. The researcher planned to add selections to the library based on the adolescents’ favorite choices for use in the main study and to keep the media choices current.

Unfortunately, previously developed data collection questionnaires measuring the demographic data, extraneous variables, and outcome variables related to distraction, engagement, and the allergy testing experience were not available for this study. Through the piloting-pretesting, the newly developed Pre-and Post-testing Questionnaires were evaluated for reliability and validity. Adolescent participants were asked about their understanding of the items listed on both the Pre- and Post-testing Questionnaires. Content validity of the two questionnaires has been assessed by seeking verification of the items with the allergy clinic nurses and a doctorally-
prepared pediatric nurse with expertise in research related to pain management.

Seeking evidence for content validity is appropriate for the development of the questionnaires measuring the demographic data, extraneous variables, and outcome variables related to distraction, engagement, and the allergy testing experience. As another beginning step toward assessing validity, six adolescents known to the researcher (a twelve-year-old boy, a thirteen-year-old boy, a fourteen-year-old boy, a fifteen-year-old girl, a sixteen-year-old boy, and a seventeen-year-old girl) independently evaluated the Pre- and Post-testing Questionnaires and provided valuable feedback about their understanding of the content of the questions. The questionnaires were revised based on the group’s comments. The researcher also took a testing and measurement graduate course and asked the professor and fellow students for feedback about the Pre-and Post-testing Questionnaires. This, too, provided valuable information and led to the final version of the forms for use in the feasibility study.

Data Management and Analysis

In this feasibility study, data analysis was conducted to test that phase of the research study. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) 12.0, a computerized statistical analysis program. Initially, all data collection forms including the Pre-testing Questionnaire, State Anxiety scale, APPT and FACES pain rating forms, and Post-testing Questionnaire were reviewed at the time of data collection for any outliers, missing, or what seemed to be erroneous data. The researcher asked the participant to clarify any information at that time. Missing dependent variable (pain ratings) and independent variable (the group assignment) data
did not occur in this study because the researcher collected and reviewed all forms at the time of data collection.

All data were coded and entered by the researcher and a data entry assistant who has several years of experience using SPSS. Together the researcher and data entry assistant coded and entered the data and then double-checked all SPSS output to examine the data files for any errors or outliers. All subject records were checked for any errors in data entry and corrected. Frequency distributions were conducted for every variable; ranges of values were checked for any outliers or errors. Histograms and box plots were constructed. Any errors found upon reviewing the SPSS output were corrected by re-entering the data. At the time of data coding and data entry, the only truly missing data included total number of allergens tested for a few participants; those numbers were retrieved from the allergy clinic and entered. For items that were not applicable to answer on the Post-testing Questionnaire, such as for group one participants who did not take part in the interventions or those who did not receive Phase II allergy testing, data were coded as "999" under missing values for the variables.

Using SPSS, the data were analyzed via descriptive and inferential statistics. The level of significance was set at .05 for all inferential univariate analyses and .025 for the multivariate analyses. Descriptive data included frequencies and, as appropriate, measures of central tendency for demographic data, such as gender, age, and ethnicity; extraneous variables, such as number of allergens tested; the moderator variable, anxiety; and the dependent variable, pain perception as measured by ratings from the APPT and FACES scores. Distribution of this data was analyzed for each of
the three groups. The independent variable was also summarized descriptively. Frequencies of participants for each group and of each distraction in the self-selected group were tallied. Pearson’s product moment correlation was used to analyze the existence of any relationships between continuous variables, such as age and the dependent variable, pain perception. Differences in proportions of gender and race/ethnicity were analyzed using cross-tabulation.

Data were analyzed based on the original research study questions. While hypothesis testing was originally planned, due to the small sample size, hypothesis testing could not be conducted. Instead effect size and power were analyzed for planning future hypothesis testing and calculating the sample size for the main study. Inferential statistical tests, multivariate analysis of variance (MANOVA) and follow-up univariate analysis of variance (ANOVA), were conducted to pilot test the main effect of the distraction intervention (research questions one and two). The three groups: usual care, nurse-selected distraction intervention, and self-selected distraction were compared on the dependent variable, pain perception, as measured by pain intensity on the two pain rating scales. The pain ratings were evaluated to determine whether one of the pain scales could be used as the dependent variable in the main study. The univariate analyses provided information concerning the contribution of each pain rating scale to determine if one sufficiently measured the dependent variable, while the MANOVA offered information about the interaction effect of the two pain perception ratings.

Two-way ANOVA was also conducted to analyze a possible interaction effect of the independent variable, group assignment, and age using two age groups within
adolescence: early (ages ten to thirteen) and middle (ages fourteen to seventeen) on pain perception. In addition to the main effects, an interaction effect was analyzed.

Pearson’s product moment correlation was used to answer research question three by analyzing the existence of a relationship between perceived level of engagement in the distraction activity measured by the Post-testing Questionnaire and pain perception measured by each of the pain scales (APPT and FACES). Descriptive data compared the number of participants who wanted to be distracted during each phase of allergy testing.

To answer research question four, two-way ANOVA was conducted to analyze a possible interaction effect between two factors, anxiety using the State Anxiety score grouped as low, moderate, or high anxiety and the distraction intervention, on pain perception. Pearson’s product moment correlation was also used to analyze a relationship between state anxiety and pain perception. Anxiety, using the State Anxiety score, was also included as a covariate in multivariate analysis of covariance (MANCOVA). The MANCOVA was conducted to statistically control for anxiety to reduce the error variance in the dependent variable. As suggested by Owen & Froman (1998) and Hinkle et al. (1998), prior to conducting the MANCOVAs, scatterplots were examined and correlations between anxiety and pain perception were calculated to determine the existence of a linear relationship between anxiety and pain perception. The second assumption concerned testing for homogeneity of regression or parallelism to determine that an interaction did not exist between the covariate, anxiety, and the distraction intervention.
Participant responses to the open-ended questions on the Pre- and Post-testing Questionnaires, as well as the researcher’s observations during the allergy testing procedure, were entered into an EXCEL database. This permitted the researcher to easily examine the data for themes that existed across participants. The results of this descriptive data were summarized. The results of the participants’ choices of pain words used to describe the allergy testing experience were also summarized.

Furthermore, the psychometric properties of the APPT and FACES scales were re-analyzed for the specific study population. The pain ratings from the APPT and FACES pain scales were correlated using Pearson’s product moment correlation. Cronbach’s alpha was calculated on the State Anxiety scale for this specific study population. The psychometric properties of the Pre-and Post-testing Questionnaires were also analyzed by Cronbach’s alpha and point-biserial correlations. In addition, relationships between several anxiety-related items on the Pre-testing Questionnaire, such as needle anxiety, past experiences with allergy testing, and expectations of allergy testing, and state anxiety were analyzed through Pearson’s product moment correlation. Relationships between several Post-testing Questionnaire items were also examined by Pearson’s product moment correlation. Test-retest reliability of the Post-testing Questionnaire was examined.
CHAPTER V
RESULTS

The findings of this feasibility study are presented in this chapter. First results of the descriptive statistical analyses are provided. Then the four research questions are answered using the planned statistical analyses with goals of pilot testing the analysis and obtaining effect sizes to determine the sample size necessary for the main study. The small sample size of this feasibility study precluded hypothesis testing. Results of psychometric testing of the instruments are provided. Additional interesting findings are also included in this chapter, as well as a descriptive analysis of the researcher’s observations and participant’s responses to the open-ended questions on the Post-testing Questionnaire. Due to the small sample size, all results of this feasibility study must be interpreted cautiously.

Descriptive Statistics

Frequencies and appropriate measures of central tendency for the demographic data: age, gender, and ethnicity; extraneous variables, such as number of allergens tested; the moderator variable, anxiety; and the dependent variable, pain perception as measured by the pain rating scores on the APPT Word Graphic and the FACES rating scales, are described below. Additionally the independent variable is summarized by describing the characteristics of the participants in each of the three groups.

Age. The 32 participants of the feasibility study ranged in age from ten to seventeen years; all ages in this range were represented. The one ten-year-old participant was close to his eleventh birthday, assigned to group one, and able to complete all the instruments without difficulty. The mean age of the participants was
14.06 years ($SD = 2.31$). Two phases of adolescence were represented in the study: fifteen participants were in the early adolescence phase (ages ten to thirteen) and seventeen were in the middle adolescence phase (ages fourteen to seventeen).

**Gender.** Fifteen females and seventeen males participated in this study.

**Race/ethnicity.** Participants in the study identified their race or ethnicity as African-American/black ($n = 4$), Hispanic/Latin ($n = 2$), or White/Caucasian ($n = 26$).

**Extraneous variables.** Several extraneous variables were analyzed. One possible extraneous variable was the number of allergens tested during the allergy testing. The number of allergens tested equates to the number of skin pricks or scratches in Phase I testing and the number of intradermal injections in Phase II testing. In Phase I allergy testing, the number of allergens ranged from 24 to 42 pricks or scratches with a mean of 28 scratches per participant. All 32 study participants received Phase I allergy testing. Twenty-four of the participants each received 27 scratches or pricks with the majority of the remaining number of scratches received by only one participant. Only 27 study participants received Phase II allergy testing. In Phase II allergy testing, the number of allergens tested ranged from seven to 23 intradermal injections with a mean of eighteen intradermals per participant. Twelve of the participants received either 21 ($n = 6$) or 23 ($n = 6$) intradermals. The remaining number of intradermals was received by only one or two participants (See Table 1).
Table 1: Number of Allergens Tested

<table>
<thead>
<tr>
<th></th>
<th>Phase I ($N = 32$)</th>
<th>Phase II ($n = 27$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>24 - 42</td>
<td>7 - 23</td>
</tr>
<tr>
<td>Mean</td>
<td>28.00</td>
<td>17.96</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>3.16</td>
<td>5.32</td>
</tr>
<tr>
<td>Median</td>
<td>27.00</td>
<td>21.00</td>
</tr>
</tbody>
</table>

An extraneous variable emerged during data collection; the type of skin testing for Phase I changed from a droplet-and-lancet technique to an allergen-impregnated Greer DermaPIK prick technique. Six study participants had allergy skin testing using the droplet-and-lancet technique before its use was discontinued in the AMC allergy center; the remaining 26 participants had allergy skin testing using a Greer prick technique.

The nurse administering the allergy testing was identified as a possible extraneous variable. Primarily two nurses conducted all the allergy testing; one nurse, a licensed practical nurse, tested fifteen participants and another nurse, a registered nurse, tested twelve participants. Two other nurses had been orienting to the allergy center and tested a total of five participants.

**Moderator variable.** Anxiety was identified as a moderator for this study. The participant’s state anxiety score was measured by Spielberger’s State Anxiety scale of the STAI. State anxiety scores can range from 20 (lowest state anxiety) to 80 (highest state anxiety). The participants’ state anxiety scores ranged from 20 to 65 with a mean of 37.22 ($SD = 11.9$) and median of 37.50.
The relationship between age and state anxiety was analyzed using Pearson’s product moment correlation. No statistically significant correlation was found between mean age and mean state anxiety, \( r(30) = -.06 \).

Anxiety was further measured, specifically “needle” anxiety, on the Pre-testing Questionnaire. Ratings of whether injections evoke feelings of anxiety ranged from one (not at all) to five (extremely nervous) with a mean rating of 2.84 (\( SD = 1.42 \)) and median rating of 3.00. All values were represented. The participant’s past experience with injections, thought to be linked with “needle” anxiety, was measured on the Pre-testing Questionnaire. Ratings ranged from one (didn’t bother me) to five (worst experience ever) with a mean rating of 2.44 (\( SD = 1.16 \)) and a median rating of 2.00. Expectation of the allergy testing experience was also considered linked to anxiety and measured on the Pre-testing Questionnaire. Ratings ranged from one (pleasant) to five (extremely painful) with a mean rating of 2.63 (\( SD = .833 \)) and median of 3.00. All participants (\( N = 32 \)) responded to these questions prior to allergy testing.

Anxiety related specifically to the allergy testing experience was measured on the Post-testing Questionnaire. Ratings of Phase I allergy testing (scratch/prick) anxiety ranged from one (not nervous at all) to five (most nervous I could feel) with a mean rating of 2.02 (\( SD = 1.04 \)) and median rating of 2.00. All values were represented; all 32 participants completed the rating. Ratings of Phase II allergy testing (intradermal) anxiety ranged from one to four with a mean of 2.35 (\( SD = 1.04 \)) and median of 2.00. Twenty-seven participants experienced Phase II allergy testing and completed the rating. For those participants who participated in both phases of allergy testing (\( n = 27 \)), Phase II allergy testing anxiety was significantly higher (2.35) than
Phase I allergy testing anxiety (1.78), $t(26) = -3.29, p = .003$ (two-tailed), $d = -.63$. No statistically significant differences were found in mean allergy testing anxiety across the three groups. The Phase II mean rating was slightly higher for the self-selected distraction group (2.56) than the identical usual care group and nurse-selected distraction group mean allergy testing anxiety (2.25).

**Independent variable.** Ten participants were included in group one (usual care), twelve participants in group two (nurse-selected distraction), and ten participants in group three (self-selected distraction). Of those participants assigned to the self-selection group, seven chose a videotape, two selected a music CD, and one chose a book-on-cassette. The following media choices were selected:

- "Bikes- Summer Two Gravity Games" videotape ($n = 3$)
- Sponge Bob, Square Pants "Sponge Buddies" videotape ($n = 2$)
- "The Rock" videotape ($n = 1$)
- Destiny’s Child “The Platinum’s on the Wall” music videotape ($n = 1$)
- “The Miseducation of Lauryn Hill” music CD ($n = 1$)
- Weezer music CD ($n = 1$)
- “Holes” by Louis Sachar book-on-cassette ($n = 1$)

Prior to answering the research questions, the three groups were initially compared to determine if the groups were equivalent on various variables. Table 2 illustrates the demographic characteristics and state anxiety scores of each of the three groups, as well as data regarding the possible extraneous variables.
Table 2: Comparison of Variables Across Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1 (n = 10)</th>
<th>Group 2 (n = 12)</th>
<th>Group 3 (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age $M (SD)$</td>
<td>13.80 (2.04)</td>
<td>14.83 (2.25)</td>
<td>13.40 (2.59)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Female</td>
<td>7</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African-American/Black</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Hispanic/Latin</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>7</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Number of Allergens</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase I $M (SD)$</td>
<td>27.30 (1.95)</td>
<td>28.33 (4.31)</td>
<td>28.30 (2.67)</td>
</tr>
<tr>
<td>Phase II $M (SD)$</td>
<td>18.50 (6.00)</td>
<td>17.80 (5.37)</td>
<td>17.67 (5.24)</td>
</tr>
<tr>
<td>Lancet Technique</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Nurse</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>LPN</td>
<td>6</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>-</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>State anxiety $M (SD)$</td>
<td>43.40 (13.09)</td>
<td>35.42 (8.64)</td>
<td>33.20 (12.67)</td>
</tr>
</tbody>
</table>

Note. In Phase II testing, Group 1 n = 8, Group 2 n = 10, and Group 3 n = 9.
One-way ANOVAs revealed no statistically significant differences in the means of several variables across the three groups. No differences were found in mean:

- ages, $F(2, 29) = 1.15, p = .33$;
- number of scratches/pricks (Phase I testing), $F(2, 29) = .34, p = .71$;
- number of intradermals (Phase II testing), $F(2, 24) = .56, p = .95$;
- state anxiety scores, $F(2, 29) = 2.22, p = .13$;
- “needle” anxiety ratings, $F(2, 29) = .07, p = .93$;
- ratings of past experiences with injections, $F(2, 29) = .45, p = .64$;
- ratings of expectation of allergy testing, $F(2, 29) = 1.19, p = .32$;
- Phase I post-allergy testing anxiety ratings, $F(2, 29) = .89, p = .92$; or
- Phase II post-allergy testing anxiety ratings, $F(2, 24) = .25, p = .78$.

An ANOVA assumption was not met in ratings of expectation of allergy testing. Levene’s test of equality of error variance detected a statistically significant difference in the error variance of the expectation ratings across the three groups. Thus the error variance of this variable was not equivalent for the three groups.

Chi square analyses found no statistically significant differences for gender or race/ethnicity among the three groups. Tables 3 and 4 present a comparison of the actual and expected frequencies for each of the three groups. Note that in the race/ethnicity analysis, 67% of the cells had fewer than five expected frequencies, and in the gender analysis, 33% of the cells had fewer than five expected frequencies.
Table 3: Gender Differences Across Groups

<table>
<thead>
<tr>
<th>Gender</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Row Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>3 (5.3)</td>
<td>6 (6.4)</td>
<td>8 (5.3)</td>
<td>17 (53.1%)</td>
</tr>
<tr>
<td>Female</td>
<td>7 (4.7)</td>
<td>6 (5.6)</td>
<td>2 (4.7)</td>
<td>15 (46.9%)</td>
</tr>
<tr>
<td>Column Total</td>
<td>10 (31.3%)</td>
<td>12 (37.5%)</td>
<td>10 (31.3%)</td>
<td>32 (100%)</td>
</tr>
</tbody>
</table>

χ²(2, N = 32) = 5.10, p = .08

Table 4: Race/Ethnicity Differences Across Groups

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Row Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>African-American/Black</td>
<td>2 (1.3)</td>
<td>1 (1.5)</td>
<td>1 (1.3)</td>
<td>4 (12.5)</td>
</tr>
<tr>
<td>Hispanic/Latin</td>
<td>1 (0.6)</td>
<td>1 (0.8)</td>
<td>0 (0.6)</td>
<td>2 (6.3)</td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>7 (8.1)</td>
<td>10 (9.8)</td>
<td>9 (8.1)</td>
<td>26 (81.3)</td>
</tr>
<tr>
<td>Column Total</td>
<td>10 (31.3%)</td>
<td>12 (37.5%)</td>
<td>10 (31.3%)</td>
<td>32 (100%)</td>
</tr>
</tbody>
</table>

χ²(4, N = 32) = 1.86, p = .76

Dependent variable. Descriptive data for each of the pain ratings during Phase I and Phase II allergy testing are presented in Table 5. The mean pain rating using the FACES scale was higher than the APPT Word Graphic rating scale during Phase I allergy testing. However, for Phase II allergy testing, the mean pain rating using the
APPT Word Graphic scale was higher than the FACES rating scale. Overall mean pain ratings were higher for Phase II allergy testing than for Phase I allergy testing.

Table 5: Pain Ratings During Phase I and Phase II Allergy Testing

<table>
<thead>
<tr>
<th>Pain Rating</th>
<th>Phase I (N = 32)</th>
<th>Phase II (n = 27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPT Word Graphic Rating Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>0 - 3.50</td>
<td>0 - 8.20</td>
</tr>
<tr>
<td>Mean (Standard Deviation)</td>
<td>1.31 (0.83)</td>
<td>4.12 (2.25)</td>
</tr>
<tr>
<td>Median</td>
<td>1.50</td>
<td>4.90</td>
</tr>
<tr>
<td>FACES Rating Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>0 - 6.00</td>
<td>0 - 6.00</td>
</tr>
<tr>
<td>Mean (Standard Deviation)</td>
<td>1.97 (1.45)</td>
<td>3.74 (1.66)</td>
</tr>
<tr>
<td>Median</td>
<td>2.00</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Pearson's product moment correlation was used to examine a relationship between the pain ratings during each phase of allergy testing for only those participants who received both phases of testing (n = 27). A moderate significant correlation was found between the APPT Word Graphic Phase I and Phase II allergy testing pain ratings, \( r(25) = .62, p = .001 \). A moderate correlation was also found between the FACES Phase I and Phase II allergy testing pain ratings, \( r(25) = .69 \), which was significant at the .01 level.

Relationships between the numbers of scratches/pricks received during Phase I testing and the pain ratings, as well as between the numbers of intradermals received
during Phase II testing and the pain ratings, were analyzed using Pearson’s product
moment correlation. For Phase I allergy testing, a low significant correlation was
found between the mean number of scratches and the mean Word Graphic pain rating,
r(30) = .35, p = .048. No significant correlation was found between the mean number
of scratches and the mean FACES pain rating, r(30) = .18. For Phase II allergy testing,
no significant correlations were found between the mean number of intradermals and
each of the pain ratings: the APPT Word Graphic rating, r(25) = -.13, or the FACES
rating, r(25) = -.06.

Relationships between age and each of the pain intensity ratings during Phase I
and Phase II allergy testing were analyzed using Pearson’s product moment
correlation. No statistically significant correlations were found between mean age
(14.06 years) and mean pain ratings using the Word Graphic Rating scale, r(30) = -.07,
or FACES pain rating scale, r(30) = -.16, during Phase I allergy testing. Again, no
statistically significant correlations were found between mean age (14.19 years) and
mean pain ratings using the APPT Word Graphic Rating scale, r(25) = .06, or FACES
pain rating scale, r(25) = .19, during Phase II allergy testing. When age was
categorized as early adolescence (ten to thirteen years) and middle adolescence
(fourteen to seventeen years), one-way ANOVAs also found no statistically significant
differences between mean age and mean pain intensity ratings using the two pain
rating scales during Phase I or Phase II allergy testing (See Table 6).
### Table 6: Pain Ratings by Age Group for Phase I and Phase II Allergy Testing

<table>
<thead>
<tr>
<th>Age Group</th>
<th>APPT Word Graphic</th>
<th>FACES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M (SD)$</td>
<td>$M (SD)$</td>
</tr>
<tr>
<td><strong>Phase I</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Adolescence ($n = 15$)</td>
<td>1.31 (0.74)</td>
<td>2.00 (1.31)</td>
</tr>
<tr>
<td>Middle Adolescence ($n = 17$)</td>
<td>1.30 (0.93)</td>
<td>1.94 (1.60)</td>
</tr>
<tr>
<td>$F(1, 30) = .002$</td>
<td>$F(1, 30) = .013$</td>
<td></td>
</tr>
<tr>
<td><strong>Phase II</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Adolescence ($n = 12$)</td>
<td>3.88 (2.19)</td>
<td>3.42 (1.62)</td>
</tr>
<tr>
<td>Middle Adolescence ($n = 15$)</td>
<td>4.31 (2.36)</td>
<td>4.00 (1.69)</td>
</tr>
<tr>
<td>$F(1, 25) = .25$</td>
<td>$F(1, 25) = .82$</td>
<td></td>
</tr>
</tbody>
</table>

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One-way ANOVAs revealed no statistically significant differences between gender and mean pain intensity ratings using either of the two pain rating scales during Phase I or Phase II allergy testing or between race/ethnicity and the mean pain ratings (See Tables 7 and 8).

Table 7: Pain Ratings by Gender for Phase I and Phase II Allergy Testing

<table>
<thead>
<tr>
<th>Gender</th>
<th>APPT Word Graphic</th>
<th>FACES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Phase I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (n = 17)</td>
<td>1.13 (0.76)</td>
<td>1.59 (1.28)</td>
</tr>
<tr>
<td>Female (n = 15)</td>
<td>1.51 (0.89)</td>
<td>2.40 (1.55)</td>
</tr>
<tr>
<td></td>
<td>$F(1, 30) = 1.67$</td>
<td>$F(1, 30) = 2.64$</td>
</tr>
<tr>
<td>Phase II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (n = 16)</td>
<td>3.84 (2.41)</td>
<td>3.31 (1.66)</td>
</tr>
<tr>
<td>Female (n = 11)</td>
<td>4.52 (2.03)</td>
<td>4.36 (1.50)</td>
</tr>
<tr>
<td></td>
<td>$F(1, 25) = .58$</td>
<td>$F(1, 25) = 2.81$</td>
</tr>
</tbody>
</table>
Table 8: Pain Ratings by Race/Ethnicity for Phase I and Phase II Allergy Testing

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>APPT Word Graphic M (SD)</th>
<th>FACES M (SD)</th>
<th>Phase I</th>
<th>Phase II</th>
</tr>
</thead>
<tbody>
<tr>
<td>African-American/Black (n = 4)</td>
<td>1.50 (0.50)</td>
<td>3.00 (1.16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic/Latin (n = 2)</td>
<td>1.70 (0.42)</td>
<td>2.00 (0.00)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/Caucasian (n = 26)</td>
<td>1.25 (0.89)</td>
<td>1.81 (1.50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$F(2, 29) = .38$</td>
<td>$F(2, 29) = 1.19$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African-American/Black (n = 3)</td>
<td>4.70 (0.61)</td>
<td>4.33 (0.58)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic/Latin (n = 1)</td>
<td>5.00 (-)</td>
<td>4.00 (-)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/Caucasian (n = 23)</td>
<td>4.00 (2.42)</td>
<td>3.65 (1.77)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$F(2, 24) = .19$</td>
<td>$F(2, 24) = .22$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Research Questions 1 and 2

Research questions one and two, which are listed as follows, were analyzed by using one-way ANOVA and MANOVA. The main effect as related to question two below, the primary purpose of this study, was tested by one-way MANOVA for both of the phases of allergy testing.

- What is the effect of a nursing intervention, distraction, on the perception of acute procedural pain among adolescents as they undergo allergy skin testing?
Specifically, what is the effect of self-selected distraction, rather than nurse-selected distraction, on acute pain perception among adolescents undergoing allergy testing?

One-way MANOVA was conducted to determine the effect of distraction on the two pain ratings from the APPT Word Graphic Rating scale and the FACES pain rating scale used as two dependent variables. Levene's assumption of homogeneity of variance and Box's M measure of equality of the variance-covariance matrices were met. Wilks' Lambda, the more commonly used multivariate test, found no statistically significant differences in pain perception among the three groups in either Phase I allergy testing, $F(4, 56) = 1.06$, or Phase II allergy testing, $F(4, 46) = .68$. Only approximately seven percent of the multivariate variance in pain perception was explained by the group assignment in Phase I allergy testing, and only six percent of the variance was explained by the group assignment in Phase II allergy testing. Two follow-up univariate ANOVAs for each of the pain ratings revealed no statistically significant differences among the three groups' mean pain ratings for either the APPT Word Graphic ratings or the FACES ratings during each phase of allergy testing (See Table 9 for a comparison of the mean pain ratings across the three groups).
Table 9: Pain Ratings Across Groups During Phase I and Phase II Allergy Testing

<table>
<thead>
<tr>
<th>Pain Rating</th>
<th>Group 1 (n = 10)</th>
<th>Group 2 (n = 12)</th>
<th>Group 3 (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APPT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M(SD)$</td>
<td>1.40 (1.02)</td>
<td>1.28 (.65)</td>
<td>1.24 (.90)</td>
</tr>
<tr>
<td>97.5% CI (lower, upper)</td>
<td>.76, 2.04</td>
<td>.70, 1.87</td>
<td>.60, 1.88</td>
</tr>
<tr>
<td>$F(2, 29) = .09, p = .91$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FACES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M(SD)$</td>
<td>2.20 (1.75)</td>
<td>2.25 (1.22)</td>
<td>1.40 (1.35)</td>
</tr>
<tr>
<td>97.5% CI (lower, upper)</td>
<td>1.12, 3.28</td>
<td>1.2, 3.23</td>
<td>.32, 2.48</td>
</tr>
<tr>
<td>$F(2, 29) = 1.14, p = .34$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APPT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M(SD)$</td>
<td>3.73 (2.24)</td>
<td>3.98 (2.05)</td>
<td>4.62 (2.63)</td>
</tr>
<tr>
<td>97.5% CI (lower, upper)</td>
<td>1.77, 5.68</td>
<td>2.23, 5.73</td>
<td>2.78, 6.46</td>
</tr>
<tr>
<td>$F(2, 24) = .35, p = .71$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FACES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M(SD)$</td>
<td>3.25 (1.83)</td>
<td>3.90 (1.52)</td>
<td>4.0 (1.73)</td>
</tr>
<tr>
<td>97.5% CI (lower, upper)</td>
<td>1.82, 4.68</td>
<td>2.62, 5.18</td>
<td>2.66, 5.35</td>
</tr>
<tr>
<td>$F(2, 24) = .49, p = .62$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Separate one-way ANOVAs were conducted because a Type I error was of little concern in this feasibility study. The power doubled owing to the higher alpha level for the univariate analysis (.05) rather than the lower alpha for the follow-up ANOVAs of the multivariate analysis (.025; the alpha level is divided by the number of dependent variables to control for a Type I error). However, with this less conservative alpha, the slight increase in power was still not high enough to detect any possible statistically significant differences in pain perception across the three groups for either Phase I or Phase II allergy testing. All other results from the univariate analyses were identical to the follow-up univariate testing in the multivariate analysis.

The effect sizes from the follow-up one-way ANOVAs of this feasibility study were used in the power analysis to calculate the sample size needed for the main study. The ANOVA effect sizes were chosen rather than those from the MANOVA because even higher sample sizes would be needed for multivariate analyses in the main study. The eta squared values for the APPT Word Graphic pain ratings during Phase I and II allergy testing were .01 and .03, respectively, which are considered to be small effect sizes. The eta squared values for the FACES pain ratings during Phase I and II allergy testing were .07 and .04, medium and small effect sizes, respectively. Due to the incongruence between the APPT and FACES effect sizes in Phase I allergy testing, the smaller, more conservative effect size of the APPT was chosen for the power analysis. Thus, for the main study with an alpha of .05, estimation of power at .80, and .01 and .03 respectively for effect sizes, approximately 319 subjects would be required per group for Phase I allergy testing and 105 subjects needed per group for Phase II allergy.
testing using the APPT Word Graphic pain rating as one dependent variable in a univariate ANOVA comparing three groups.

Next, to further examine questions one and two, an additional analysis was conducted by averaging the two pain intensity rating scores for each group in Phase I allergy testing. The self-selected distraction group averaged pain rating (1.32) was slightly lower, than the usual care group (1.80) and the nurse-selected distraction group (1.77) averaged pain ratings, which were almost identical. Although no statistically significant differences were found, $F(2, 29) = .62$, the trend was a lower averaged pain rating for the self-selected distraction group in Phase I only.

Groups two and three were then combined into one distraction group ($n = 22$) and compared to the usual care group ($n = 10$) to determine a difference in any distraction intervention versus no distraction. Levene’s assumption of homogeneity of variance and Box’s M measure of equality of the variance-covariance matrices were met. One-way MANOVA again found no statistically significant differences in pain perception between the two groups during either Phase I allergy testing, $F(2, 29) = .18$, or Phase II allergy testing, $F(2, 24) = .74$. The only noteworthy result of combining the two distraction groups was a more similar eta squared (.01) between the two pain ratings (APPT Word Graphic and FACES) in Phase I allergy testing.

An interaction effect of age with the group assignment on pain perception was examined by conducting a two-way ANOVA. Although Levene’s test of homogeneity of variance was not significant for all analyses, assumptions associated with equal variance of the dependent variable across groups could not be assumed because cell frequencies were unequal and very small. Therefore, analyses were conducted using
unweighted means analysis. In the two-way ANOVA, age was recoded as early adolescence (ten to thirteen years) and middle adolescence (fourteen to seventeen years) and entered as a co-factor. Using two-way ANOVA, no statistically significant interactions between age and group assignment or main effects for group or age were found for either the APPT Word Graphic or FACES pain perception ratings during Phase I or Phase II allergy testing. However, as illustrated in Figure 3A – D, an interaction effect is observed.
Figure 3. Interaction Between Adolescent Age Group and Group Assignment on APPT (A, C) and FACES (B, D) Pain Ratings During Phase I (A, B) and Phase II (C, D) Allergy Testing
Research Question 3

Research question three as follows was analyzed by using Pearson’s product moment correlation. Only those participants in groups two and three were included in this analysis; the usual care group did not participate in a distraction intervention.

- What is the relationship between level of engagement in the distraction activity and perception of acute procedural pain in adolescents?

Correlations were analyzed between one of the Post-testing Questionnaire items that asked the participant to rate ability to pay attention to the videotape, CD, or cassette during allergy testing, and the pain rating scores from the APPT Word Graphic Rating scale and FACES rating scale. Participants who received Phase II allergy testing answered this item twice, after each phase of allergy testing. Ratings of ability to pay attention to the distraction intervention ranged from one (could not pay attention at all) to five (totally absorbed at all times) with a mean Phase I rating of 3.76 (SD = .86) and a mean Phase II rating of 3.34 (SD = .91).

Pearson’s product moment correlation found no correlation between ability to pay attention and the APPT Word Graphic pain ratings, $r(20) = -.17$, during Phase I allergy testing. However, a non-significant, low negative correlation was found between ability to pay attention and the FACES pain ratings during Phase I testing, $r(20) = -.26$. During Phase II allergy testing, significant, moderate negative correlations were found between ability to pay attention and both the APPT pain ratings, $r(17) = -.54$, $p = .016$, and the FACES pain ratings, $r(17) = -.68$, $p = .001$. Whereas, only three to seven percent of the variance in Phase I allergy testing pain perception was explained by ability to pay attention, more of the variance was
accounted for in Phase II allergy testing. Twenty-nine to 46% of the variance in Phase II allergy testing pain perception, as measured by the APPT and FACES respectively, was explained by ability to pay attention to the distraction intervention.

Since the ability to pay attention to the distraction intervention could be affected by the desire to be distracted, allergy testing participants assigned to groups two and three were asked about their desire to be distracted from the allergy testing on the Post-testing Questionnaire. Seventeen of the 22 Phase I allergy testing participants who were in the distraction intervention groups indicated that they wanted to be distracted. Three of the five who did not want to be distracted were in the self-selected distraction group. Seventeen of the nineteen Phase II participants who were in the distraction intervention groups indicated that they wanted to be distracted from the allergy testing. Twenty-four of the total 32 participants reported that they want to be distracted when undergoing any healthcare procedure. However, ten participants also indicated that they want to pay attention when a healthcare procedure is being performed.

When asked to indicate whether distraction lessened the allergy testing pain, twelve of the 22 Phase I and twelve of the nineteen Phase II allergy testing participants assigned to the intervention groups agreed. Sixteen of the 22 Phase I and thirteen of the eighteen Phase II allergy testing participants assigned to the intervention groups agreed that self-selection in choosing a distraction was more helpful in lessening pain than nurse-selected distraction.
Research Question 4

Research question four was analyzed by two-way ANOVA and MANCOVA. Additional analyses related to anxiety were conducted using Pearson’s correlation.

- How does anxiety interact with the effect of distraction on acute procedural pain perception in adolescents undergoing allergy testing?

Two-way ANOVA was conducted to examine an interaction between anxiety and the two distraction intervention groups on pain perception. Separate two-way ANOVAs were conducted for both the APPT Word Graphic and FACES rating scales, as well as any main effects, for both Phase I and Phase II allergy testing. State anxiety, as measured by the Spielberger State Anxiety scale, was recoded as three levels of anxiety: low (20-39), moderate (40-59), and high (60-80) and entered in the analyses as a co-factor. However, in the two intervention groups, there were no participants categorized in the high anxiety category.

Levene’s test of homogeneity of variance was not significant for all analyses indicating error variance associated with the dependent variable was equal across all three groups. However, frequencies were unequal in the cells. Therefore, because equal variance of the dependent variable in all cells could not be assumed, unweighted means analysis was used.

The 2 x 2 ANOVA indicated no significant interaction between anxiety and the distraction intervention on the two pain perception ratings during Phase I or Phase II allergy testing and no significant main effect for the distraction intervention itself during Phase I and Phase II allergy testing. However, as illustrated in Figure 4A -D, an interaction is observed in Phase I with the APPT rating scale (Figure 4A).
Figure 4. Interaction Between Anxiety and Group Assignment on APPT (A, C) and FACES (B, D) Pain Ratings During Phase I (A, B) and Phase II (C, D) Allergy Testing.
The analysis did find a significant main effect for anxiety on the FACES pain ratings during Phase I allergy testing and on both pain ratings during Phase II testing. The mean pain ratings were significantly higher for participants with moderate anxiety than those with low anxiety (See Table 10).

Table 10: Pain Ratings by Anxiety Level

<table>
<thead>
<tr>
<th>Anxiety</th>
<th>APPT Word Graphic</th>
<th>FACES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (95% CI)</td>
<td>M (95% CI)</td>
</tr>
<tr>
<td>Phase I Allergy Testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1.10 (.67, 1.53)</td>
<td>1.21 (.65, 1.78)</td>
</tr>
<tr>
<td>Moderate</td>
<td>1.59 (1.00, 2.18)</td>
<td>2.93 (2.17, 3.70)</td>
</tr>
<tr>
<td></td>
<td>$F(1, 18) = 2.01, p = .17$</td>
<td>$F(1, 18) = 14.40, p = .001^*$</td>
</tr>
<tr>
<td>Phase II Allergy Testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>3.44 (2.11, 4.78)</td>
<td>3.11 (2.35, 3.88)</td>
</tr>
<tr>
<td>Moderate</td>
<td>5.96 (4.05, 7.86)</td>
<td>5.50 (4.41, 6.59)</td>
</tr>
<tr>
<td></td>
<td>$F(1, 15) = 5.31, p = .04^*$</td>
<td>$F(1, 15) = 14.55, p = .002^*$</td>
</tr>
</tbody>
</table>

* $p \leq 0.05$, two-tailed.

After finding the significant main effect for anxiety, the researcher proposed that perhaps in controlling for anxiety, the independent variable, distraction intervention, may indeed have an effect on pain perception ratings. Initially Pearson’s product moment correlation was used to determine a relationship between state anxiety and pain perception. The analyses found moderate significant correlations between
state anxiety and each of the two pain ratings for Phase I allergy testing, \( r(30) = .53, p = .002 \) (APPT) and \( r(30) = .76, p = .000 \) (FACES), and Phase II allergy testing, \( r(25) = .42, p = .03 \) (APPT) and \( r(25) = .47, p = .01 \) (FACES).

MANCOVA was then conducted to determine the effect of distraction on pain perception using the pain rating scales (APPT Word Graphic and FACES) as two dependent variables while statistically controlling for anxiety as a covariate. The ANCOVA assumption that the covariate and the dependent variable show a linear relationship above \( r = .30 \) was met. The homogeneity of slopes or regression assumption associated with ANCOVA was met; no significant interactions between group assignment and state anxiety were found. With this assumption met, the group assignment should not have an effect on the relationship between pain perception and state anxiety. The homogeneity assumption of variance-covariance associated with MANOVA was met; Box’s test of equality of covariance matrices of the dependent variables across the groups was not significant. Levene’s test of equality of error variances across groups was not significant, and thus the homogeneity of variance assumption was met. Alpha was set at .025 for this multivariate analysis.

No statistically significant differences were found in the Phase I or Phase II allergy testing adjusted pain perception means among the three groups after controlling for anxiety, Phase I \( F(4, 54) = 1.81, p = .14 \) and Phase II \( F(4, 44) = 1.32, p = .28 \) (Wilks’ Lambda). Follow-up univariate ANOVAs also found no significant differences among the groups for Phase I, \( F(2, 28) = .30, p = .74 \) (APPT) and \( F(2, 28) = 2.49, p = .10 \) (FACES), or Phase II, \( F(2, 23) = 1.43, p = .26 \) (APPT) and \( F(2, 23) = 1.88, p = .18 \) (FACES). After controlling for anxiety, the adjusted mean Phase I or
Phase II pain ratings were not significantly different across the three groups (See Table 11 and compare adjusted means in Table 11 to unadjusted means in Table 9).

Table 11: Adjusted Pain Ratings Across Groups After Controlling for Anxiety

<table>
<thead>
<tr>
<th>Pain Rating</th>
<th>Group 1 (n = 10)</th>
<th>Group 2 (n = 12)</th>
<th>Group 3 (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>APPT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M$</td>
<td>1.15</td>
<td>1.36</td>
<td>1.40</td>
</tr>
<tr>
<td>97.5% $CI$</td>
<td>.57, 1.72</td>
<td>.85, 1.86</td>
<td>.84, 1.96</td>
</tr>
<tr>
<td><strong>FACES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M$</td>
<td>1.59</td>
<td>2.43</td>
<td>1.80</td>
</tr>
<tr>
<td>97.5% $CI$</td>
<td>.88, 2.30</td>
<td>1.80, 3.05</td>
<td>1.10, 2.49</td>
</tr>
</tbody>
</table>

*Note.* State anxiety covariate evaluated at 37.22 (20 = low, 80 = high).

<table>
<thead>
<tr>
<th>Pain Rating</th>
<th>Group 1 (n = 8)</th>
<th>Group 2 (n = 10)</th>
<th>Group 3 (n = 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>APPT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M$</td>
<td>3.36</td>
<td>3.88</td>
<td>5.06</td>
</tr>
<tr>
<td>97.5% $CI$</td>
<td>1.60, 5.13</td>
<td>2.32, 5.43</td>
<td>3.38, 6.74</td>
</tr>
<tr>
<td><strong>FACES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M$</td>
<td>2.96</td>
<td>3.82</td>
<td>4.36</td>
</tr>
<tr>
<td>97.5% $CI$</td>
<td>1.72, 4.19</td>
<td>2.73, 4.91</td>
<td>3.18, 5.53</td>
</tr>
</tbody>
</table>

*Note.* State anxiety covariate evaluated at 35.30 (20 = low, 80 = high).
State anxiety, the covariate, was not the focus of the MANCOVA, but the test revealed an effect of anxiety on pain perception in Phase I allergy testing while controlling for any particular distraction group, $F(2, 27) = 22.71$, significant at the .025 level. State anxiety accounted for 63% of the variance in pain perception associated with Phase I allergy testing for a given distraction treatment group. A significant effect of anxiety on pain perception was also found in Phase II allergy testing, $F(2, 22) = 4.85, p = .02$, with state anxiety accounting for 31% of the variance in pain perception associated with Phase II allergy testing for a particular distraction treatment group.

Reliability and Validity of the Instruments

Pain rating scales. Pearson’s product moment correlation was used to verify concurrent validity of the APPT Word Graphic Rating scale and the FACES rating scale. Mean pain intensity ratings from the APPT Word Graphic rating scale ($M = 1.31$) and the FACES rating scale ($M = 1.97$) during Phase I allergy testing were significantly, highly correlated, $r(30) = .76$, at the .01 level. The mean pain ratings from the APPT ($M = 4.12$) and the FACES ($M = 3.74$) during Phase II allergy testing were very highly correlated, $r(25) = .90$, significant at the .01 level. These highly correlated relationships demonstrate support for concurrent validity of the instruments.

Construct validity of the APPT Word Graphic and FACES pain rating scales was further supported by the lower pain ratings for the multiple pricks and scratches of Phase I allergy testing and higher pain ratings for the multiple intradermal injections of Phase II allergy testing. The APPT Word Graphic rating scale had a mean pain rating of 1.31 ($SD = .83$) and the FACES rating scale had a mean pain rating of 1.97 ($SD = .
1.45) for Phase I allergy testing. The APPT Word Graphic rating scale had a mean pain rating of 4.12 ($SD = 2.25$) and the FACES rating scale had a mean rating of 3.74 ($SD = 1.66$) for Phase II allergy testing. Furthermore, all participants correctly marked the locations of the allergy testing sites on the body outline of the APPT.

Correlations of separate APPT Word Graphic and FACES pain ratings for Phase I and Phase II allergy testing provided verification of test-retest reliability. While the pain ratings were higher for Phase II allergy testing, moderate correlations were found between Phase I and Phase II for the 27 participants undergoing both phases of allergy testing. Moderate correlations were found between the Phase I and Phase II APPT Word Graphic ratings, $r(25) = .62$, and between the Phase I and Phase II FACES pain ratings, $r(25) = .69$, with both significant at the .01 level.

**State anxiety.** The twenty items of the State Anxiety scale of Spielberger's STAI were analyzed using an internal consistency estimate of reliability. Two participants were excluded from the analysis due to each missing one item on the anxiety scale. A coefficient alpha of .93 for 30 adolescent study participants was calculated, thus providing support for reliability of the State Anxiety scale with this study’s population. This alpha is consistent with a coefficient alpha of .90 for a group of 424 tenth-grade students as reported in the STAI manual (Spielberger, 1983).

**Pre-testing questionnaire.** Psychometric testing of three items on the Pre-testing Questionnaire related to past experiences with injections, expectations of allergy testing, and “needle” anxiety was initiated. A relationship between each of the three items and the State Anxiety scale of the Spielberger STAI was examined by Pearson’s product moment correlation. Validity and reliability of Spielberger’s State Anxiety
scale have been supported. Moderate, significant correlations were found between each of the three newly developed, anxiety-related items on the Pre-testing Questionnaire and state anxiety, thus providing beginning support for concurrent validity of these new items. An internal consistency estimate of reliability was used to analyze reliability of the three Pre-testing Questionnaire items together as a three-item measure. Coefficient alpha was calculated as .78 for this three-item measure. Low-moderate correlations were found between expectations of allergy testing and past experiences with injections and between expectations of allergy testing and “needle anxiety.” A high correlation was found between past experiences and “needle” anxiety contributing to 50% of the shared variance. See Table 12 for the correlation matrix.

<table>
<thead>
<tr>
<th>Anxiety Measures</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Past Experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Expectation</td>
<td>.44*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Needle Anxiety</td>
<td>.71**</td>
<td>.50**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. State anxiety</td>
<td>.50**</td>
<td>.61**</td>
<td>.64**</td>
<td></td>
</tr>
</tbody>
</table>

* P < 0.05, two-tailed. ** P < 0.01, two-tailed.

Post-testing questionnaire. Psychometric testing of the Post-testing Questionnaire was also begun. Because the items on the Post-testing Questionnaire are of different formats, such as numerical rating scales, agree/disagree, yes/no and open-ended responses, the entire Post-testing Questionnaire could not undergo one test of reliability or concurrent validity. Like items were grouped together in terms of related constructs and tested as follows.
Several items from the Post-testing Questionnaire were tested for a relationship with the Spielberger State Anxiety scale by using Pearson's product moment correlation. Moderate correlations were found between state anxiety and both Phase I allergy testing anxiety, $r(30) = .66$, and Phase II allergy testing anxiety, $r(25) = .48$, both significant at the .01 level. A low negative, non-significant correlation was found between state anxiety and ability to pay attention to the videotape, CD, or cassette during Phase I allergy testing, $r(20) = -.26$, but a moderate negative, significant correlation was found during Phase II allergy testing, $r(17) = -.63$, $p = .004$. These significant correlations with the State Anxiety scale, which has support for validity and reliability, indicate beginning support for concurrent validity of these new Post-testing Questionnaire items.

A low negative, non-significant correlation was found between the item asking about distraction preference in relation to any healthcare procedure and state anxiety, $r(30) = -.29$. Wanting to be distracted specifically from the allergy testing was not correlated with state anxiety for Phase I, $r(30) = -.12$, or Phase II, $r(25) = .11$, allergy testing or with ability to pay attention to the distraction intervention for Phase I, $r(20) = .03$, or Phase II, $r(17) = .06$, allergy testing.

Additionally, relationships between several of the new items themselves were examined using Pearson's product moment correlation. Moderate correlations were found between the Pre-testing Questionnaire item related to needle anxiety and the Post-testing Questionnaire item related specifically to Phase I allergy testing anxiety, $r(30) = .53$, $p = .002$, and Phase II allergy testing anxiety, $r(25) = .62$, $p = .001$. 

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An internal consistency estimate of reliability was used to analyze reliability of three Post-testing Questionnaire items together as a three-item measure. Coefficient alpha for this three-item measure was calculated as .49 for Phase I allergy testing and as .75 for Phase II allergy testing. A low-moderate correlation was found between allergy testing expectation and allergy testing anxiety; however, ability to pay attention to the distraction intervention was not correlated with allergy testing anxiety or allergy testing expectation following Phase I allergy testing (See Table 13 for this inter-item correlation matrix). Moderate correlations were found between all three items following Phase II allergy testing (See Table 14 for this inter-item correlation matrix).

### Table 13: Post-testing Questionnaire Inter-item Correlation Matrix Phase I \( (n = 22) \)

<table>
<thead>
<tr>
<th>Post-testing Questionnaire Items</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Able to pay attention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Expectation of allergy testing</td>
<td>-.113</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Allergy testing anxiety</td>
<td>-.159</td>
<td>.466</td>
<td></td>
</tr>
</tbody>
</table>

### Table 14: Post-testing Questionnaire Inter-item Correlation Matrix Phase II \( (n = 19) \)

<table>
<thead>
<tr>
<th>Post-testing Questionnaire Items</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Able to pay attention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Expectation of allergy testing</td>
<td>-.538</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Allergy testing anxiety</td>
<td>-.448</td>
<td>.513</td>
<td></td>
</tr>
</tbody>
</table>

Test-retest reliability was also evaluated by correlating the Phase I and Phase II scores of two of these items, allergy testing anxiety and allergy testing expectation. A
moderate correlation was found between Phase I and Phase II allergy testing anxiety, 
\[ r(25) = .52, p = .005. \] A moderate correlation was also found between Phase I and 
Phase II allergy testing expectation, \[ r(23) = .50, p = .01. \] The results of these two 
reliability measures, Cronbach’s alpha and test-retest, provide beginning support for 
reliability of this three-item sub-measure of the Post-testing Questionnaire.

A relationship between two items on the Post-testing Questionnaire and the 
pain perception ratings was examined by using Pearson’s product moment correlation. 
No significant correlations were found between perceived effect of distraction in 
reducing pain and combined mean pain scores for Phase I, \[ r(20) = -.21, \] or Phase II, 
\[ r(17) = -.05, \] allergy testing. No significant correlation was found between perceived 
benefit of choosing one’s own distraction and combined mean pain scores for Phase I 
allergy testing, \[ r(20) = -.13, \] but a non-significant, low negative correlation was found 
for Phase II, \[ r(16) = -.29. \]

Two additional items on the Post-testing Questionnaire that were intended to 
be the reverse of the same construct had perfect correlations with each other for Phase 
I and Phase II allergy testing at the .01 level of significance.

**Additional Findings**

**Pain rating scale preference.** When asked to choose a preference in using either 
of the pain rating scales on the Post-testing Questionnaire, the decision was split 
almost evenly. Sixteen selected the APPT Word Graphic rating scale and fifteen chose 
the FACES rating scale as the pain rating scale of choice.

**Pain words chosen.** The APPT includes an area with a listing of grouped pain 
words by sensory, affective, evaluative, and temporal classifications. The study
participants were asked to circle words that described the pain of allergy testing. The
words were compiled and listed in order of decreasing frequency of selection (See
Table 15).

Table 15: Commonly Chosen Pain Words

<table>
<thead>
<tr>
<th>Pain Word Chosen</th>
<th>Frequency</th>
<th>Pain Word Chosen</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensory</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Itching</td>
<td>23</td>
<td>Like a pin</td>
<td>14</td>
</tr>
<tr>
<td>Like a pin</td>
<td>12</td>
<td>Pin like</td>
<td>10</td>
</tr>
<tr>
<td>Like a pinch</td>
<td>12</td>
<td>Like a pinch</td>
<td>9</td>
</tr>
<tr>
<td>Like a sting</td>
<td>8</td>
<td>Itching</td>
<td>8</td>
</tr>
<tr>
<td>Scratching</td>
<td>8</td>
<td>Like a sting</td>
<td>8</td>
</tr>
<tr>
<td>Like a scratch</td>
<td>7</td>
<td>Pinching</td>
<td>8</td>
</tr>
<tr>
<td>Pin like</td>
<td>7</td>
<td>Sharp</td>
<td>7</td>
</tr>
<tr>
<td>Burning</td>
<td>6</td>
<td>Stinging</td>
<td>7</td>
</tr>
<tr>
<td>Sharp</td>
<td>6</td>
<td>Hurting</td>
<td>4</td>
</tr>
<tr>
<td>Stinging</td>
<td>6</td>
<td>Aching</td>
<td>3</td>
</tr>
<tr>
<td><strong>Biting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swollen</td>
<td>3</td>
<td>Pressure</td>
<td>3</td>
</tr>
<tr>
<td>Aching</td>
<td>2</td>
<td>Sore</td>
<td>3</td>
</tr>
<tr>
<td>Hurting</td>
<td>2</td>
<td>Hot</td>
<td>2</td>
</tr>
<tr>
<td>Like an ache</td>
<td>2</td>
<td>Like a scratch</td>
<td>2</td>
</tr>
<tr>
<td>Pinching</td>
<td>2</td>
<td>Numb</td>
<td>2</td>
</tr>
<tr>
<td>Sore</td>
<td>2</td>
<td>Scratching</td>
<td>2</td>
</tr>
<tr>
<td>Stiff</td>
<td>2</td>
<td>Like a hurt</td>
<td>1</td>
</tr>
<tr>
<td>Tight</td>
<td>2</td>
<td>Like an ache</td>
<td>1</td>
</tr>
<tr>
<td>Hitting</td>
<td>1</td>
<td>Shocking</td>
<td>1</td>
</tr>
<tr>
<td>Hot</td>
<td>1</td>
<td>Shooting</td>
<td>1</td>
</tr>
<tr>
<td>Like a hurt</td>
<td>1</td>
<td>Stabbing</td>
<td>1</td>
</tr>
<tr>
<td>Like a sharp knife</td>
<td>1</td>
<td>Stiff</td>
<td></td>
</tr>
<tr>
<td><strong>Numb</strong></td>
<td>1</td>
<td>Swollen</td>
<td>1</td>
</tr>
<tr>
<td>Pressure</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shocking</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shooting</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stabbing</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pounding</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Continued next page
Table 15 continued

<table>
<thead>
<tr>
<th>Affective</th>
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<th>Affective</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Awful</td>
<td>2</td>
<td>Awful</td>
<td>1</td>
</tr>
<tr>
<td>Dizzy</td>
<td>1</td>
<td>Dizzy</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Frightening</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temporal</th>
<th></th>
<th>Temporal</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td>3</td>
<td>Off and on</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Off and on</td>
<td>2</td>
<td>Comes and goes</td>
<td>1</td>
</tr>
<tr>
<td>Constant</td>
<td>2</td>
<td>Constant</td>
<td>1</td>
</tr>
<tr>
<td>Once and awhile</td>
<td>1</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td>2</td>
<td>Sneaks up</td>
<td>1</td>
</tr>
<tr>
<td>Steady</td>
<td>2</td>
<td>Sometimes</td>
<td>1</td>
</tr>
<tr>
<td>Comes on all of a sudden</td>
<td>1</td>
<td>Steady</td>
<td></td>
</tr>
<tr>
<td>Sneaks up</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluative</th>
<th></th>
<th>Evaluative</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annoying</td>
<td>13</td>
<td>Uncomfortable</td>
<td>12</td>
</tr>
<tr>
<td>Uncomfortable</td>
<td>2</td>
<td>Annoying</td>
<td>8</td>
</tr>
<tr>
<td>Bad</td>
<td>1</td>
<td>Bad</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Terrible</td>
<td>1</td>
</tr>
</tbody>
</table>

Open-ended responses on post-testing questionnaire. Several items on the Post-testing Questionnaire were open-ended items that invited the participants to respond. These responses provide greater insight into interpreting the quantitative data analyses.

- In response to paying attention to the distraction intervention, the participants of groups two and three indicated that the pricking by the nurse (n = 3) and the itchiness of the allergens (n = 6) kept them from being fully distracted by the intervention. Others said that they wanted to know what was happening (n = 5). Using needles (n = 4) and increased pain (n = 5) in Phase II testing was reported as interfering with distraction.

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• In response to doing anything to self-distract, participants reported looking elsewhere ($n = 8$), thinking of something else ($n = 4$), talking with a family member ($n = 3$), making a fist/squeezing the table ($n = 2$), reading the wall posters ($n = 1$), singing along with the music CD ($n = 1$), and tongue biting ($n = 1$).

• In response to anything helpful the nurse did, participants shared that the nurse explained the procedure ($n = 13$), reassured that pricking wouldn’t hurt/wouldn’t hurt long ($n = 9$), was calm, relaxed, friendly, and personable ($n = 3$), said not to look ($n = 2$), pinched the adolescent’s arm ($n = 2$), and asked if the adolescent felt okay ($n = 1$).

• In response to making allergy testing better, participants replied testing would have been better if they watched a favorite television show/more interesting videotape ($n = 5$), listened to own music ($n = 3$), had something to do to be distracted ($n = 2$), mother was present ($n = 2$), boyfriend was present ($n = 1$), read a magazine along with listening to music ($n = 1$), were not assigned to the distraction group ($n = 1$), and there were no needles/less pain ($n = 2$).

Behaviors observed during allergy testing. Participants in all three groups displayed similar behaviors related to pain and/or anxiety. These behaviors were displayed by both males and females and across all ages of the study participants. Some participants denied pain and/or anxiety, while others reported various degrees of anxiety and/or pain. Phase II allergy testing evoked more pain/anxiety behaviors. At times pain and anxiety were denied by some participants, but the participant displayed behaviors that represented pain and/or anxiety. Other participants displayed no pain or
anxiety behaviors but reported feeling pain and/or anxiety. Often participants were initially calm and quiet but displayed pain/anxiety behaviors as the allergy testing was conducted. Even when appearing calm, some participants voiced anxiety about injections and the upcoming procedure.

The pain and/or anxiety behaviors displayed were:

- making faces, e.g. squinting, frowning, raised eyebrows
- sighing, grunting, moaning
- verbalizations, e.g. “Ahh!,” “Ow!,” “Oh, God,” “That hurt!”
- crying
- knees shaking
- legs bouncing
- tensing arm
- breathing heavily

When the tray of syringes in the vials was brought into the room for Phase II allergy testing, most of the participants reacted to the presence of the “needles,” even if they had been calm during the Phase I testing. Commonly spoken reactions were, “they’re not for me, are they?”, “Oh, man! How many for me?”, and “These look like they’ll hurt.” One participant expressed that the presence of the tray of syringes placed in front of her while the nurse left the room heightened her anxiety.

Self/parent-initiated interventions observed during allergy testing. All participants in the study had a parent present during the actual allergy testing procedure except for one whose mother left the room during Phase I of testing; this participant was in the self-selected distraction group. Parent-adolescent interactions
varied. Some parents sat in a chair next to the adolescent and read; others chatted with the adolescent. Some parents watched the videotape, but couldn’t listen, along with the adolescent participants in groups two and three. A few parents directed the adolescent to the videotape by commenting on the content or by saying to pay attention; others interrupted the distraction intervention by asking questions. Some parents tried to distract adolescents in the usual care group from the testing procedure to posters on the wall or airway models. Several mother-adolescent dyads held hands. Two mothers rubbed their child’s extremity; one kissed her daughter’s face and reassured her.

Adolescents frequently watched the allergy testing procedure regardless of the group assignment and were reminded by the parent to watch the videotape. The adolescents often looked away from the allergy testing, or vacillated between watching and looking away. One adolescent was chewing gum and stopped chewing with every intradermal needle inserted then resumed chewing. Some adolescents blew on each injection site after the needle was removed. Many adolescents in groups two and three were absorbed in watching the videotape during testing.

Nurse-initiated interventions observed during allergy testing. Sometimes, the nurses had difficulty allowing the adolescent to be distracted away from the allergy testing by the distraction intervention. They were accustomed to talking with the adolescents and found not speaking to adolescents in the intervention groups unnatural. They often left the tray of syringes and vials in the visual field of the adolescent attempting to watch the videotape. They sometimes discarded the used syringes across the visual field of the adolescents as they were watching the videotape. Often they reassured the adolescents that the procedure wouldn’t be very painful, it
would be over soon, or the adolescent was doing well, usually with the usual care
group but also for a few of the intervention group participants.

**Adverse events.** Two of the 32 study participants experienced adverse events
after Phase II allergy testing; another seemed to be developing a reaction after Phase I
so the physician decided not to proceed with Phase II testing to avoid worsening the
symptoms. Each of the three adolescents was from one of the three groups. State
Anxiety scores were 41, 37, and 58 for the group one, two, and three participants
respectively. “Needle” anxiety, past experience with injections, and expectation of
allergy testing were each rated as two by the usual care participant. However, the two
intervention group participants rated “needle” anxiety as five, past experience as four,
and expectation of the allergy testing as three. All participants reported feeling very
anxious at the time of allergy testing and also reported that they passed out with
injections and “needles.”

The participants had similar vasovagal syncope reactions. They became weak,
pale, dizzy, nauseated, and faint with vital sign changes including decreased blood
pressure. The near-miss participant reported a headache and dizziness. The adolescents
responded to lying supine and cool compresses; after examination by the physician, no
medical intervention was necessary. In all cases, the physician ruled-out a reaction to
the allergens themselves. All participants indicated they wanted to finish the study and
did complete the study when their vital signs stabilized and they reported feeling
better.

**Nursing recruitment videotape rating.** Participants in group two were asked to
rate whether they liked the nursing recruitment videotape geared for adolescents.
Group two participants rated whether they liked the videotape on a scale from 1 (I liked it a lot) to 5 (I did not like it at all). The ratings by eleven participants ranged from 1 to 4 with a mean of 2.73 (SD = 1.01) and median of 3.00.

Media choices. The study participants listed several favorite media choices, such as videotapes, CDs, or books-on-cassette (See Appendix G, Adolescent Audiovisual Media Choices). This list was intended to provide the researcher with ideas for the media library planned for use in the main study.
CHAPTER VI
DISCUSSION

The results of this feasibility study represent a beginning evaluation of the effect of self-selected distraction, and distraction in general, on pain perception in adolescents during allergy skin testing, a commonly performed healthcare procedure. All phases of the main study were evaluated through this feasibility study. Participant recruitment, randomized group assignment, intervention testing, instrument evaluation, and data analysis were evaluated for the planned main study. As an aspect of testing the data analysis in the feasibility study, the actual findings were not the focus of the analysis and should be interpreted cautiously.

An interpretation of the results is provided as related to the three theoretical frameworks: the distraction framework, the gate control theory, and the adolescent developmental model. Then limitations of the study are presented. Significance to nursing practice, implications for nursing education, and recommendations for future research are included.

Interpretation of Analysis

In the actual main study analysis, the data would be analyzed prior to hypothesis testing in the manner provided to demonstrate comparability across groups following random assignment. Results intended to determine comparability of the groups on specific variables must be interpreted cautiously because while no statistically significant differences were found among the groups, the results may be related to the small group sample sizes and subsequent insufficient power to detect a statistically significant difference among the groups. Variation in state anxiety across
the groups was approaching significance and might have affected the results of the MANCOVA used to answer research question four. Also cross-tabulations of gender and race/ethnicity violated assumptions of the chi square analysis due to the very small cell sizes.

**Pain perception ratings.** The results of the collapsed pain ratings from the three groups represent more accurate findings. The pain ratings were, as expected, lower during Phase I scratch/prick allergy testing and higher during Phase II intradermal allergy testing. For those who had both phases of allergy testing, a relationship was found between the two pain ratings; lower or higher pain ratings were found for both phases of testing. Interestingly, the pain ratings were not related to the number of allergens tested, i.e. the number of scratches and intradermals. No significant differences were found between gender or race/ethnicity and pain ratings. However, the female adolescents had consistently higher mean pain ratings than the males on both the APPT Word Graphic and FACES rating scales during both phases of allergy testing. This has been a consistent finding throughout the pain literature.

Pain words chosen from the APPT word descriptor list were clustered around mainly sensory words. The commonly chosen words for allergy testing were words that might be expected: itching, pin like/like a pin, pinching/like a pinch, like a sting, scratching/like a scratch, sharp, stinging, burning, annoying, and uncomfortable. A variety of pain/anxiety-related behaviors were exhibited during both phases of the allergy testing that supported the pain ratings. These pain behaviors were exhibited by both males and females of various adolescent ages.
Pain ratings and distraction engagement. Data from the two intervention groups were collapsed to determine if a relationship existed between pain ratings and level of engagement in the distraction intervention (research question three). During the more painful Phase II allergy testing, adolescents who indicated they were able to pay more attention to the distraction intervention reported lower pain ratings. Wanting to know what was happening and the actual pricking/injecting with resulting pain, as well as itchiness, a confounding variable, interfered the most with being able to pay attention. The early and middle adolescents’ ability to pay attention might have been influenced by brain development as well. Developmental neuropsychology literature suggests that the frontal cortex, which is important for adult-like ability to ignore distractions, such as pain, is not fully developed until about age fifteen (Goldberg et al., 2001).

More of the adolescents indicated they wanted to be distracted from the Phase II allergy testing than from the Phase I allergy testing. Phase I testing was less painful and while most of the participants indicated that they wanted to be distracted, only about half agreed that the distraction lessened their pain. Overall, regardless of the phase of allergy testing, most participants agreed that self-selected distraction was more helpful in lessening pain than nurse-selected distraction.

Effect of distraction on pain ratings. The results of the inferential statistical analysis used to answer research questions one, two, and four must be interpreted cautiously due to the small sample size. Again, the focus of this feasibility study was on testing the analysis phase of the study, as well as all the other phases of the study, not necessarily on finding statistically significant differences.
For these reasons, the main effect related to self-selected distraction on acute pain perception (research questions one and two) must be interpreted cautiously. Insufficient power likely contributed to the lack of a statistically significant difference in the pain ratings among the groups. The small sample size of the study precluded hypothesis testing. Analyses were instead conducted to test the statistical analyses chosen to answer the main research questions, to determine effect sizes, and to re-calculate the sample size for the planned main study using actual effect sizes from the feasibility study in the power analysis.

Nevertheless, the results of this study do not support self-selected distraction, or distraction at all, as an effective intervention for adolescents in decreasing pain perception associated with allergy skin testing. A trend toward lowest pain perception for the self-selected distraction group in Phase I allergy testing was only found after averaging the two pain ratings, and this effect was not statistically significant. However, during Phase II allergy testing, the highest pain perception was reported by the self-selected distraction group. There are several possible explanations for this finding.

**Distraction framework.** Overall, the results of this feasibility study lack congruence with the distraction framework proposed by McCaul and Malott (1984). The lack of statistically significant findings and furthermore findings that the self-selected distraction group had the highest pain perception in Phase II allergy testing are contrary to the expected results that would support the principles of the distraction framework. However, that engagement in the distraction intervention accounted for a
portion of the variance in the pain of Phase II allergy testing provides some support for
the distraction framework.

The distraction framework claims that less distress will be experienced in
response to a painful stimulus when the person is distracted through performance in an
attentionally demanding task. Furthermore, distraction strategies that require greater
attentional capacity will be more effective in lessening pain perception. Perhaps the
self-selected distraction was not optimally demanding of attention. Perhaps the
distraction theoretical framework as proposed is too simplistic because it doesn’t take
into account the affective dimension of pain and resulting pain/“needle” anxiety. Also
more recent attentional models have explored attention beyond limited capacity theory.
These other frameworks for distraction may warrant exploration for possible
consideration in the main study. In contrast to the assumption that processing is
controlled, results from an attentional neuroimaging study suggest that distraction does
not involve voluntary control (Rees, Frith, & Lavie, 2001). Instead, the researchers
purport that visual distractors are processed whenever free visual capacity exists. Even
when auditory distractors are present and being processed, visual distractors can be
processed simultaneously by separate areas in the cortex supporting a theory of
separate attentional capacity rather than limited attentional capacity. This could
explain why the adolescents’ attention was directed from the self-selected media
distraction intervention back to the visually present syringes and needles. Without any
other coping strategies, the pain perception increased.

The other explanation is that the fourth principle of McCaul and Malott’s
theory was operating. The fourth principle proposes that distraction will be more
effective than sensation redefinition with mild pain with the reverse being true for intense painful stimuli. For the higher Phase II allergy testing pain perception, sensation redefinition of the painful stimuli might have been more effective. The adolescents were not always able to engage in the distraction intervention, even though it was self-selected, and attentional focus shifted from the intervention to the painful stimuli of the intradermal injections. Additionally, not all adolescents wanted to be distracted from the injections; some wanted to watch. Distraction then would be less effective for these individuals. Quite possibly, sensation redefinition might have been a better strategy for those adolescents who desired to attend and monitor rather than be distracted.

But these explanations don’t fully explain why the self-selected group would necessarily have the highest pain perception, albeit not significantly different. An examination of the anxiety level of this group provides additional information.

Gate control theory. The findings regarding the descriptive pain ratings and anxiety ratings are congruent with the explanation of the physiological-affective components of the pain response offered by the gate control theory. The adolescents in this feasibility study did report low to moderate sensory pain and did identify sensory and evaluative pain words. For the most part, affective pain words were not selected. The affective component of the allergy testing pain experience was evident in the state anxiety scores, needle anxiety ratings, and specific allergy testing anxiety ratings.

State anxiety was lowest for the self-selected distraction group. Overall, state anxiety accounted for 63% of the variance in pain perception during Phase I allergy testing but only 31% of the variance of pain perception during Phase II allergy testing.

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In the intervention groups alone, state anxiety accounted for 10 to 44% of the variance in the APPT and FACES ratings respectively during Phase I testing and 26 to 49% of the variance during Phase II allergy testing. The adolescents reacted especially to the tray of intradermal syringes in the allergen vials as it was brought into the examination room. Specific allergy testing “needle” anxiety was significantly higher in Phase II allergy testing probably reflecting the presence of the syringes in the tray of vials and realization that injections were part of Phase II allergy testing. While not statistically significantly different from the other two groups, specific allergy testing anxiety was highest for the self-selected distraction group.

Furthermore, adolescents in the intervention groups with moderate state anxiety reported greater pain than those with lower state anxiety. This finding is consistent with many research studies on the relationship of anxiety and pain in children and adolescents (Bodden-Heidrich et al., 2000; Lander & Fowler-Kerry, 1991, 1993; Mansson et al., 1993; Pederson, 1995, 1996b; Smith et al., 1996; Zeltzer & LeBarron, 1982). However, prior studies have not controlled for anxiety in evaluating the effect of distraction on pain perception.

The adjusted mean pain scores after controlling for anxiety in this feasibility study resulted in unexpected findings. In ANCOVA, the group pain ratings are compared after adjusting for the effect of the covariate, in this case, state anxiety (Polit, 1996). The adjusted pain rating means reflect the size of the differences among the group means on the covariate, state anxiety, i.e. the larger the group differences on anxiety, the larger the adjustments to the pain rating means (Hinkle et al., 1998). For groups with covariate means less than the grand covariate mean (i.e. the mean state
anxiety rating across the three groups), the adjusted dependent variable mean will be greater than the unadjusted mean, and the reverse is true for groups with covariate means greater than the grand covariate mean. In other words, after controlling for anxiety in Phase I allergy testing, the mean pain ratings of the two distraction groups increased but decreased for the usual care group. This resulted in the highest adjusted mean APPT pain rating for the self-selected distraction group, due to the lowest state anxiety mean, after initial univariate analysis indicated the self-selected distraction group had the lowest pain rating prior to controlling for anxiety.

In Phase II allergy testing, the trend of lowest pain ratings for the usual care group to the highest pain ratings for the self-selected distraction group persisted in both the unadjusted and adjusted mean APPT and FACES pain ratings. Again, the mean pain ratings increased for the self-selected distraction group but decreased for both the usual care and nurse-selected groups after controlling for state anxiety. This unanticipated finding that the self-selected distraction group would have the highest adjusted mean APPT pain ratings in both phases of allergy testing and highest FACES rating in Phase II might reflect group disparity in pre-treatment state anxiety levels despite lack of a statistically significant difference when comparing anxiety across the groups and despite random assignment to groups. As discussed previously, the self-selected group also reported higher specific Phase II allergy testing anxiety, although not statistically significant.

Other studies have suggested that moderate anxiety directs attention toward pain (Janssen & Arntz, 1996; Rhudy & Meagher, 2000). Perhaps greater processing of pain/“needle” anxiety increased the affective dimension of pain perception for the self-
selected distraction group. As proposed by the gate control theory, the anxiety associated with the allergy testing experience, specific “needle” anxiety, and possibly past negative experiences associated with healthcare procedures could have activated descending nerve fibers that kept the gate open to the incoming painful stimuli of the allergy skin testing.

The results of this feasibility study, even with its small sample size, support anxiety as a possible moderator of the effectiveness of the distraction intervention on pain perception (research question four). In the feasibility study, while no statistically significant differences in pain perception were found among the groups after controlling for anxiety as a covariate in both phases of allergy testing, probably due to insufficient power, the effect of anxiety itself on pain perception was significant despite the small sample size.

State anxiety and ability to pay attention to the distraction intervention were negatively related during Phase II allergy testing suggesting that with higher anxiety, ability to pay attention decreases. This finding is consistent with literature that suggests attentional narrowing occurs with anxiety (Janelle et al., 1999). One participant in the self-selected distraction group reported that she “couldn’t really pay attention because when you are distracted, it makes me feel a little more scared than before because you think something really bad is going to happen.” Anxiety might interfere with the adolescent’s attentional capacity during the allergy testing. For this adolescent, anxiety might have been heightened by a mismatch between usual or preferred coping style and the assignment to the distraction intervention thus further limiting her capacity to pay attention to the distraction.
Another possibility is that the distraction activity wasn’t engaging enough to overcome the adolescent’s anxiety and pain associated with the allergy testing procedure. Anxiety associated with the application of multiple, painful stimuli might override distraction’s ability, even when selected by the individual, to divert the adolescent’s attention from the pain. According to Eccleston (1995b), to be effective, distraction tasks must be demanding of the central attentional resources used in pain processing. However, anxiety may limit the amount of resources available for task performance (Keogh & French, 1997). Johnson et al. (1998) found even pleasant distraction failed to alter the emotionality of pain. Anxiety coupled with pain might overwhelm attentional resources and reduce distraction’s effectiveness. Consistent with the gate control theory, the descending anxiety impulses might have over-ridden the positive descending effect of distraction and did not permit closure of the gate to incoming painful impulses from the allergy testing.

**Adolescent developmental model.** The data analyses indicated that the group assignment effect on pain perception was not the same for early adolescents and middle adolescents. There was an interaction between age and group assignment, but the interaction was unable to be detected statistically due to small cell sizes and insufficient power. In Phase I testing, middle adolescents in the usual care group reported greater pain perception using both rating scales than the early adolescents and greater pain than the two intervention groups. However, in the intervention groups, early adolescents reported more pain than the middle adolescents. In Phase II testing, the middle adolescents in both the usual care and self-selected distraction groups reported more pain than the early adolescents using both rating scales. Only in the
nurse-selected distraction group did the early adolescents report greater pain perception than the middle adolescents. No pattern of an interaction between a specific age group of adolescence and the distraction interventions emerged in the analysis. Other research studying the effect of distraction on procedural pain in children found age-related differences in pain perception and used age as a co-factor in the analysis (Carlson et al., 2000; Vessey et al., 1994).

Another interesting finding of this feasibility study involved the role of the parent/guardian in comforting their adolescent son or daughter. For the most part, parents played an important role in providing support to their adolescent child. All but one adolescent had a parent present during the actual allergy testing procedure. The adolescents never told their parent to leave the room and seemed to want the presence and support of their parent. This is congruent with literature on adolescent development. Parental presence has been identified as an important coping strategy for adolescents when experiencing physical pain (Crandall et al., 2002; Weekes et al., 1993), and many adolescents turn to their parents for help with personal problems (Offer & Schonert-Reichl, 1992). Observations in this study would support that. Perhaps the use of the headset in listening to the media might have separated the adolescent from the parent who is a source of comfort and support and might have denied some adolescents access to an important coping mechanism.

The involvement of parent in the procedure perhaps as distraction coaches during distraction interventions may be appreciated by some adolescents and parents. Some parents in the feasibility study were eager to become involved in the distraction intervention by engaging the adolescent in the distraction. Exploring the desired role
of the parent during the procedure from the perspective of the adolescent and parent is important for nursing practice. What little we know from this feasibility study and the studies by Crandall et al. (2002) and Weekes et al. (1993) about the role of parent for adolescents experiencing acute pain suggests that adolescents desire their parent's presence and perhaps even a more intimate role, such as hand holding, for comfort and support during the procedure and as a way to manage pain. Nurses are in a unique position to support the parent-adolescent relationship during healthcare encounters.

Many adolescents canceled or did not come for their scheduled appointments. This factor may be related to the adolescent developmental level and the struggle for choice, control and independence. Canceling or not showing for the appointment may also be related to the anticipated pain of the allergy testing procedure. Anxiety was found to be a rather common experience among the adolescents in the feasibility study and might be related to anticipatory pain. These findings are consistent with previous research that indicated anticipatory fear and pain prior to allergy testing prevented some from undergoing the testing (Carr et al., 1998; Wolf et al., 1994). Also not coming to a scheduled appointment could have been a coping strategy for some adolescents. One mother called and reported that she could not get her daughter into the car for the appointment.

Various coping strategies are employed by adolescents when experiencing stressors. Coping style has been explored and has been recommended as a factor to consider when selecting nonpharmacologic interventions to cope with pain (Chen, Craske, Katz, Schwartz, & Zeltzer, 2000; Kleiber et al., 2001; Kwekkeboom, 2003; Tsao, Fanurik, & Zeltzer, 2003). Coping style is considered a broad trait-like tendency.
to use particular coping responses and is stable over time (Kavsek & Seiffge-Krenke, 1996). Approach and avoidance were identified as two basic coping factors used by adolescents aged eleven to sixteen and use was often found to overlap when adolescents were facing stressors.

Approach factors are primarily comprised of problem-focused strategies that are more effective for long-term resolution; these strategies are directed toward the stressor and aimed at reducing or altering the stress-producing event (Kavsek & Seiffge-Krenke, 1996). Avoidance factors are comprised of emotion-focused strategies that are directed away from the stressor and are often effective for short-term coping (Kavsek & Seiffge-Krenke, 1996; Reid et al., 1998). Problem-focused coping involves direct attempts at solving or altering the problem situation or changing the source of stress, whereas emotion-focused coping is directed at managing emotional distress and controlling emotions by seeking advice, comfort, and help from others (Hodgins & Lander, 1996; Kavsek & Seiffge-Krenke, 1996; Rudolph, Dennig, & Weisz, 1995).

Boys and girls use different coping strategies and use of these strategies changes over adolescence (Byrne, 2000; Reid et al., 1998). Girls shift from using more problem-focused coping to more emotion-focused coping strategies over adolescence (Byrne, 2000). Adolescent boys used more problem-focused avoidance than girls (Reid et al., 1998). Reid et al. found that adolescents who perceived they had greater control over pain used approach and problem-focused avoidance strategies more often and used emotion-focused avoidance strategies less often; distraction is considered a problem-focused strategy. Perception of control over the event led to use of more adaptive coping strategies. Furthermore, use of problem-focused avoidance strategies
in adolescents was related to lower levels of pain and emotional distress and higher
pain thresholds. In contrast, use of emotion-focused avoidance strategies was related to
more pain and distress and lower pain thresholds.

Depending on coping style, some adolescents may attend to the pain source
focusing on the sensory experience while others may attempt to distract themselves
from the pain (Franck et al., 2000). Distraction might be more useful for those who are
accustomed to distracting themselves from threatening cues, described as blusters in
some coping literature (Reid et al., 1998; Kwekkeboom, 2003; Miller, 1987; Rudolph
et al., 1995). Differences in choice of coping strategy might be based on differences in
coping style (Miller, 1987). Blusters preferred to listen to distracting music; while
monitors, who seek information and prefer to cope by attending to threatening cues,
avoid distraction as a coping strategy (Kwekkeboom, 2003; Miller, 1987). Attempts to
engage in distraction might heighten anxiety for monitors or those who might prefer to
problem solve (Kwekkeboom, 1999).

Matching coping style with preferred nonpharmacologic intervention has been
recommended (Kwekkeboom, 1999) and may be associated with improved pain
outcomes for adolescents by providing choice and control. In this feasibility study,
almost one-third of the self-selected distraction group reported that they did not want
to be distracted from the allergy skin testing and almost one-half of the intervention
groups reported that the distraction did not help to reduce pain perception. These
results suggest incongruence between the adolescents’ usual coping style and the use
of distraction as the nonpharmacologic intervention. Quite possibly more monitors
were assigned to the intervention groups. While this was not studied, the possibility

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exists that these monitors desired to cope through seeking information from the nurse and using problem solving strategies. The use of a distraction strategy would have been counterproductive for these adolescents. Furthermore, preventing use of usual coping strategies might have heightened anxiety, led to decreased coping ability, and resulted in increased pain perception.

The trend toward the highest pain ratings in the self-selected distraction group might also be related to how adolescents use media. Not only is media, especially music, used for coping with day-to-day stressors, but media for adolescents might actually influence the process of identity formation (Larson, 1995; Steele & Brown, 1995). The adolescent can be considered an individual with multiple and fragmented concepts of the self during a time when responsibility for emotional self-regulation is being transferred from parent to child (Larson, 1995). The division between the exterior public self and the interior private, new self might be part of the process of identity formation. Adolescents’ solitary time spent in their bedrooms is often used for cultivation of this new self and as a way to renegotiate the parent-child relationship. Media use is prominent in this important solitary activity. Media might be used for cultural and social integration, mood enhancement, coping with emotions, self-expression, fantasy about the new self, and role modeling (Steele & Brown, 1995). Television viewing may allow for disengagement from stress and negative emotional states (Larson, 1995). In contrast, listening to music might help in exploration of the private self allowing for ruminations about personal reference to the music.

Based on this literature, perhaps then the adolescents in this current study had more invested in the personal media choices than for mere use as distraction. Perhaps
using the media as a distraction from physical pain did not fit with the adolescents’ accustomed use of media. These adolescents might have had much more invested in the media selections, such as using media for processing their new personal identity and coping with everyday life psychosocial stressors. Perhaps then in this study, pain and anxiety were heightened during the more stressful Phase II allergy testing because the media use did not allow for distraction from the physical pain. This hypothesis coupled with differences in preferred coping style might suggest that use of media such as videotape viewing or music listening is not congruent with an adolescent developmental framework.

Limitations

Four main limitations occurred with this study. One was the limited access to adolescent patients scheduled for allergy testing and the resulting small sample size. This led to conduction of only the feasibility study and not the main study as originally proposed. Results of this feasibility study using a small convenience sample are not generalizable.

Violations of assumptions might have occurred; some cell sizes were very small and unequal. Normal distribution assumptions might have been violated. Additionally, error variance of the dependent variable might not have been equally distributed among the small group sizes. Despite these violations, MANOVA is usually robust with moderate to large sample sizes; however, in this study with a small sample size, results might have been affected by violations in the assumptions. While the Box’s M statistic in testing the assumption of the variance-covariance matrices of the dependent variable in the multivariate analyses found no statistically significant
differences, this lack of significance cannot be fully interpreted as meeting the assumption. Instead non-significance might have been the result of the small sample size and subsequent insufficient power to detect a significant difference (Green, Salkind, & Akey, 2000).

Another limitation related to the researcher’s role as interventionist. The roles of principal investigator, interventionist, data collector, and nurse became blurred at times in this study. Insufficient funding prevented the researcher from hiring an interventionist-data collector. Additionally the researcher stepped out of the role of investigator and into the role of nurse on occasions when participants began to experience an adverse effect of the allergy testing. On one occasion only a licensed practical nurse was in the office as well as a physician who was with a patient in another examination room. The researcher’s feelings of ethical responsibility to the participant as a patient in these situations led to less than desirable control in the conduction of the research study. Based on the recommendations for conducting intervention research, a separate interventionist-data collector who is not a nurse would be desirable for future research studies.

The other limitation concerned the Phase I allergy testing technique used. For the first six participants, four in the usual care group, the technique was a more involved and more painful droplet and lancet-scrape technique. This technique was replaced with a less painful, allergen-impregnated, tiny Greer DermaPik prick technique. In another study comparing four methods of allergy skin testing, the DermaPik prick was rated second least painful; participants’ mean allergy testing discomfort was rated approximately twelve on a 0 to 100 visual analog scale (Corder,
Hogan, & Wilson, 1996). This is consistent with the mean Phase I APPT pain rating, which was 1.31, or thirteen on a 0 to 100 scale. In this current study, effectiveness of the distraction intervention could have been related to the lesser perceived pain associated with this new testing technique; in essence, in Phase I allergy testing, there was little reason to need distraction. Limited accessibility to the study population prevented the researcher from substituting the six participants.

Another limitation in the procedure concerned interruptions in the distraction intervention. Nurses, physicians, and parents/guardians interrupted the distraction interventions. Despite education of the nurses and reminders to family members, many times the distraction was interrupted. Parents often asked questions or reminded the adolescent to pay attention to the distraction. On occasion, a parent interfered with the equipment, and the distraction was interrupted. The nurses were accustomed to their routine and to talking with the adolescents as they performed allergy testing. The nurses would usually comfort the adolescent or provide information about the testing itself, such as what the pain experience was like.

The main interference involved placing the tray of syringes in the allergen vials in front of the participant or reaching across the participant’s field of vision to dispose of the used syringes and evoking increased anxiety. Because the study was conducted infrequently over the year or more of data collection, the nurses were updated and reminded each time a participant was enrolled in the study. The nurses were very positive, committed to helping, and always cooperative about the study. This major limitation warrants further consideration in planning the design for a future main study.
Significance for Nursing Practice

Based on the results of this feasibility study, nurses know more about the overall allergy testing experience from the adolescent’s perspective. Nurses know more about the sensory-affective pain response of adolescents to the allergy testing experience. Nurses know that adolescents can differentiate and self-rate the separate sensory and affective components of the pain experience and should incorporate pain assessment into their practice. Nurses know that adolescents do indeed perceive allergy testing-related pain with greater pain experienced in Phase II testing. Nurses have knowledge about average pain ratings associated with the phases of allergy testing and the pain words adolescents selected to describe the allergy testing experience. The specific words used to describe allergy testing would be helpful to nurses as they are informing adolescents about what to expect regarding the allergy testing procedure. This current study also identified individual differences in pain perception despite similar conditions. For example, two seventeen-year-old adolescent males with almost identical, very low state anxiety scores and both in the self-selected distraction group rated the pain of Phase II allergy testing very differently. While one rated the pain as .06, the other rated the pain as 8.0 using the same APPT rating scale. Nurses have knowledge then about the average pain perception but also have knowledge regarding individual pain perception. Nurses also have knowledge that the pain perception rating is not necessarily congruent with the individual adolescent’s behavioral reaction.

While the self-selected distraction intervention did not have a statistically significant effect on pain perception, half of the adolescents reported that they
perceived this strategy to be helpful. Assessing adolescents for the desire to be
distracted before implementing distraction interventions is an important nursing
intervention. Studies have recommended that assessing preferred coping style and
matching the style to the nonpharmacologic intervention may be more effective in
reducing pain perception (Chen et al., 2000; Tsao et al., 2003). As a result of this
feasibility study, nurses know that distraction does not benefit everyone. For those
who prefer another strategy, use of distraction may actually increase stress, pain, and
discomfort.

Adolescents may need recommendations for strategies to cope because they are
still engaging in ego identity formation. Perhaps the development of patient education
literature about effective ways to cope and reduce pain perception during the procedure
of allergy testing, such as listening to a favorite CD or videotape, could help
adolescents to have a more positive experience. Some adolescents, especially those
who use a blunting coping style, may choose to cope with the procedure by engaging
in distraction, especially self-selected distraction using music or videotapes of their
choice. This information could be sent to adolescents along with a written appointment
reminder. This would serve to encourage keeping the appointment, thus avoiding lost
revenue to the allergy center, and may promote a more positive testing experience for
those who cope best through distraction. The cost to the allergy center would include
the purchase and maintenance of the audiovisual equipment, as well as the cost of
developing, printing, and mailing the patient information. This would hopefully be
offset by greater appointment attendance rates because the allergy center loses revenue
for every canceled appointment.
Knowledge about anxiety related to the allergy testing experience might be the most clinically significant finding of this study. Nurses know that adolescents experience anxiety when approaching allergy skin testing and that viewing “needles” prior to the upcoming testing procedure raises anxiety further. Nurses have knowledge that anxiety experienced by the adolescents is not necessarily expressed by outwardly observed behaviors. Nurses need to quickly identify anxiety prior to allergy testing, possibly through use of a short questionnaire, such as the three-item rating scale measure from the Pre-testing Questionnaire, and implement anxiety-reducing interventions, such as relaxation, prior to the testing procedure. Pre-procedural anxiety ratings, even verbal ratings, can predict pain and anxiety during the procedure (Benotsch, Lutgendorf, Watson, Fick, & Lang, 2000). In reducing anxiety, pain perception and untoward effects might be reduced and overall satisfaction improved.

Nurses have also learned from this study that adolescents recognize the importance of the nurse-patient relationship. In other research, adolescents identified nurses as helpful with regard to health problems (Offer & Schonert-Reichl, 1992). The adolescents in this feasibility study identified the presence of a calm, relaxed, friendly, personable nurse as helpful. This is congruent with knowledge that a warm relationship with parents is advantageous to adolescent development. Favaloro (1988) recommends that nurses approach adolescents with warmth and respect for their new fragile identity, recognize adolescents’ limited ability to verbalize feelings, and assist adolescents to acknowledge and express feelings to promote coping with pain. The presence of a warm, caring nurse even during brief episodic interactions, such as allergy skin testing procedures, is recognized as important to adolescents and may
facilitate the building of trust. Furthermore, explanations about the procedure and
reassurances regarding anticipated pain perception by the nurse were appreciated by
the adolescents in this study. This warm relationship with the nurse may be beneficial
as the adolescent moves toward becoming a more independent, autonomous client in
the healthcare system.

Quite possibly the distraction intervention of this study interfered with the
formation of the nurse-patient relationship. The nurses were not able to use their
typical strategies for interacting with the adolescents, such as talking with them about
the procedure, the allergies, or everyday adolescent life, e.g. what high school they
attended, any sports interests, etc. The nurses might have felt uncomfortable in the new
role imposed on them by the study design. Sometimes the nurses would not stay in the
new role and would interrupt the distraction by talking with the adolescent. By
engaging in the distraction, the adolescents, too, might have felt a disconnection
between themselves and the nurse.

Finally, diagnosis is essential for treatment. If the allergy testing experience is a
positive one, then adolescents may be more likely to participate in allergy
desensitization therapy. Of interest, at the end of the study, the nurse manager of the
allergy center reported that none of the adolescent patients are currently receiving
allergy desensitization therapy despite many adolescents having positive reactions to
allergens tested during allergy testing.

Implications for Nursing Education

The results of this study have implications for nursing education. Nursing
curricula need to integrate pain management for adolescents as well as for children and
adults. Pain management education should include pain assessment, pharmacologic and nonpharmacologic interventions, and instruction about how to use best evidence as a basis for nursing practice. The curriculum should include care of adolescents as a separate and distinct developmental level. Often care of adolescents is included under general care of children or is sometimes an aspect of adult care, especially for late adolescents. Adolescent developmental issues should be addressed as separate and distinct with consideration given to adolescents’ unique developmental needs that impact nursing care. Specific pain management strategies that relate to adolescence, as well as the uniqueness of the pain experience for the adolescent should be addressed in the curriculum.

Recommendations for Future Research

Based on the findings of this feasibility study, conducting the proposed main study at the AMC allergy/immunology center is not feasible due to the low patient volume in the targeted age group, adolescents aged eleven through seventeen years. This medical practice does not attract a large enough number of patients in that age range to support the main study. Additionally, by using the original power analysis with an estimated medium effect size, the sample size was greatly underestimated for the original proposed main study ($N = 156$). Using the actual effect sizes from this feasibility study and recalculating the sample size, 960 participants (319 per group) would be needed as the main study sample size for Phase I allergy testing and of those, 315 participants (105 per group) would be needed for Phase II testing.

Instead the results of this feasibility study suggest that the main study would need to be planned as a multi-site study. Adding a virtual reality (VR) experience to
the self-selected distraction intervention would resolve the problem of the presence of syringes and needles. By wearing VR glasses or helmet, the adolescents would be fully immersed in the media of choice. This intervention would be developmentally appropriate for adolescents since virtual game playing is common among adolescents. Several studies of this new technology have been undertaken recently with adolescents undergoing painful procedures; results indicate this is a promising nonpharmacologic intervention (Hoffman, Doctor, Patterson, Carrougher, & Furness, 2000; Hoffman, Patterson, Carrougher, & Sharar, 2001; Schneider & Workman, 1999; Wint et al., 2002). Grant funding would be necessary for this study to hire interventionists/data collectors, purchase the STAIG instruments, obtain the VR equipment, build the media library, and obtain participant/staff appreciation gifts. Control over the allergy testing technique and procedure would need careful attention including protocols developed for the nurses performing the allergy testing.

Only Phase II allergy testing is recommended for the VR main study based on the small effect size of Phase I testing. Higher pain perception was reported in Phase II than in Phase I making the desire for distraction greater. Testing only Phase II differences would reduce the sample size to a more reasonable but still high 315 participants. Only one set of post-procedure measures would be needed thus reducing participant research burden. These measures could then be taken immediately after the Phase II allergy testing without having to wait for the allergen reaction processing period.

The state anxiety scale of the STAIG provided a valid and reliable measure of anxiety in the adolescents in this study. The three items on the Pre-testing

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Questionnaire related to “needle” anxiety, expectation of the allergy testing, and past experiences with injections were tested as a three-item measure and demonstrated beginning support for validity and reliability. According to Kleiber and Harper (1999), the quality of prior healthcare experiences might affect the child’s response to the current healthcare procedure and be an intervening variable when using distraction as an intervention to reduce pain. This three-item measure related to state anxiety might offer nurses a quick means of assessing anxiety prior to allergy testing. Predicting state anxiety and possible pain from this three-item Pre-testing Questionnaire measure could be a focus of a future research study. An item from the Post-testing Questionnaire specific to allergy testing anxiety could possibly be moved to the Pre-testing Questionnaire measure since this item was related to the three items. The Post-testing Questionnaire will require revision and further validity and reliability testing before use in the main study.

The instrument testing in the feasibility study found the APPT and FACES pain rating tools to be appropriate measures of pain intensity for the study participants. Further support for validity and reliability of these pain measures was demonstrated. The adolescents did not have a preference for either pain rating scale and indicated both the APPT Word Graphic and FACES rating scales were acceptable. The APPT permits more comprehensive measurement of pain beyond the pain intensity rating by including pain location on the body outline drawing and selection of pain words from the word descriptor list. Additionally, the use of the 100 millimeter word graphic rating scale permits more precise measurement of pain intensity. Some adolescents were not content to circle one of the six face points on the FACES scale and wanted to
choose a point between the faces; this limitation of the rating scale prevented precise pain measurement. The FACES rating scale may not be a sensitive enough measure to detect slight variation in pain ratings. Consistent with a study comparing faces pain scales (Chambers et al., 1999), the “smiling” face might have contributed to the higher mean FACES pain rating compared to the APPT Word Graphic rating in Phase I allergy testing. The inconsistency in the effect size between Phase I and Phase II allergy testing using the FACES rating scale adds further concern in using this pain measure. Overall, based on the results of this feasibility study, along with the strong support for the validity and reliability of the instrument, the APPT is recommended as the one dependent variable measure for the VR main study because more precise pain intensity measurement can be obtained, as well as information about pain location and pain quality.

The use of ANCOVA is recommended as the statistical test in the VR main study to analyze the differences among the groups when using one dependent variable and controlling for anxiety. When planning for analysis in the main study, ANCOVA would add power to the statistical test (ANOVA) while controlling for what appears to be an important covariate and would reduce the likelihood of a Type II error. Because ANCOVA is a more powerful test than ANOVA, fewer participants might then be possible. Consideration of age as another covariate is also recommended for the main study. It might be useful to study both trait and state anxiety in the main study. Trait anxiety influences state anxiety and might be important to consider. Other researchers have called for research studying whether anxious individuals are more susceptible to distraction (Keogh & French, 1997).
Measurement of engagement in the VR distraction intervention is recommended. Engagement in the distraction intervention needs to be explored as a possible moderator variable in the main study. The use of VR as the distraction intervention would be expected to further facilitate engagement because the participant is “immersed” in the media. Investigations of procedural pain in adolescents testing newer technologies might offer information about the possible effectiveness of multisensory, interactive distraction in reducing adolescents’ acute pain.

Further investigation into coping strategies, specifically the desire to be distracted versus attending to the procedure, should be included. Kwekkeboom (1999) described the need for matching the cognitive behavioral nonpharmacologic strategy with the individual’s preferred coping style noting that attempting to engage in distraction may increase anxiety for those who prefer to cope by focusing on the problem. Consideration might want to be given to selecting coping style as a covariate or using a randomized block design after screening for those who desire distraction and only assigning those participants to the distraction interventions.

The cancellation of appointments in the adolescent population warrants further study and could serve as a focus for future research. If the cause of the cancellation is related to anxiety and anticipatory pain of the allergy testing, perhaps knowledge of self-selected distraction as a technique to reduce pain and anxiety might offer those adolescents who desire distraction a method for gaining control over these feelings thus reducing the tendency to use cancellation as a coping strategy. Future exploration in this area could shed insight into the coping strategies used by adolescents. While cost analysis was not part of this feasibility study, it became clear that the trend of
appointment cancellation meant lost revenue for the allergy center. Therefore, inclusion of cost analysis is recommended in the VR main study.

The role of anxiety in the occurrence of adverse reactions during allergy testing also needs exploration. Three patients exhibiting vasovagal reactions to allergy testing in a small study of only 32 participants is a rather high rate. Use of an anxiety-reducing intervention, such as relaxation, might effectively decrease anxiety and subsequently avoid adverse reactions, decrease time in performing the testing, and improve patient satisfaction with testing. Study of preferred coping style may also provide insight into matching nonpharmacologic interventions and reducing incidence of vasovagal reactions. A recent study using preferred coping style as a moderating variable evaluated the effectiveness of a VR audiovisual distraction in reducing vasovagal reactions in first-time blood donors (Bonk, France, & Taylor, 2001). Participants who preferred a monitoring style of coping did not benefit from the distraction intervention. But for those with a blunting coping style, significantly fewer subjective symptoms were found in response to the blood donation procedure. Future research that examines the relationship between preferred coping style and use of nonpharmacologic interventions might extend knowledge that encourages nurses’ assessment of coping style before implementation of the intervention. This might reduce anxiety that has been heightened in those for whom coping style and intervention are mismatched.

More research of adolescence as a unique developmental period and thus a unique population should be undertaken. Avoiding the inclusion of older adolescents with the study of adults or adolescents in the study of children overall would inform nursing about specific developmentally-appropriate care of an overlooked age group.
Studies to further explicate factors, such as past pain experience, culture, and parent role, that may predict pain or improve pain management for adolescents would be important since little is known about the relationship between these factors and pain in adolescence. Studies of cultural or ethnic differences and similarities in the pain experience of adolescents could better inform nursing of the importance of culturally-congruent care. Studies of the influence and implications of culture on care of adolescents overall and specifically on care of the adolescent in pain are needed.

Research is needed on the importance of parental presence and identification of the most optimal parental role in the care of adolescents in pain, specifically identifying effective strategies that parents can initiate during painful experiences. Cultural influences on the parent-adolescent relationship may impact the desired parental role from the perspective of the parent and the adolescent when adolescents experience pain.

Study of intrapersonal factors that influence pain perception and inform nurses about effective pain management for adolescents, such as gender, temperament, preferred coping style, usual coping strategies, usual pain response, and anxiety, fear and depression as related to pain, would add to the current gap in knowledge about adolescents in pain. More research on the influence of past painful experiences and memory of previous painful events on the adolescent’s current pain would be useful in identifying factors that could predict pain response. Additional study of nonpharmacologic interventions, including distraction, specifically for adolescents and the match to preferred coping style would also add to the current lack of knowledge about the specific care of adolescents in pain. Studying the efficacy of
nonpharmacologic interventions across various pain experiences, such as acute injury pain, acute procedural pain, acute post-operative pain, chronic disease pain, and end-of-life pain, would also add to the body of knowledge about care of adolescents.

**Conclusion**

This feasibility study examined the effects of a nonpharmacologic intervention, distraction, specifically self-selected distraction, on adolescents' acute pain perception during allergy testing. Additional understanding of allergy testing pain and anxiety in adolescents, as well as of the self-selected distraction intervention itself, was gained. This feasibility study actually allowed for testing and refinement of the distraction intervention. The results of this study cannot be generalized but offer nurses in clinical practice more information about the allergy testing experience. Nurses can independently implement nonpharmacologic interventions in their practice when caring for children in pain (Acute Pain Management Guideline Panel, 1992a). While the statistical analysis of this feasibility study did not support self-selected distraction in reducing pain perception, many of the adolescents reported that self-selected distraction was a helpful strategy. Perception of helpfulness of a nursing intervention is in and of itself therapeutic. Distraction may not be for everyone, but for those desiring distraction, it may offer a reduction in perceived pain intensity.

Self-selected distraction, as one nonpharmacologic intervention, warrants further study. Although this feasibility study did not support self-selected distraction, other research has demonstrated a positive effect of distraction on pain perception. Through further study of the effect of self-selected distraction and nurse-selected distraction on acute pain perception, additional knowledge could be gained about the
relationship between attentional capacity and distraction, as well as the interaction
effect of factors, such as coping style and anxiety. By examining whether a self-
selected distraction activity places an optimal demand on attentional capacity for those
who prefer that coping strategy, contributes to the diverting of attention away from the
acute pain stimulus, and reduces overall pain perception, more could be learned about
this intervention.

This feasibility study assisted in understanding more about distraction as an
intervention by identifying anxiety as a possible moderator variable affecting the
efficacy of distraction on pain outcomes. Further study would seek to extend current
information about the usefulness of distraction to a common healthcare procedure that
differs in the delivery of painful stimuli. Unlike, for example, venipuncture which
involves one intended “needle stick,” allergy skin testing applies multiple, repetitive
painful stimuli that may increase anxiety even more.

Effective methods for reducing acute pain perception and associated anxiety
during allergy skin testing are needed. Nursing interventions are needed to ameliorate
anticipatory fear associated with the skin testing and hesitancy to undergo the
procedure. Without an accurate diagnosis and subsequent treatment, chronic symptoms
of allergic rhinitis and asthma can interfere with quality of life and lead to increased
morbidity through permanent, progressive changes in the respiratory mucosa and
remodeling of the airways (Ferguson, 1997; Opperwall, 2000; Ten Hacken, Postma, &
Timens, 2003). By promoting the adolescents’ agreement and willingness to
participate in allergy skin testing, an essential diagnostic tool, appropriate treatment
can be planned to improve the adolescents’ overall health and decrease long-term
effects of the untreated allergic response. Treatment of allergic rhinitis is important in controlling asthma (Braunstahl & Hellings, 2003). Providing adolescents with a sense of control is essential to their continued development. This sense of control extends to healthcare management especially as related to chronic illness, such as allergic rhinitis and asthma.

Learning about distraction as an intervention and its effect on outcomes related to pain will continue to contribute to linkages between nursing interventions and nursing outcomes in the advancement of nursing science. Only approximately 25% of nursing research focuses on testing interventions (Melnyk, 2003). More intervention research studies are needed to advance nursing science and guide clinical practice decision-making thus improving healthcare outcomes (Whittemore and Grey, 2002). Feasibility pilot studies that test and refine interventions, measures, and outcomes are important for the next phases of clinical research.
APPENDIX A

ADOLESCENTS SCHEDULED FOR ALLERGY SKIN TESTING

October 2002-November 2003

<table>
<thead>
<tr>
<th>Patient</th>
<th>Date</th>
<th>Age</th>
<th>Gender</th>
<th>Study Subject #</th>
<th>Reason for non-participation in study</th>
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<tr>
<td>2</td>
<td>10/17/02</td>
<td>15</td>
<td>F</td>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td>10/18/02</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>11/04/02</td>
<td>11</td>
<td>M</td>
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<td></td>
<td></td>
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<tr>
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<td>11/18/02</td>
<td>17</td>
<td>F</td>
<td>3</td>
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</tr>
<tr>
<td>7</td>
<td>11/18/02</td>
<td>14</td>
<td>M</td>
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<tr>
<td>8</td>
<td>11/18/02</td>
<td>11</td>
<td>M</td>
<td></td>
<td>Has IEP/inclusion criteria not met</td>
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<tr>
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<td>11/22/02</td>
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<td>4</td>
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<td>13</td>
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<tr>
<td>19</td>
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<td>M</td>
<td></td>
<td>Has IEP/inclusion criteria not met</td>
</tr>
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<td>M</td>
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<td>11</td>
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<td>M</td>
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<td>17</td>
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<td>M</td>
<td>18</td>
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<tr>
<td>Date</td>
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<tr>
<td>04/23/03</td>
<td>Refused to participate</td>
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<td>05/14/03</td>
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<td>05/28/03</td>
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<tr>
<td>06/18/03</td>
<td>Consent/assent expired 6/17/03</td>
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<td>06/20/03</td>
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<td>06/30/03</td>
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<td>07/16/03</td>
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<td>07/17/03</td>
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<td>07/21/03</td>
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<tr>
<td>08/08/03</td>
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<tr>
<td>08/13/03</td>
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<tr>
<td>08/14/03</td>
<td>Came without parent; couldn’t consent to procedure or study</td>
<td></td>
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<tr>
<td>08/14/03</td>
<td>Autistic, needs interpreter</td>
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<td>08/15/03</td>
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<td>08/19/03</td>
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<td>08/22/03</td>
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<td>08/27/03</td>
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<tr>
<td>09/03/03</td>
<td>Grandfather refused to participate, concerned about adding to appointment time and ability to get a ride home</td>
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<tr>
<td>09/08/03</td>
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<td>09/15/03</td>
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<td>09/26/03</td>
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<td>10/06/03</td>
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<tr>
<td>11/04/03</td>
<td>Severe disabilities and developmental delays/non-verbal</td>
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<td>11/12/03</td>
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<td>11/20/03</td>
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<tr>
<td>11/24/03</td>
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Note: Missing data on some adolescents who cancelled the allergy testing appointment.
APPENDIX B

ASSENT/CONSENT FORM

ALBANY MEDICAL CENTER
ALBANY, NY 12208

PERMISSION TO TAKE PART IN A HUMAN RESEARCH STUDY

Title of research study:
Effect of Self-selected Distraction on Adolescents’ Acute Procedural Pain Perception

Principal Investigator:
Debra Jeffs, MS, RN

We invite your child to take part in a research study because your child is between 11 and 17 years of age and is having allergy skin testing.

What you should know about a research study

• We give you this consent form so that you can read about the purpose, risks and possible benefits of taking part in this research study. Please review it carefully.

• The main goal of regular medical care is to help each patient. The main goal of a research study is to learn things to help future patients.

• We cannot promise that this research study will help you.

• Just like regular medical care, your taking part in this research study can result in harmful effects that may be minor or serious.

• Someone will explain this research study to you. Feel free to ask all the questions you want before you make a decision.

• A research study is something you volunteer for. Whether or not you take part in this research study is up to you.

• You have the right to choose not to take part in the research study. Also if you agree to take part now, you can change your mind later on.

• Whatever you decide it will involve no penalty or loss of benefits that you would get anyway.

1 - Why is this research study being done and what is its purpose?

The goal of this research is to compare ways nurses can help children reduce any uncomfortable feelings during the allergy skin tests.
2 - Who is doing the research study?

Debra Jeffs, MS, RN a nursing doctoral student from the University of Massachusetts is conducting this research study. Jocelyn Celestin, MD, FAAAAI has agreed to assist with the study. We expect about one hundred and fifty-six (156) children from Albany Medical Center will participate in this study. We expect that each child will participate in the study for about one hour including the actual allergy testing.

3 - What can you expect if your child takes part in this research study?

Children with any pain and children with learning difficulties will not be eligible to participate in the study. If your child is eligible for participation in the study, Ms. Jeffs will ask your child to complete two questionnaires in a quiet waiting area while waiting for the allergy testing to begin. This will take about 15 minutes. One questionnaire will ask questions about feeling calm or nervous. The other questionnaire will ask questions about your child’s age, prior experience with medical “shots,” and what they expect the allergy testing to be like.

No one knows yet which way will help children best during allergy testing. Each participant in the study will be assigned by chance to one of three groups. One group of participants will receive the care usually provided during allergy testing. Another group will watch a health education videotape (like ones shown in doctors’ waiting rooms) during the allergy testing. The third group will choose whether to watch a videotape, to listen to a music CD, or to listen to a “book-on-cassette.”

Next your child will begin the scheduled allergy skin testing with the nurse in Dr. Celestin’s office. If your child receives the usual care during allergy testing, the nurse will probably talk to your child during the testing. If your child is assigned to the health education videotape, your child will be asked to watch it during the allergy testing. If your child is in the self-selection group, your child will be asked to choose one videotape, music CD, or book-on-cassette from a small collection and then your child will be asked to watch or listen to it during the allergy testing. Participating in the study will not add any extra time to the allergy testing.

After the allergy testing is over, Ms. Jeffs will ask your child to fill out three forms about how comfortable or uncomfortable the allergy testing was. Some of the questions will ask about the way the allergy testing felt and how your child liked watching the health videotape or choosing the videotape, music CD or book-on-cassette. This will take about 15 minutes. Your child will receive a small gift for participating.
4 - What are the risks and possible discomforts?

There are no known risks to participating in the study. Certain questions may cause some feelings of uneasiness. If this is the case, Dr. Celestin, Ms. Jeffs, or the office nurse will answer any questions your child has about the allergy testing and reassure your child. Parents may see the questionnaires, if desired. Completion of the questionnaires will add extra time to your child’s appointment but not to the allergy testing itself.

5 - What are the possible benefits?

Your child may not benefit directly from being in this research study. However, it is hoped that by participating, your child will find the allergy testing more comfortable. We cannot promise that this will happen. Your child’s participation may help others having allergy testing in the future as a result of knowledge gained from the research.

6 - If you do not want your child to take part in the research study, are there other choices?

You are free to choose not to take part in this research study. If you decide not to have your child take part in this research study, your child would automatically receive the care usually provided during allergy testing. Your decision regarding your child’s participation will not affect the allergy testing procedure or allergy care your child will receive.

7 - If you have any questions or problems, whom can you call?

If you have any questions about the research study now or later, or if you think you have been injured by the research, you should call the study doctor, Dr. Celestin, at [phone number] and Ms. Jeffs, the investigator at [phone number] or her supervisor, James Fain, PhD, RN, FAAN, Director of the Doctoral Program at the University of Massachusetts, [phone number]. If you cannot reach the study doctor, you may call the Albany Medical College Research Office at [phone number]. You may also call this number if you have complaints about this research study, you believe you are not being treated fairly, or you have questions about your rights as a research subject.

8 - What information will be kept private?

No one will have access to your child’s personal information gathered during the research study. Your child will be identified only by a code number. We may publish the results of this research. However, we will keep your child’s name and other identifying information private. Your child’s name will not be used in any reports or publications of this study.
9 - Can your child's taking part in the research end early?
You or your child may decide not to continue in the research study at any time without
it being held against you or your child and without losing any benefits you or your
child currently have. The person in charge of the research study can remove your child
from the research study without your approval. Possible reasons for removal include
failure to follow instructions of the research staff. We will tell you about any new
information that may affect your child’s health, welfare or choice to stay in the
research study.

10 – What else do you need to know?
You will not be allowed to access your child’s research records.
If you agree to allow your child to take part in this research study, your child will
receive a $10.00 gift certificate to a local record/music store.

We will give you a signed and dated copy of this consent form.
Assent To Take Part In A Human Research Study

Title of research study:
Effect of Self-selected Distraction on Adolescents’ Acute Procedural Pain Perception

Principal Investigator:
Debra Jeffs, MS, RN

Ms. Jeffs is doing a research study to compare different ways nurses can help adolescents to be more comfortable during allergy skin testing. You are having allergy skin testing, so we are asking you if you want to be in this study. About 156 boys and girls, aged 11-17 years, will take part in this study. This study will last for the duration of your allergy appointment today.

1 - What will happen to me if I am in this study?
First, you will complete 2 questionnaires before the allergy testing starts. One questionnaire will ask you questions like your age and how you felt any other time that you had injections or “shots.” The other questionnaire will ask you if you feel calm or nervous. This will take you about 15 minutes to fill out the forms. Some of the words on the questionnaire may be confusing. Ms. Jeffs will be available to help explain them.

Then you will be assigned by chance to one of three groups during the allergy skin testing. You will either receive the care usually provided during allergy testing, or watch a health education videotape (like one in a doctor’s waiting room) during the allergy testing, or choose whether to watch a videotape, listen to a music CD, or listen to a book-on-cassette.

Next you will begin the scheduled allergy skin testing with the nurse in Dr. Celestin’s office. If you receive the usual care during allergy testing, the nurse will probably talk to you during the testing. If you are assigned to the health education videotape group, you will be asked to watch it during the allergy testing. If you are in the self-selection group, you will be asked to choose one videotape, music CD, or book-on-cassette from a small collection and then you will be asked to watch or listen to it during the allergy testing. Participating in the study will not add any extra time to the allergy testing.

After the allergy testing is over, you will fill out three forms about how comfortable or uncomfortable the allergy testing was. Some of the questions will ask about the way the allergy testing felt and how you liked watching the health videotape or choosing the videotape, music CD or book-on-cassette. This will take about 15 minutes.
2 - Will any parts of the study make me sick or feel bad?
No. If some of the questions you are asked on the forms make you feel uncomfortable, you can talk to Ms. Jeffs, Dr. Celestin, or the nurse doing the allergy testing.

3 - What if I have questions?
You can ask Ms. Jeffs or Dr. Celestin about the study. You can ask any questions now or later. Call [redacted] to talk to Ms. Jeffs or [redacted] to talk to Dr. Celestin.

4 - What else do I need to know?
Being in the study may not make you feel more comfortable during allergy testing.

Being in the study will not take any extra time for the allergy testing but will add time to your appointment.

Your name will not be used on any of the forms. You will be known only by a code number. The information you provide during the study will remain confidential and private.

We will give you a signed and dated copy of the consent form.

You will receive a $10 gift certificate to a music store.

5 - Do I have a choice to be in this study?
You do not have to be in the study. Your allergy care will not change because you choose to join or not join the study. If you choose not to join the study, you will receive the usual care provided during allergy testing. If you decide to be in the study and then change your mind, that is okay, too. You can quit the study at any time but not the allergy testing. You just need to tell the nurse or Ms. Jeffs. You can stop at any time and no one will be upset or mad at you.

Note: Actual AMC assent/consent signature forms unable to be reformatted for this document.
### APPENDIX C
### LIBRARY OF AUDIOVISUAL MEDIA

<table>
<thead>
<tr>
<th><strong>Music CDs</strong></th>
<th>**</th>
<th>**</th>
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</thead>
<tbody>
<tr>
<td>Britney Spears: Britney</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Celine Dion: A New Day Has Come</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creed: Weathered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dave Matthews Band: Everyday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jennifer Lopez: On the 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marc Anthony</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michelle Branch: The Spirit Room</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSYNC: Celebrity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheryl Crow: C'mon, C'mon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Miseducation of Lauryn Hill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weezer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will Smith: Born to Reign</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Videotapes</strong></th>
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<th>**</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 Olympic Winter Games</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2Gether: The Original Movie (music video)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aaron Carter: Oh Aaron Live in Concert! (music video)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bikes: Summer Two Gravity Games</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brandy: The Videos (music video)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destiny’s Child: The Platinum’s on the Wall (music video)</td>
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<td></td>
</tr>
<tr>
<td>Incubus: The Morning View Sessions (music video)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Los Angeles Lakers 2000-2001 NBA Champions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickelback Unauthorized Fragile This Side Up (music video)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSYNC Pop-Odyssey Live (music video)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sponge Bob-Square Pants Sponge Buddies</td>
<td></td>
<td></td>
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<tr>
<td>World Wrestling Federation- The Rock: Just Bring It</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Books-on-Cassette</strong></th>
<th>**</th>
<th>**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne Rice: The Vampire Lestat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.L. Konigsburg: From the Mixed-Up Files of Mrs. Basil E. Frankweiler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elizabeth George Speare: The Sign of the Beaver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jack Canfield, Mark Victor Hansen, Kimberly Kirberger: Chicken Soup Teenage Trilogy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lemony Snicket: A Series of Unfortunate Events Book 1: The Bad Beginning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Louis Sachar: Holes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Star Wars Jedi Quest: The Trail of the Jedi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stephen King: Everything’s Eventual (5 Dark Tales)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX D

PAIN RATING SCALES

ID# ____________________________
DATE ________________________

ADOLESCENT PEDIATRIC PAIN TOOL (APPT)

INSTRUCTIONS:
1. Mark the areas on these drawings to show where you had pain.
   Make the marks as big or small as the place where the pain was.
2. Place a straight, up and down mark on this line to show how much pain you had.

[Mark line]

No Pain
Little Pain
Medium Pain
Large Pain
Worst Possible Pain

3. Circle as many of these words that describe your pain.

1. annoying
   Bad
   Horrible
   miserable
   Terrible
   uncomfortable
2. Aching
   Hurting
   like an ache
   like a hurt
   Sore
3. Beating
   Hitting
   pounding
   punching
   throbbing
4. Biting
   Cutting
   like a pin
   like a sharp knife
   pin like
   Sharp
   stabbing

1. Blisttering
   Burning
   Hot
   Cramping
   Crushing
   like a pinch
   Pinching
   Pressure
   like a scratch
   like a sting
   Scratching
   Stinging
   Shocking
   Shooting
   Splitting

2. aweful
   deadly
   dying
   killing
   crying
   frightening
   screaming
   terrifying

If you like, you may add other words:

BSA:__________
IS:__________
#S(2-9)/37 = ___%  
#A(10-12)/11 = ___%  
#E(1, 13)/8 = ___%  
#T(14, 15)/11=___%  

Total
____/67 = ___%
FACES Pain Rating Scale

INSTRUCTIONS:

Circle the face that shows how much pain you felt during the allergy testing.

The "smiling" face (0) represents no pain at all even if you do not feel like smiling.
The "crying" face (10) represents the most pain you could possibly have even if you do not feel like crying.

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APPENDIX E

PRE-TESTING QUESTIONNAIRE

I.D. # __________________

Thank you for agreeing to participate in this study!
Please complete the following questions to the best of your ability.
It is very important that you give accurate information.
There are no right or wrong answers.
Do not put your name on this form.

1. Age_______

2. Male_______(0) Female_______(1)

3. Race or Ethnicity:
   ____ Asian/Pacific Islander
   ____ African-American/Black
   ____ Hispanic/Latin
   ____ White/Caucasian
   ____ American Indian/Native Alaskan
   ____ Other/Unknown (Specify) ___________________

4. Have you ever had injections/"shots" or blood-drawn?
   No _____
   Yes _____
   If "Yes", number of times: 1-2 _____ 3-5 _____ More than 5 ______

Circle a number for #5-7.
5. What were your experiences like when you had injections/"shots" or blood drawn?

Didn’t bother me………………………………………………Worst experience ever
   1.................................2.................................3.................................4.................................5
   ______ I do not remember the experience.

6. What do you expect the allergy testing to be like?

Pleasant…………………………………………………………Extremely painful
   1.................................2.................................3.................................4.................................5

7. Do needles or “shots” make you nervous?

Not at all........................................................................Extremely nervous
   1.................................2.................................3.................................4.................................5

1 9 6
<table>
<thead>
<tr>
<th>I.D. #</th>
<th>Investigator to complete:</th>
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<tbody>
<tr>
<td>Day_______ Date_____________ Time____________</td>
<td></td>
</tr>
<tr>
<td>Group: 1 2 3</td>
<td></td>
</tr>
<tr>
<td>CD___ Video___ Book Cassette__</td>
<td></td>
</tr>
<tr>
<td>Name of media</td>
<td></td>
</tr>
<tr>
<td>Permission of parent/guardian on file in patient chart and research office</td>
<td></td>
</tr>
<tr>
<td>Assent of child on file in patient chart and research office</td>
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</tr>
<tr>
<td>Child not capable of assent</td>
<td></td>
</tr>
<tr>
<td>Inclusion criteria met</td>
<td></td>
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<tr>
<td>Nurse_______________________</td>
<td></td>
</tr>
<tr>
<td>Location and Number of Scratches/Pricks: Right forearm #_______ Left forearm #_______ Other #_______ #_______</td>
<td></td>
</tr>
<tr>
<td>Type of Allergens:</td>
<td></td>
</tr>
<tr>
<td>Food ___________</td>
<td></td>
</tr>
<tr>
<td>Environmental _____________ Intradermal Testing: Yes ____ No</td>
<td></td>
</tr>
<tr>
<td>Right upper arm #____________</td>
<td></td>
</tr>
<tr>
<td>Left upper arm #____________</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F

POST-TESTING QUESTIONNAIRES

Post-testing Questionnaire
Group 1

I.D. # ___________________
Date ___________________

Now that you have had the allergy testing, please answer these questions. It is very important that you give accurate information. There are no right or wrong answers.

Do not put your name on the form.

1. During a painful healthcare procedure, do you like to be distracted or pay attention?
   - I like to be distracted from what’s being done. _______ Agree _______ Disagree
   - I like to pay attention to what’s being done. _______ Agree _______ Disagree

2. Did you want to be distracted from the allergy testing? _______ Yes _______ No

3. Did you do anything to distract yourself during the allergy testing? _______ Yes _______ No
   If yes, what?
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

4. Was the allergy testing what you expected? _______ Yes _______ No
   - Better than expected.............................................................................Worse than expected
     1........................2............................3..........................4..........................5

5. How nervous did you feel during the allergy testing?
   - Not nervous at all...........................................................................Most nervous I could feel
     1........................2............................3..........................4..........................5

6. Was there anything the nurse did or said to make the allergy testing an okay experience?
   ________________________________________________________________
   ________________________________________________________________

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7. How could this allergy testing experience have been better for you?


8. Which pain rating scale did you like better? _______ FACES _______ APPT

9. List your top 3 favorite choices of videotapes, CDs, or books-on-cassette:


Thank you for your participation! Your assistance is very helpful!
Post-testing Questionnaire
Groups 2 & 3

I. D.#_____________
Date _______________

Now that you have had the allergy testing, please answer these questions. It is very important that you give accurate information. There are no right or wrong answers.

1. During a painful healthcare procedure, do you like to be distracted or pay attention?
   I like to be distracted from what’s being done. ________ Agree ________ Disagree
   I like to pay attention to what’s being done. ________ Agree ________ Disagree

2. Did you want to be distracted from the allergy testing? ________ Yes ________ No

3. Were you able to pay attention to the videotape, CD, or cassette during the allergy testing?
   Could not pay attention at all..............................................................at all times
   1...........................2............................3............................4...........................5

   Explain_________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________

4. Did you do anything else to distract yourself from the allergy testing?___ Yes ___ No
   If yes, What?______________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________

5. I think the distraction lessened my pain. ________ Agree ________ Disagree

6. The distraction did not decrease my pain. ________ Agree ________ Disagree
7. Choosing my own distraction, like a favorite or new videotape or CD, is more helpful in lessening my pain than the nurse choosing the distraction. 

Agree ____________ Disagree ____________ 

8. Was the allergy testing what you expected? ______ Yes ______ No 

Better than expected........................................................................Worse than expected 
1........................2..........................3...........................4..........................5 

9. How nervous did you feel during the allergy testing? 

Not nervous at all........................................................................Most nervous I could feel 
1........................2..........................3...........................4..........................5 

10. Was there anything the nurse did or said to make the allergy testing an okay experience? 

11. How could this allergy testing experience have been better for you? 

12. Which pain rating scale did you like better? ______ FACES ______ APPT 

13. If you watched the nursing videotape, rate how you liked it: 

I liked it a lot........................................................................I did not like it at all 
1........................2..........................3...........................4..........................5 

14. List your top 3 favorite choices of videotapes, CDs, or books-on-cassette: 

Thank you for your participation! Your assistance is very helpful!
APPENDIX G

ADOLESCENT AUDIOVISUAL MEDIA CHOICES

<table>
<thead>
<tr>
<th>Music CDs</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Aaron “5”</td>
<td>Disturbed</td>
<td>Mariah Carey</td>
</tr>
<tr>
<td>Amerie</td>
<td>Eminem</td>
<td>Metallica “Black Album”</td>
</tr>
<tr>
<td>Ant They Might Be Giants</td>
<td>Garth Brooks</td>
<td>Mudvayne</td>
</tr>
<tr>
<td>Beatles</td>
<td>Good Charlotte “The Young and the Hopeless”</td>
<td>Nelly</td>
</tr>
<tr>
<td>Beyonce</td>
<td>Greenday</td>
<td>Rap</td>
</tr>
<tr>
<td>Center Stage</td>
<td>ICP</td>
<td>Red Hot Chili Peppers</td>
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<tr>
<td>Classical music</td>
<td>Kenny Chesney</td>
<td>Rock n’roll music</td>
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<tr>
<td>Coldplay</td>
<td>Kinks “Greatest Hits”</td>
<td>Soothing music</td>
</tr>
<tr>
<td>Counting Crows</td>
<td>Lincoln Park</td>
<td>Weezer</td>
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<tr>
<td>Dave Matthews</td>
<td>Loudacris</td>
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<table>
<thead>
<tr>
<th>Videotapes</th>
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<tbody>
<tr>
<td>2 Fast, 2 Furious</td>
<td>Dirt bike</td>
<td>New Found Glory</td>
</tr>
<tr>
<td>8 Mile</td>
<td>Entertainment</td>
<td>Poltergeist</td>
</tr>
<tr>
<td>A television show</td>
<td>Fast and Furious</td>
<td>R &amp; B music videotape</td>
</tr>
<tr>
<td>A Walk to Remember</td>
<td>Friday After Next</td>
<td>Rap music videotape</td>
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<tr>
<td>Ashanti</td>
<td>Funny</td>
<td>Romeo Must Die</td>
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<td>Austin Powers</td>
<td>Galtacca</td>
<td>Rugrats</td>
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<tr>
<td>Back to the Future</td>
<td>Goldmember</td>
<td>Save the Last Dance</td>
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<td>Beyonce</td>
<td>Happy Gilmore</td>
<td>Sponge Bob</td>
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<tr>
<td>Biker Boys</td>
<td>Harry Potter</td>
<td>Sports</td>
</tr>
<tr>
<td>Bill Nye the Science Guy</td>
<td>Holes</td>
<td>Teen education tapes (sex ed, diseases, etc.)</td>
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<tr>
<td>Billy Madison</td>
<td>Lion King</td>
<td>The Grinch Who Stole Christmas</td>
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<td>Cartoons</td>
<td>Little Mermaid</td>
<td>The Rock</td>
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<td>Center Stage</td>
<td>Lord of the Rings</td>
<td>The Watsons Go to Birmingham</td>
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<td>Chicken Rum</td>
<td>Monster Garage</td>
<td>Toy Story</td>
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<td>Cledus Jud</td>
<td>Monty Python</td>
<td>Transformers</td>
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<td>Comedy</td>
<td>Mr. Deeds</td>
<td>Wallace and Gromit</td>
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<tr>
<td>Dawn to You</td>
<td>Music</td>
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<table>
<thead>
<tr>
<th>Books-on-Cassette</th>
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</thead>
<tbody>
<tr>
<td>Bud not Buddy</td>
<td>Holes</td>
<td>Listen to a calm book</td>
</tr>
<tr>
<td>“Hachatt”, by Gary Paulsen</td>
<td>Music</td>
<td>Sign of the Beaver</td>
</tr>
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REFERENCES


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