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HEALING HEALTHCARE DESIGN FOR ADOLESCENT PATIENTS: PROMOTING HOLISTIC QUALITY OF LIFE

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ASTRACT OF THESIS

HEALING HEALTHCARE DESIGN FOR ADOLESCENT PATIENTS:

PROMOTING HOLISTIC QUALITY OF LIFE

This study examined environmental preferences for adolescent patients in hospital patient rooms and activity rooms to determine age-appropriate healing design elements. The health-related quality of life (HRQOL) concept was adapted to this study as a theoretical framework. In order to develop an age-appropriate healing design, a comprehensive understanding of adolescents' cognitive developmental stages and their expectations in hospital settings needs to be recognized. Thirty-two adolescent outpatients aged 15 to 18 participated in the survey. Data collection consisted of three different instruments: Emotional state survey with demographics, Photo analysis with semantic differentials, and environmental preference value survey. Comfort, sadness and stress affected adolescent patients' preference responses. Adolescent patients preferred having a home-like environment for their patient rooms due to their needs for comfort and control of privacy. They also preferred having enjoyable and controllable activity rooms that supported peer connection, self-identity, and stress reduction. Environmental values that are important to adolescents were control of privacy, a quiet place to go, a place for activity, and having a controllable outside view.

Keywords: adolescent patients, healing, quality of life, hominess, enjoyable

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_____6/27/2011_____

HEALING HEALTHCARE DESIGN FOR ADOLESCENT PATIENTS:

PROMOTING HOLISTIC QUALITY OF LIFE

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Eun Young Kim

The Graduate School

University of Kentucky

2011

HEALING HEALTHCARE DESIGN FOR ADOLESCENT PATIENTS: PROMOTING
HOLISTIC QUALITY OF LIFE

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THESIS

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A Thesis submitted in partial fulfillment of the requirement for the
Degree of Master of Fine Art in the
College of Design at the
University of Kentucky

By

Eun Young Kim

Lexington, Kentucky

Director: Dr. Allison Carll-White, Professor of

Lexington, Kentucky

2011

DEDICATION

To my father, Jinwan Kim,

and mother, Yisook Kim

for bottomless support

To my husband, Kun-Jun Han,

For love and dedication he has given

To my daughters, Youn Seon Han and Younjin Han,

For being treasures in my life

ACKNOWLEDGEMENT

It has been a long journey to complete this thesis from the very first day when I started my study at the School of Interior Design at the University of Kentucky. There have been many people who have helped and supported me. Through this journey, I have learned the endless power of encouragement from them.

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INTRODUCTION

Background

In recent decades, the focus of healthcare providers and hospital environment planners has been toward patients' satisfaction, which is a part of considering patients' quality of life. This new approach to patient-centered healthcare has impacted new healthcare physical settings as well as their medical service quality in positive ways. Research on patient-centered healthcare design has produced some evidence of healing design guidelines (Ulrich, 1984; Ulrich & Zhu, 2007; Verderber, 1986).

Adolescence provides a unique opportunity to prevent health conditions and behaviors with life-long implications for individuals and for society (English, Park, Shafer, Kreipe, & D'Angelo, 2009). However, the increasing elderly population has been forcing our society to prepare for a future that will have different socio-economic circumstances than at present. Under this challenging demographic dynamic, the focus of the majority of research on healthcare environmental design tends to deal with the aging population. On the other hand, children who are hospitalized have been the subject of research in many related areas in terms of psychological and developmental risks involved in overnight hospital stays (Adams, Theodore, Goldenberg, McLaren, & McKeever, 2010). Even though there is much concern and effort in improving adolescents' health in general, there is not much empirical evidence regarding applicable age-appropriate healing environmental design for adolescent patients. Instead, most of the research on adolescent healthcare is conducted from the viewpoint of public health policy, adolescent medicine, and prevention programs for at-risk behaviors (Adolescent and

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Health Care Service, 2007; Friman, Soper, Sinclair, & Shanahan, 1996). Environmental factors such as family, peer group, school, and community characteristics contribute to adolescents' health and risk behaviors. These environmental factors include not only social characteristics but also physical characteristics that influence adolescents' decision making on healthy or risky behaviors in the long-term. In 2010, the U. S. Department of Human Health Services re-activated the Office of Adolescent Health (OAH) and has put forth efforts into finding improved approaches to adolescents' safety, health, and well-being (Fox & Frohman, 2011). However, the newly released report on the future direction of the OAH does not include the impact of healthcare physical environments

In summary, due to the unstable and dynamic characteristics of adolescence, little design research on healing environmental intervention on adolescent patients' healing process has been conducted. Also, there is a gap in the body of knowledge regarding how hospital environments may impact the healing process of adolescents and how this process differs from young children and adult patients.

Justification of the problem

Adolescence is characterized by dramatic physical and emotional changes in the process of growing from childhood into adulthood (Health, 2009). Sudden physical changes and rapid cognitive development affect self-consciousness, sensitivity, concerns over bodily change and excruciating comparisons between oneself and one's peers. The National Institute of Health Agency (2003) reports that many adolescents are at increased risk for depression and potential suicide attempts due to pressures and conflicts that may

arise within families, school or social organizations, and intimate relationships. Changes in identity, biological development, and peer interaction may result in behaviors that generate mistrust in adults. In addition to numerous changes in their lives, chronic illness can be a huge obstacle for adolescents. Research has suggested that adolescents with a chronic condition are at increased risk for experiencing adjustment problems (Wallander & Varni, 1995). Therefore hospitalization poses potentially harmful threats to their biological, social, and cognitive development (Blumberg & Devlin, 2006; Boice, 1998).

In fact, there are more adolescents with serious illness than ever before (Boice, 1998). The National Center for Health Statistics (NCHS) emphasized the importance of spending for hospitalized adolescents' healthcare. According to the NCHS (2000), adolescents 10 to 19 years of age had 1.6 million hospitalizations annually from 1995 to 1997 (Blumberg & Devlin, 2006). The U.S. Department of Human Health Services reported that approximately 9 percent of adolescents aged 10 to 17 years old were engaged in limited activities due to a chronic health condition in 2004 -2005. About one-fifth of adolescents with an activity limitation had symptoms due to mental, emotional, or other behavioral problems. Annually, adolescents 10 to 19 years of age made about 13 million emergency department visits, and the same age group of adolescents averaged 1.8 million hospital stays from 2002 to 2004 (MacKay & Duran, 2008). Preventable adolescent health problems cost an estimated $700 billion per year (Committee on an Adolescent and Health Care Service, 2007).

Hospital environments may impact healing in adolescents differently than young children and adults. However, the effects of physical environmental interventions on

adolescents in healthcare settings have not been examined. In order to provide holistic healing intervention to adolescent patients, the expectations from actual user groups need to be identified, since psychologically supportive environments can positively influence a user's well-being. Along with the psychological environmental approaches, this study will add to the evidence for healing healthcare design. Therefore, this research will focus on understanding the value of environmental healing effects on adolescent patients in a healthcare setting and will investigate interior design elements that provide potential healing effects to support adolescents' health-related quality of life.

Objectives

In order to develop an age-appropriate healing design, a comprehensive understanding of adolescents' cognitive developmental stages and their expectations in hospital settings needs to be recognized. Based on the adolescents' specific needs of restoration, autonomy, and social connection with peers, objectives of this study were identified:

1. To understand the value of environmental healing effects such as control over privacy, self-esteem, and social support on adolescent patients.

2. To investigate adolescent patients' preferences and environmental values that may affect adolescents' healing processes in hospital settings.

3. To discover symbolic design elements that reinforce adolescents' feelings of comfort, sense of control, and sense of belonging in hospital design.

Theoretical framework: Health-Related Quality of Life

The concept of Health-Related Quality of Life (HRQOL) was introduced at the First International Conference on Health-Related Quality of Life in 1994. There is not a universally accepted conceptual definition of HRQOL (Coyle, 2009) nor a clear suggestion of which indicators contribute more than others (Morewitz & Goldstein, 2007). The literature review shows that the key concept of HRQOL is a holistic approach toward an individual's physical, psychological, and social well-being to measure the medical outcome of an individual's quality of life. This concept emphasizes the importance of a patient–centered approach and patients' self-reported well-being rather than assessments by clinicians or biomedical parameters (Sawyer et al., 2004). A number of studies including Bowling (1995) and Cantrell and Lupinacci (2008) defined HRQOL as a multidimensional measuring tool that includes physical functioning, psychological adjustment, social function, and sense of well-being. Most of the conceptual definitions of HRQOL refer to a person or group's subjective perception of their physical and mental health (Abdullah & Jamal, 2010).

There is a significant amount of health-related research that has been done using the HRQOL concept as a measuring tool of healthcare outcomes or as a theoretical framework for healthcare service due to its comprehensive approach. Measured HRQOL is regarded as a complete healthcare outcome that can be a reference for healthcare-related decision making. The widely used tool is the form SF-36V2 (Medical Outcomes Study Short Form 36 Health Survey). It consists of 36 items that ask eight dimensions of health status: physical functioning, physical role, body pain, general health, vitality, social functioning, emotional role, and mental health (Coyle, 2009). As a measurement

tool of healthcare outcomes, Patrick and Chiang (2000) studied the effectiveness of using

HRQOL. They explained how individuals' quality of life can be affected by health status,

internal factors, and external factors.
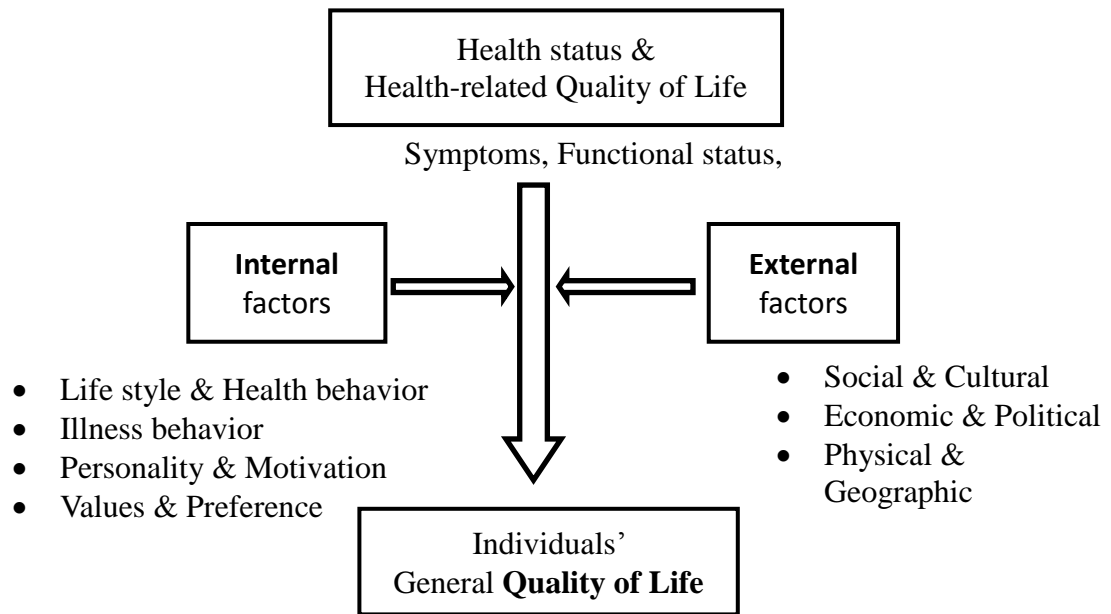
Figure 1.1 Health-related Quality of Life and influential factors
Adapted from Patrick & Chiang (2000, p.II-19)

This tool has been modified to each patient group's specific medical condition

and used as a measurement tool for their medical treatment outcome. Ko et al.(2000)

examined the relationship between functional results and quality of life in patients. They

used the SF-36 Physical Health Survey and Mental Health Summary Scales as two

validated instruments. Cantrell and Lupinacci (2008) adopted HRQOL into their research

on children and adolescent cancer survivors and found that HRQOL has a positive

relationship with patients' self-esteem and coping strategy with hopelessness from their

sickness. Healing environmental elements can provide a way of reducing stress and

enhancing quality of life (Shepley, Fournier, & McDougal, 1998; Sherman, 2005). Using

the same approach, Park (2007) proposed a HRQOL conceptual model of physical environmental effects on children's well-being in hospital design. These healthcare design researchers used the HRQOL concept as a measuring tool of research participants' emotional states. Ulrich (1991) proposed a supportive healthcare design theory that emphasizes understanding the needs of patients, visitors and staff in hospital environments. This approach overlaps with the HRQOL in focusing on actual users' needs and health status.

The HRQOL concept was adapted to this study as a theoretical framework. Promoting the healing process is affected by adolescents' internal factors such as demographics, emotional states, values and preferences of design. Hospitals' physical environments include external factors in this framework that also affect an adolescent patient's healing process. To promote holistic quality of life for adolescent patients, these two factors need to be compatible with each other. This study examines adolescent patients' emotional states by testing their preferences of patient rooms and activity rooms to determine healing design elements. Figure 1.2 shows the relationship among factors that affect individuals' healing process in hospital settings.

Definition

Adolescent

There is no clearly defined description of an adolescent regarding age range. Each institution uses its own age range for the adolescent according to the purpose of usage.

The present study defines the adolescent by ages ranging from 15 to 18 years old or by
school grade ranging from 9th to 12th grade.

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                  ┌──────────────────────────┐
                  │      Health status &     │
                  │ Health-related Quality of Life │
                  └──────────────────────────┘
                    •   Symptoms, Functional status

  ┌──────────┐            ╭──────────╮            ┌──────────┐
  │ Internal │    ──▶     │  Healing │    ◀──      │ External │
  │ factors  │            │ process  │            │ factors  │
  └──────────┘            ╰──────────╯            └──────────┘
    • Age                                           • Patient room
    • Gender                                        • Activity room
    • Emotional state
    • Values
    • Preference
                      ┌──────────────────────┐
                      │  Adolescent's general │
                      │   Quality of Life     │
                      └──────────────────────┘
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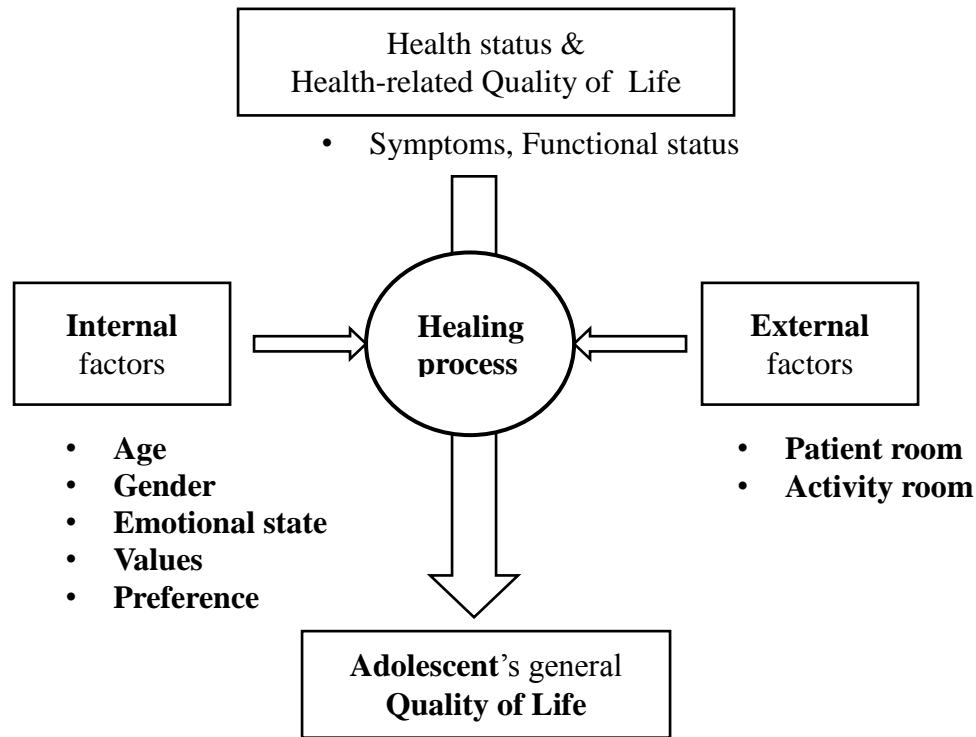
Figure 1.2. Theoretical Framework

Limitation

The participants of the study were adolescent outpatients and Kentucky residents
at the Division of Adolescent Medicine at the University of Kentucky Clinic. A
convenience sample based on age and mild medical conditions that may limit the
generalizability of the findings was used. The results from convenience samples might
contain certain unknown regional or cultural characteristics.

<center>**CHAPTER TWO**</center>
<center>**LITERATURE REVIEW**</center>

It is important to understand how patients react to hospital environments. Well-designed physical elements in hospital settings can promote patients' stress reduction and psychological well-being so that they advance to positive healing procedures under potentially stressful hospitalization. To gain an understanding of the importance of compatibility between adolescent patients and hospital environments, the literature on adolescence, environmental stress for patients, environmental preferences, and healing approaches was reviewed.

Adolescence

     Age.

One of the organizations under the U.S. Department of Health and Human Services, Healthy People 2010, defined adolescent ages from 10 to 19 years old and ages from 20 to 24 years old as young adults (HealthyPeople.gov, 2010). The Healthy People in Every Stage of Life Program defined adolescents as 12 to 19 years olds (Adolescent and Health Care Service, 2007). The National Institute of Health and the Agency for Healthcare Research and Quality (AHRQ) defined adolescents as 11 to 17 years old in the current report (Agency for Healthcare Research and Quality, 2008). Spear (2000) defined adolescents as ages 12 to 18 and labeled late adolescents as ages up to 25 years old. The American Academy of Pediatrics categorized adolescent ages from 11 to 21 years old (American Academy of Pediatrics, 2011). The Youth Risk Behavior Survey, conducted by the Division of Adolescent and School Health, defined students in grades 9

<center>9</center>

through 12 as adolescents (Centers for Disease Control and Prevention, 2010). The World Health Organization defined "adolescents as individuals in the 10 to 19 years age group (Organization, 2009).

Due to the lack of a clear age definition, adolescent research has covered individuals' age ranging from 10 to 24 years old. This study defined adolescents aged from 15 to 18 or the students in grades 9 through 12 to differentiate from early adolescents under the age of 15.

Development.

Adolescence is characterized by dramatic physical and emotional changes in the process of growing from childhood into individual maturity. Adolescents are maturing physically and their social skills are expanding. Their cognitive centers are also in flux (Ramowski & Nystrom, 2007). The sudden and rapid physical changes that adolescents typically experience cause this development period to be one of self-consciousness, sensitivity, and concern over one's own body changes.

Based on Piaget's four stages of cognitive development, the formal operational stage begins for most at 12 or 13 years of age and continues into adulthood. In this stage children can think hypothetically and use logic to solve problems. Not only objects and experiences but hypotheses can be understood by the child, and this capacity of thinking allows a child to engage in deductive reasoning (Piaget, 1930). A child can think about a problem abstractly and indentify the factors that affect the situation (Brainerd, 1978; Wardworth, 1978). Piaget noted that children at the formal-operational level are able to experience and comprehend relationships between the mind and body experience in

indirect ways. At this stage children can think theoretically and hypothetically so that they no longer require physical conditions to make rational decisions (Piaget, 1930).

It is important for adolescents to be psychologically healthy and this affects their general quality of life. Bovier et al (2004) confirmed that perceived stress is an important risk factor for low mental health. The research indicated that self-esteem is a key component for young adults' mental health. They also pointed out the significant impact of the poorly understood relationship between perceived stress and social support (Bovier, Chamot, & Perneger, 2004). The particularly vital changes in adolescents' behavior influence social interactions and affiliation with peers (Spear, 2000). Adolescents have been reported to spend about one-third of their waking hours with peers, but only 8% of this time talking with adults. Adolescents are most happy when talking with peers (Spear, 2000). Adolescents' sense of control is at risk when they are forced to live away from their homes, families, and friends (Friman et al., 1996). For adolescents, health status and healthcare can be complicated by constant developmental changes, questions about confidentiality, relationships with families and peers, and other factors specific to this stage of life (Adolescent and Health Care Service, 2007). Therefore, it is essential to understand their physical and psychological state and needs in adolescent healthcare design.

Environmental Stress in Healthcare

Hospital environments can be stressful places for everyone who comes. Stress is regarded as an interaction between the person and the environment, and this interaction provides the basis for the ability or inability to deal with a stressful event. Stress is also intensified as a result of a misfit between individuals' needs and environmental attributes. Hospital environments are stressful in part because of environmental complexity and unfamiliarity, especially for patients (Kaplan, 1983).

Patients in hospitals face many physical and psychological challenges such as an unfamiliar environment, painful medical procedures, and separation from family and friends. Lack of privacy, uncontrollable noise, glare, and poor indoor air quality can also be stressors for hospitalized patients. These challenges affect the patients' recovery process significantly as stressors (Ulrich, 1991; Ulrich, Zimring, Quan, & Joseph, 2004). Possible effects from stress may result in a longer hospitalization due to symptoms such as depression, elevated blood pressure and heart rate, or a weakened immune system (R. Ulrich, 1984, 1991). The decreased functionality of the immune system due to stress can work against the patient's healing process (Kennedy, 1990). Psychologically, stress causes a sense of helplessness, generating anxiety, depression, and lower self-esteem (Eisen, 2006). Stress also can generate a variety of reactions adversely affecting wellness, including verbal outbursts, social withdrawal, sleeplessness, alcohol abuse, and noncompliance with medication (Ulrich, 1991).

A study of pain perception in subjects ages 5 to 16 showed that patient-perceived pain intensity was related to anxiety, depressive symptoms, lower self-esteem and behavioral problems (Varni et al., 1996). In children's healthcare, fear and anxiety are

found to be a strong source of stress that affect pain perception and behavioral responses (Hart, 1994). For adolescent patients, the separation from their peers and lack of privacy could be the major psychological stressors.

Coping with stress.

Patients' health and safety are influenced by environmental impact (Ulrich, et al, 2004).   The environmental characteristics that potentially evoke stress may lead to physical or psychological discomfort and even sickness. As reaction to the stress, individuals go through coping processes (Evans & Cohen, 1987). Stress in hospital settings is an important medical concern because it is both a significant health outcome in itself, and it directly and negatively affects many other outcomes (Cohen, Tyrrell, & Smith, 1991). Stress is also a person-based concept due to individual differences in their reaction to environmental conditions (Evans & Cohen, 1987). A large group of studies used environmental stressors and coping theory as a conceptual framework of person-environment relationship (Eisen, 2006; Kaplan, 1983; Park, 2007; Ulrich, 1991). Environmental elements that are compatible with patients' needs may reduce stress and promote the healing process in healthcare design.

Research suggests additional ways for design to support coping with stress. Through empirical research, there is a clear idea that the physical environment has a significant impact on health and safety (Ulrich, et al, 2004). A positive environmental affect as stimuli can promote patients' well-being by reducing stress or negative feelings. When settings are supportive and accommodate individual differences, this compatibility can reduce ambient stressors via obtaining a sense of control and applying a coping

strategy (Kaplan, 1983; Topf, 2000; Ulrich, et al., 2004). This support design as positive stimuli can be applied into physical healthcare design. This means that the designed environment removes stressful characteristics such as loud noise and glare from inappropriate lighting fixtures (Ulrich, 1991).

The ways of helping patients cope with stress will promote patients' wellness. In order to promote the relationship between the built environment and human health in a positive way in the healthcare setting, many researchers focus on identifying the specific user groups' needs based on their psychological and physiological conditions. Topf (2000) agreed with the idea that personal variables contribute greatly to coping factors. The review of literature evidenced the importance of stress reduction in healthcare settings regarding patients' healing processes, especially for adolescent patients due to dynamic developmental changes in adolescent characteristics (Bovier, et al., 2004; Huffcutt, 2010).

Major indoor environmental stressor.

Physical environments consist of indoor environmental factors and interior design elements. The indoor environment and interior design elements interact with patients in healthcare settings. Hospital indoor quality affects patients' satisfaction with their treatment and the medical staff's working environment as well (Dascalaki, Gaglia, Balaras, & Lagoudi, 2009). When patients cannot counteract negative environmental factors or unfamiliar settings, the environment creates distress and affects patients' healthcare outcomes negatively, both physically and psychologically. Indoor environment factors include air quality, noise, lighting, and ambient temperature.

Indoor air quality is related to infection rate and mainly affects patients' physical well-being. However, Rashid and Zimring (2008) stated that "very few studies have been reported on the effects of ambient temperature in health care settings" (p.167). Among these environmental factors, noise and lighting are the critical properties affecting patients' overall healing process.

   Noise.

   Noise is defined as the presence of unwanted sound. Undesired sound causes stress and affects patients' psychological well-being. As one of the major environmental stressors, noise is the most examined in hospital environments (Devlin & Arneill, 2003). The stress from noise in hospitals is largely uncontrollable by individual coping, and intervention is needed (Topf, 2000). Empirical research indicated that noise in healthcare settings created stress (Rashid & Zimring, 2008; Ulrich, et al., 2004). Previous research found that the standard of 45 dB (A) noise level advocated by the U.S. Environmental Protection Agency (EPA) is often exceeded for rest and sleep in the hospital (Topf, 2000). More recent noise levels in hospital settings also found that current hospital noise levels were higher than the guideline value of the World Health Organization (WHO). The WHO specifies 35 dB (A) or less for background noise, but research found 45 to 68dB (A) in hospital settings. The WHO specified 40dB (A) or less for the nighttime peak, but the actual noise level in a hospital at night is 80 to 90dB (A) (Rashid & Zimring, 2008). The major physical effect of noise was sleep disruption, raised blood pressure, and increased heat rate. Noise influences patients' satisfaction with environmental control, social interaction, and social support, and causes insensitivity to social cues (Rashid & Zimring, 2008).

There are many sources of noise in healthcare settings such as telephones, alarms, trolleys, ice machines, paging systems, nurse shift changes, staff caring for other patients, doors closing, staff conversations, and patients crying out or coughing. Studies showed that higher than average sound levels significantly deterred the healing process. Noise created subjective stress and annoyance not only for patients but also for nurses who worked in a pediatric intensive care unit (Morrison, Haas, Shaffner, Garrett, & Fackler, 2003). Moreover, noise affected nurses' emotions by causing exhaustion and burnout as well as medical errors (Rashid & Zimring, 2008).

Lighting.

The effects of lighting on the psychological and physiological stress of patients have been studied. Natural light may positively influence patents' mental health and intake of pain medicine. Walch et al. (2005) tested the effects of exposure to sunlight on pain medication in 89 patients who had undergone spine surgery. Patients in the bright rooms required less analgesic medications and reported significantly greater decreases in stress and decreased pain. Exposure to light may enhance recovery from painful medical conditions. Bright light is effective in reducing depression among mental disorder patients. A study on the length of hospitalization related to direct sunlight demonstrated that access to sunlight shortened hospital stays and caused more daytime activities (Salin, 1992). Rashid and Zimring (2008) reviewed research on the lighting effects in healthcare environments. Daylighting positively affected patient groups with mental disorders and Alzheimer's disease, but cool fluorescent lighting had negative effects. Full-spectrum fluorescent lights with digital ballasts were able to eliminate most problems related to cool, flickering fluorescent lights.

Environmental preferences in Healthcare settings

Environmental preferences affect individuals' environmental satisfaction and psychological well-being. Individuals have different preferences according to their personality, emotional states and health status. In healthcare settings, patients' environmental preferences may impact their healing process and restoration.

Preferences and Healing

The concept of healing healthcare environments is effective for medical restoration and psychological well-being. Healing environments in healthcare create positive beneficial effects on health indicators such as anxiety, blood pressure, post-operative recovery, medication usage, and the length of hospital stays (Ulrich, 1981) A healing environment can be defined as the physical and cultural atmosphere created to support patients and families. Interior and exterior building design, gardens, family spaces, and an art collection are physical components of the healing environment (Whitehouse et al., 2001). Physical environmental stimuli that create healing effects can be provided through architectural features, interior design features, and ambient features (Harris, McBride, Ross, & Curtis, 2002a).

Gesler et al. (2004) summarized that the qualitative aspects of a healing and therapeutic healthcare approach must include physical, social, and symbolic environment design. They categorized these three different approaches to healing healthcare from previous research. The hospital is considered a 'behavior setting' where physical attributes such as lighting, color, noise, ventilation, and natural elements define the relationship between space users and the built environment. Spatial layout of a hospital room and window placement was architectural features and these are not controllable.

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Surface finishes, layout of furnishings, colors and patterns, decorative items, and

personalization items were categorized as the interior features that contained potential

healing effects. Aesthetically pleasing art can improve patients' experiences (Eisen, 2006;

Friedrich, 1999). Indoor environments with ambient features affect the healing process as

well. When patients had control over artificial lighting and natural lighting, noise level,

odors, humidity, and temperature, they experienced positive restoration (Rashid &

Zimring, 2008).

Preferences and Restoration

Restoration can be a major part of the holistic healing process for patients in

hospitals. There is empirical evidence for the preference for natural over built

environments (Hartig, 1991; Kaplan, 1995; Ulrich, 1981). Nature's ability to provide

restoration from stress and attentional fatigue could be the reason for people to prefer the

nature environments over built environments. This relationship between restoration and

preference of nature supported the idea that preferable environments may contain

potential restorative effects. A study of the relationship between restoration and nature

preference found that high levels of stress were associated with higher preferences for

nature (Van den Berg, Koole, & Van der Wulp, 2003). Preferred environments consist of

specific environmental properties and those properties may be different depending on

individuals who prefer the environment. Restorative environments can be either real or

imagined places, while restorative experiences can happen either in a physical or an

illusionary world or a combination of both (Kaplan, Kaplan, & Ryan, 1998).

Adolescents' Environmental Preferences for Healthcare

Along with the evidence-based design progress, there is constantly growing attention to patient-oriented approaches in healthcare design. Adolescent patients may experience different emotional and psychological perceptions of pain and anxiety during a hospital stay in addition to the physical illness itself. Hospitalized adolescent patients could be divided into two categories that consist of physical illness and mental illness or behavioral problems. In addition to the physical illness, the patients' mental state, due to their stage in life, may have a negative effect on the recovery process. Researchers have suggested that there are some developmental risks to hospitalized adolescents that could be a distinctive and potentially harmful threat to biological, social, and cognitive development (Blumberg & Devlin, 2006; Boice, 1998).

Preference Differences from other age group

Adolescent patients may have different environmental needs and preferences than young children and adults for their positive healing process in hospital settings. Blumberg and Devlin (2006) used photo comparisons to determine hospital preferences and concluded that adolescents between 12-14 years old have different preferences for hospital interiors than those of young children and adults. A previous study conducted on the use of pediatric healthcare facilities by adolescents aged 11 to 19 found that subjects preferred examination rooms separated from those for very young children, and the teens were dissatisfied with the given pediatric waiting room entertainment (Tivorsak, Britto, Klostermann, Neibrig, & Slap, 2004).

Previous research has demonstrated that children patients' needs and expectations of hospital environments are different from their parents. While parents are concerned about the physical comforts like hygiene, spaciousness and privacy, children detailed their ideal hospital environment as their favorite place for psychological restoration and social connection (Pelander, Lehtonen, & Leino-Kilpi, 2007). Burns (2008) interviewed 10 adolescents aged from 13 to 19 who were identified as at risk. She examined their perceptions of treatment needs and their suggestions for the design of a holistic sanctuary model. Some of the attributes for the desired model were communication, connection with peers and family members, autonomy, privacy, self-expression, and a home-like atmosphere. The youth indicated their need for structure, freedom, autonomy, respect, guidance, meaningful human connection, consistency, and competency in staff. They highly valued communication and engagement. Desire to connect with the natural world and experiences with safe and healthy environments were highly demanded.

Privacy and autonomy

A survey to determine the ideal patient room for adolescents aged 12 to 14 years old found that 96 percent of participants preferred to have a private bathroom. Eighty-nine percent suggested having a single bedroom and freedom to close the door. Ninety-seven percent of participating adolescents indicated that they wanted to have a television and control over it (Blumberg & Devlin, 2006). Adolescent patients ages 13 to 18 suggested that the patient room was a place for being alone, leisure, treatment that was closed for privacy (Hutton, 2005). Having opportunities for personalization in their patient rooms were suggested for adolescents' sense of ownership. Capability of patients

to control room temperature, lighting levels, and the television afford a sense of control, and this opportunity promotes their health and quality of life (Sherman, 2005).

Social connection

Social context influences adolescents' environmental preferences and the healing process. Hutton (2005) identified that separate activity spaces for adolescents to interact with one another were desired. Adolescent patients aged 13 to 18 years old also requested a shared television room in addition to televisions in patient rooms. Blumberg's hospital design study for adolescents aged 12 to 14 revealed that 95 percent of adolescents wanted to have a telephone near the bed. For socialization, 92 percent of them want to have activities rooms such as a game room, gym, and kitchen outside of the patient rooms (Blumberg & Devlin, 2006).

Preference for natural elements

Eisen (2006) investigated children's art preferences for those aged from 5 to 17 and found art images have potentially stress-reducing effects on children. Natural art was the highest preferred art image for all ages studied. There was no difference in art preference between hospitalized and non-hospitalized participants. Further, there was no dramatic gender difference in art preferences. However, adolescents age 12 to 14 preferred pop culture art instead of natural landscape art (Blumberg & Devlin, 2006).

Outdoor preference

Owens (1988) asked adolescents, ages 14 to 18, about the value of outdoor places. Most teenagers expressed a preference for observatory spaces without being exposed themselves. Participating adolescents valued natural and undeveloped landscapes as

places for gathering, activities, and being alone. Those unsupervised safe places need to be accessible and allow a sense of ownership. Whitehouse (2001) evaluated utilization and consumer satisfaction of a children's hospital garden environments and found out that the reasons for going to a garden were to get away from stress and improve their mood. The results of the study indicated that ages 11 to 17 went to the garden for relaxing and privacy. Boys aged 8 to 16 years showed different place preferences regarding their developmental stages. Younger boys (8 to 11) preferred places for potential activities with peers, and older boys (12 to 18) tended to choose places with more aesthetic or cognitive qualities (Malinowski & Thurber, 1996).

Color preference

Color is an important design attribute for people to interpret and understand the physical environment. Color perception is related to the aspects of visual, symbolic, emotional, and physiological awareness (Tofle, Shchwarz, Yoon, & Max-Rotale, 2003). Color schemes and technologies used throughout the hospital had a powerful symbolic force (Blumhage, 1979; Kenny & Canter, 1979) and these encouraged patients' psychological satisfaction with medical treatment. Malkin (1982) studied color preference for dental facilities design and suggested the relationship between individuals' color responses and their emotional states.

Sharpe (1974) explained that color preference differed according to children's ages. Orange, pink, and red were favorite colors of children aged 3 to 6. However, girls aged 6 to 16 preferred warm colors, while the same age boys preferred cool colors. More recent color studies found slightly different results. An empirical study with children aged 11 to 19 found that they preferred a neutral colored waiting area at clinics with teen-

oriented materials (Tivorsak, et al., 2004). A hospital design survey with adolescents

aged 12 to 14 indicated that adolescents preferred bright colors and did not specify hue or

saturation of colors (Blumberg & Devlin, 2006). Another hospital color study for

pediatric patient room design found that blue and green were the most preferred colors by

children ages 7 to 11years old. White was the least preferred color (Park, 2007).

Research on children's and adolescents' preferences for hospital themes and

colors identified that children may desire hospital environments that reflect their home

environments and they need the ability to change the environment. Children and

adolescents who participated in this research mostly preferred a single color scheme with

mid-range blue and pastel green. Adolescents who aged 11 and above preferred more

abstract design themes than younger children (Coad & Coad, 2008).

Two experiments focused on differences in environmental sensitivity as measured

with stimulus screening ability. In both experiments, participants were presented with a

scenario describing hospitalization with appendicitis and were exposed to a photo of a

hospital room. The experiments for college students, mean age 20.4 years old, tested the

effects of environmental coloring of the hospital room. Walls were painted with green

and orange. Stress-reducing effects of green and arousal-inducing effects of orange were

both more pronounced for people scoring low on stimulus screening ability (Dijkstra,

Pieterse, & Pruyn, 2008).

Empirical color research has shown that saturation and brightness have significant

impact on users' emotional responses rather than hue itself (Augustine, 2009; Tofle,

Shchwarz, Yoon, & Max-Rotale, 2003).

Healing healthcare design approaches

Psychologically supportive design elements in healthcare can promote stress reduction and restoration of patients. These elements will promote the patient's healing experience and well-being so that their quality of life with health issues may be maintained. Healing is associated with themes of wholeness and spirituality. Healing can be defined in terms of developing a sense of personal wholeness that involves physical, mental, emotional, social and spiritual aspects of human experience (Egnew, 2005). Whitehouse (2001) defined the "healing environment" as a place that engenders feelings of peace, hope, upliftment, joy, refection, relaxation, enrichment, spiritual connection, humor, and play. The physical components of the healing environment can be influenced through interior and exterior building design.

Environmental psychologists and design researchers suggest several approaches to healing environmental design such as sense of control, positive intervention, attention restoration, favorite place, supportive design, and biophilic theory. Attention restoration and biophilic theories are about creating a positive human-nature relationship that designers can apply to the healing healthcare setting by providing natural elements (Kahn, 1997; Kaplan, 1995; Wilson, 1984). A sense of community and autonomy are social attributes that affect the patients' healing process. Symbolic aspects of environment are related to the patients' beliefs and expectations when they come to the hospital. Social support is vital to patients who are isolated from their families and friends. When patients have more social opportunities, they may experience less stress from hospitalization.

Autonomy: Sense of control

A major key concept applied in healing healthcare settings for adolescents is autonomy in the environment. Even when a person has to depend on somebody else physically, the sense of autonomy allows the person to make decisions on his/her own problems and helps them reduce stress from unfamiliar and painful situations. The sense of self-esteem and self-identity is related to autonomy. Clinical research for adolescents with Juvenile Rheumatoid Arthritis demonstrated that a longer duration of illness caused poorer self-esteem. This indicated the importance of a sense of autonomy for adolescent patients (Litt, Cuskey, & Rosenberg, 1982). Providing a sense of control over the environment for adolescents is very important because they are already in the process of building self-esteem and self-identity.

Sense of control has been recognized for more than two decades as a psychological factor that can be applied to healthcare design (Steptoe, 1989). Autonomy as a sense of control plays an important role in a patients' healing process and health outcomes by means of stress reduction (Cooper, 1991; Steptoe, 1989). Uncontrollable noise, lighting, and temperature may cause negative effects on the patient's healing process. Difficult wayfinding and lack of privacy are obstacles to a sense of self-control over healthcare settings. When patients do not have a sense of control, physically and psychologically, it becomes a major obstacle for them to cope with stress. Whitehouse (2000) stressed adolescents' strong demand for privacy was related to their self-consciousness about their appearance. Therefore, autonomy is an element of psychological well-being (Boice, 1998). Acoustical and visual privacy control may be more important issues to adolescent patients than the other patient groups.

Positive intervention

The positive intervention approach reduces physical pain and psychological stresses like fear and anxiety for patients who have severe illnesses. Studies using a positive intervention approach demonstrated the positive effects in pain reduction and stress using visual distraction or other sensory effects. Hinds and Martin (1988) found that the effect of positive intervention on adolescents having a cancer treatment provided them with cognitive comfort and personal competence in coping with stress . A positive intervention can reduce stressors directly, while instruction in control/coping can reduce stressors indirectly. Individual values or technological development also affect patients' positive appraisal and coping with stress in hospital settings (Harbin, 2007). Research applying environmental intervention theory for patients demonstrated that visual distracters had a positive effect in reducing pain and stress. A series of research studies about environmental intervention theory and patients confirmed the positive effect of visual distractions in reducing pain and stress. Health outcomes are promoted by decreased stress and moderate levels of positive stimulation (Ulrich, 1981). A poorly designed built environment and continuous and extreme levels of stimulation created negative effects on patients' well-being (Ulrich, 1981; Wohlwill, 1968). It is significant to address the environmental elements that reduce patients' possible negative stress with positive interventions.

Dise-Dewis (1988) suggested that distraction is defined as a sensory shielding that protected the patient's sense of pain by sensory input from other sources. By creating cognitive comfort and reducing stress, patients' perceived pain and negative thoughts can be decreased. Paying attention to certain types of environmental stimuli could reduce

pain perception sensitivity (Diette, Lechtzin, Haponik, Devrotes, & Rubin, 2003; Dise-Lewis, 1988). Diette et al. (2003) studied the distraction effect using natural scene murals and water sounds during medical procedures. Researchers measured pain control and anxiety using a scale (a 5-point scale rating from poor to excellent). The results reported significantly reduced pain. This distraction therapy is to divert patients' attention from unpleasant experiences using sensory stimuli. Pain research with children showed the validity of guided imagery of nature scenes to reduce pain reception (Varni, 1992). Another suggestion for coping with stress was exposure to familiar natural settings that contain lower environmental load (Kaplan, 1995).

     Attention Restoration & Biophilia.

Physical environments that provide a moderate level of positive stimulation promote people's well-being (Wohlwill, 1968). If a positive environmental stimulation holds a patient's attention and interest without overstressing them, it may decrease the patient's general stress level and negative thoughts (Ulrich, 1981). One of the recommended design strategies from previous research is to apply nature elements or characteristics to healthcare design as healing factors. Kaplan (1995) examined the role of the natural environment in a person's restorative perception by effortless and directed attention and developed the attention restoration theory through empirical experiments. 'Being away', 'fascination', 'extent', and 'compatibility' were four properties of restorative effectiveness in nature. Involuntary, interest-based attention can promote restoration from the fatigue that was a result of goal-based, directed attention (Kopec, 2006).

There were some empirical findings supporting restoration theory with natural

scenes (Adams, et al., 2010; Tennessen & Cimprich, 1995; Ulrich, 1984, 1991). In

general, cancer treatment patients experience persistent and diverse coping problems,

including difficulties in interpersonal relationships and limitations in returning to former

activities. In addition to restorative effects from cancer treatment, the group started new

projects that increased their quality of life such as losing weight, music lessons, and

volunteer work. Herzog et al.(2003) studied the possible restorative benefits of a natural

view from a college dormitory window. Subjects with more natural views tended to rate

themselves as functioning effectively in daily life activities. The hospitalization of a child

can be extremely stressful to parents and family members, who also benefit from the

availability of gardens on hospital grounds (Carpman & Grant, 1993). Kahn et al. (2008)

compared the effects of three different views on stress recovery and found that the heart

rate recovery was more rapid among subjects who were shown a natural view over those

without the view.

Kaplan and Kaplan have conducted extensive research on individuals' preferences

for different sorts of landscape and found that people preferred natural environments

more than built environments, and built environments with water, trees, and other

vegetation more than built environments without such features in the landscapes (Hartig,

1991; Kaplan, 1977; Kaplan, et al., 1998; Kaplan, 1983, 1995). According to the

researchers:

Immediate outcomes of contacts with nearby nature include enjoyment,

relaxation, and lowered stress levels. In addition, the research results

indicate that physical well-being is affected by such contacts. People with access to nearby-natural settings have been found to be healthier than other individuals. (Kaplan et al., 1998, p.173)

According to Kaplan, compatibility is a special resonance between the natural setting and human inclinations (Kaplan, 1995). Natural settings such as the seaside, the mountains, lakes, streams, forests, and meadows are tranquil places for "getting away" that provide restorative opportunities for relaxation. "Fascination" is about the attracting characteristics that nature has within itself. "Soft" fascinating objects in natural settings are clouds, sunsets, snow patterns, and the motion of the leaves in the breeze. These 'soft' fascinations readily hold one's effortless attention in an undramatic way. In the distant wilderness, extent comes easily. Yet it is not about the actual physical distance rather than about a sense of extent such as trails and paths. The setting could be a small area but seem much larger (Kaplan, 1995). Miniaturization is another way of creating the feeling that one is in a whole different world such as a Japanese garden. Studies have shown that stress reduction is one of the key perceived benefits of recreating a wilderness area (Ulrich, 1993).

Studies using the Biophilia concept have examined the relative effects of natural factors in environments on the reduction of stress and psychological well-being. This approach and research evidence can be applied into healing healthcare planning. This connection between human inclination and nature evolved into the 'Biophilia Hypothesis' by Edward O. Wilson (1984). He proposed "the existence of a genetic basis for the

human predilection towards the natural world" (as cited in Stairs, 1997, p.37). According to Wilson, Biophilia is about self-conscious human pleasure in nature. In his proposal, Wilson described "Biophilia" as a human aesthetic appreciation of nature. This instinct emerges in our cognition, emotions, and other psychological responses. It continues in recurring patterns in many other cultures and societies (Kahn, 1997; Wilson, 1984). Studies have shown that even minimal connection with nature, such as looking at it through a window, increased productivity and health in the workplace, promoted healing of patients in hospitals, and reduced the frequency of sickness in prisons (Kahn, 1997). After surgery, patients who stayed in a room with a natural view through the window had a shorter hospital stay, fewer negative comments from nurses, and took fewer analgesic doses compared to patients in a room with a brick wall (Ulrich, 1984). Another study focusing on the effect of the natural environment also demonstrated greater stress recovery in response to natural rather than urban settings (Kaplan, 1995; Kaplan & Peterson, 1993).

Favorite places & Self-identity.

Favorite places could be one of the solutions to enhance healing healthcare, especially for adolescents. These places may create a restorative environment that promotes the healing process by offering an opportunity for control over the place due to the opportunity of its sense of control and self- identity. The concept of favorite places is related to place preference and affects psychological well-being and health (Korpela & Hartig, 1996).These are places for adolescents to feel safe and free when they need to "get away" from stress and anger.

The favorite places provide patients a sense of control and chances to relax, to be alone or with peers. Eisen (2006) argued both attention restoration and stress reduction frameworks assist in clarification of emotion and self-regulation as they related to the restoration process. "Adolescents provided self-report data suggesting that they use their favorite places to anchor emotion and self-regulation" (p.30). Both favorite places and restoration theories focused on elements of person-environment interactions that might contribute to place-identity, thus generating a restorative environment (Kaplan, 1983, 1985). Favorite place is where a person exercises autonomy and freedom that may build a person's place-identity and self-esteem that work as the foundation of healing (Korpela & Hartig, 1996).

Feelings of enjoyment, pleasure, familiarity, and belonging were found toward favorite places. Through an empirical pilot study of favorite places with 9 to 17-year-old adolescents, Korpela (1989) found that solitary favorite places may work as restorative environments. Participants often went to their favorite place after experiencing emotionally negative events that threatened self-esteem in order to relax, calm down, and clear their minds. This study reported that having favorite places provided subjects with the experience of beauty, control, freedom of expression, and escape from social pressure. Another study of the identification of favorite place with undergraduate students done by Korpela (1992) concluded many favorite places were natural settings such as a beautiful nature view, greenery, sunlight, and the presence of water. Factories or urban places having heavy traffic and crowds were considered unpleasant places by the subjects. He also found that both positive self-reported emotional states and the sense of self-regulation were related to the identification of favorite places. This could be interpreted

that favorite places are attached to emotion and self-regulation and help to build place-identity.

Korpela and Hartig (1996) suggested restorative experiences figure in emotion and the self-regulation process by developing place identity. For adolescents, favorite places could be used as a means of maintaining the psychic balance of pain and pleasure in healthcare settings. The sense of control and self-regulation helps to reduce stress and promote self-esteem within the environment. Due to adolescents' process of building self-identify and self-esteem, this psychological effect of favorite places plays a critical role in giving them restoration from stress.

Social support & Sense of belonging

For adolescents, their unique societal and psychological issues should be the starting point in developing appropriate healthcare design. Social support is an important factor for any patient population. When patients have a high level of social desire, there were significantly fewer complaints about hospital noise (Topf, 1985). A study by Berkman and Syme (1979) suggested that low social support in healthcare can lead to both higher susceptibility to disease and slower recovery. Social supports from family members, friends, and caregivers provide positive benefits for patients to overcome pain and stress. Individuals with high social support typically experienced less stress and had better health than those who were more socially isolated (Cohen & Syme, 1985; Harbin, 2007). It was important for patients' families and overnight guests to have flexible spaces and a group activity space for both scheduled and spontaneous events for adolescent patients (Blumberg & Devlin, 2006). Thus, research is required to support the creation of healing healthcare environments for adolescents. Healing environmental criteria were

developed through the literature review. Table 2.1 summarizes the healing criteria and potential healing effects on adolescent patients.

Table 2.1. Healing Design Concepts and Criteria for Adolescent Patients

Concept	Design criteria	Potential Healing Effects
Autonomy & Sense of control	Noise control Control lighting & temperature Control visual privacy & odor Control TV Personalization: display area Easy& clear wayfinding Personal workstation	Restoration Comfort - physical & psychological Privacy control – visual & acoustical Identity - self-esteem Physical well-being
Positive intervention	Visual distraction, water sound music, art display TV, Virtual reality	Reduction of perceived pain Reduction of perceived stress Psychological well-being
Attention restoration & Biophilia	Connection to the nature: Window: Natural view & light Water feature & sound Effortless attention Healing garden, Greenery Walking trail: mild activity Atrium Physical activity Neutral color scheme Color: orange > green	Restoration Physical well-being Psychological well-being
Favorite places & Self- identity	Quite alone place Outdoor recreation area Landscape Personalization: self-expression	Psychological well-being Restoration Reduction of perceived stress Sense of identity Seclusion
Social support & Sense of belonging	Family room Game area Physical activity room Comfortable waiting room Library	Sense of connection/ community Communication Socialization

CHAPTER THREE
METHODOLOGY

Overview of the Research

This research investigated adolescents' environmental preferences of hospital rooms and determined potential healing design attributes for adolescent patients. A series of three related surveys was designed to achieve the proposed research objectives. Adolescent outpatients at the Department of Adolescent Medicine at the University of Kentucky Clinic, ages 15 to 18, participated in the research survey. Due to the use of adolescent patients as human subjects, the research was officially approved by the University of Kentucky Institutional Review Board.

As the first step of the survey, a health-related emotional state survey was administered to measure the participants' emotional effect on environmental preference at the time of survey. The second survey, the photo analysis, was designed to identify healing design concepts. Fourteen hospital images and twenty-two bipolar word pairs of semantic differentials were used. Adolescents viewed images on a laptop computer screen to record their perceptions of the images. Finally, adolescents' design preference values for hospital design were measured by 5-point Likert scale.

Data was analyzed by descriptive statistics and statistical test models. For open-answered questions on design preference values, content analysis was done. To identify the healing design attributes from twenty-two semantic differential word pairs, factor analysis was utilized. Correlations and regressions were tested to understand the relationship among demographic data, emotional states, design preference values, and

design attributes. Figure 3.1. is a flow chart showing the research process from the

literature review to data analysis.

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┌─────────────────────────────────────────────┐
│    Literature review of  healing healthcare design │
└─────────────────────────────────────────────┘
                      ⬇
┌─────────────────────────────────────────────┐
│    Development of instruments for research survey   │
└─────────────────────────────────────────────┘
                      ⬇
┌─────────────────────────────────────────────┐
│      Approval from the University of Kentucky       │
│             Institutional Review Board              │
└─────────────────────────────────────────────┘
                      ⬇
┌─────────────────────────────────────────────┐
│        Permission from parents and participants     │
└─────────────────────────────────────────────┘
                      ⬇
┌─────────────────────────────────────────────┐
│  Data collection                                    │
│     1.  Health-Related Emotional States  & Demographic │
│         characteristics                             │
│     2.  Photo Analysis: Semantic differentials      │
│     3.  Environmental Preference Values             │
└─────────────────────────────────────────────┘
                      ⬇
          ┌──────────────────────────┐
          │  Statistical data analysis │
          └──────────────────────────┘
                      ⬇
┌─────────────────────────────────────────────┐
│  Findings of adolescent patients' environmental preferences │
└─────────────────────────────────────────────┘
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Figure 3.1.Flow Chart of Adolescent Patients' Environmental Preferences Research

Research Instruments

Three different research instruments were used to validate the collected data. Those were 1) a health-related emotional state survey, 2) photo analysis using semantic differentials, and 3) an environmental preference value survey.

Health-Related Emotional States

Environmental preference is closely related to individuals' cognitive perceptions of the surrounding environment. The emotional states of individuals with physical conditions may influence patients' cognitive response to hospital environments. Adolescents' health-related emotional states provided an assessment of adolescent patients' quality of life from both physical illness and hospital environmental stimuli. Further, it was used to determine if adolescents' issues might positively or negatively influence their healing process. The concept of the Medical Outcomes Study Short Form 36 Survey (MOS-SF 36) was adopted and developed into a health-related emotional state survey according to this research's objectives. The instrument was modified based on the literature review focusing on adolescents' perceptions based on their physical, psychological, and social issues. Participants were asked to record their feeling of comfort, sadness, anger, worry for the future, and level of stress at the time of the survey on a 5-point scale (1=not at all; 5=very much). Demographic characteristic data such as age, gender, grade, previous hospitalization experiences, and residence location were also collected.

Photo Analysis using Semantic Differentials

There were two parts of the data collection instrument used to test adolescents' environmental preferences of hospital rooms. One part contained images of ten single-patient rooms and four activity rooms. The other was semantic differentials that were matched to hospital images. This second-part was developed based on the literature review of environmental preference studies. Previous research has documented the successful use of visual images and semantic differentials to indicate environmental preferences. Dickson and Carll-White (1999) developed a methodology for assessing ten-year old children's preferences for nonresidential interior spaces using image slides and bipolar word pairs that support the use of this methodology. With the use of both visual images and semantic differentials, insight was gained regarding psychological aspects of users' perceptions of the visualized space. Ham and Guerin (2004) used black and white slide images to discover a cross-cultural comparison of preference in interior environments and found that cultural perspective in interior design was an important factor. Shin (2004) examined the degree of hominess perception in a birthing room using visual images. Seven line drawings and a 7-point Likert scale were used. The consistency and predictability of environmental preferences tests was well supported by Kaplan and Kaplan's theory of environmental psychology (Kaplan & Kaplan, 1989).

Hospital room images

The images of ten different patient rooms and four activity rooms were used for photo analysis. Autonomy and social connection are very important aspects for adolescents' healthy growth. There are even more important for adolescents' healing

process when they stay at a hospital due to illness. To investigate adolescents' unique environmental needs of autonomy and social connection, patient rooms and activity rooms were selected for examination. Hospital room images for photo analysis were created according to literature review on healing hospital design and adolescents' preferences (Blumberg & Devlin, 2006; Cama, 2009; Devlin & Arneill, 2003; Harris, McBride, Ross, & Curtis, 2002b; Ulrich, 1984).

Patient room images

Ten single patient rooms for adolescent patients were designed for the test. The images of the room contained a bed, a side table, storage unit with a flower vase on it, window seating, an arm chair next to a bed, headboard with two sconces, a tall storage cabinet and a work surface with a lamp, an art piece, a plasma TV, and a clock on the wall. The room had a large window with a valance covering most of one side wall. Orange and blue were used as the dominant color schemes for the images. Previous research suggested these two colors were among the most preferred colors for adolescents and young adults (Coad & Coad, 2008; Dijkstra, et al., 2008; Park, 2007).

To differentiate the complexity of surfaces, two different styles of patterns were applied to the arm chair and window: a medium-scale geometric pattern and a linear pattern. Ceiling details with a lighting fixture and a floor pattern with different finishes were applied to create diversity and complexity in the patient rooms. The last room design included personalization and technology opportunities for adolescent patients by providing a bulletin board, bookshelves, a laptop computer, and an iPod station. Personalization components were verbally explained by the researcher in order for adolescent participants to recognize those items easily. The room also had an abstract art

piece instead of a headboard as in all the other bedrooms. In order to embed

personalization of the room Table 3.1 summarizes the differences in each of the patient

room images.

Table 3.1. Description of the Patient Rooms

Design Properties	Descriptions of each image
	Orange room 1 : solid finish
	Orange room 2: geometric pattern
• Same furniture layout	Orange room 3: linear (tropical) pattern
• Big window with same	Orange room 4: ceiling detail/floor pattern
shape of valance	Orange room 5: personalization/technology
• Color difference	Blue room 1 : solid finish
• Component difference	Blue room 2: geometric pattern
• Surface finish difference	Blue room 3: linear (stripe) pattern
	Blue room 4: ceiling detail/floor pattern
	Blue room 5: personalization/technology

Although the design of the room remained constant, each patient room image was

differentiated by manipulating color and surface, and interior components. The angles of

viewpoint and furniture layout remained the same for all ten patient room images in order

to prevent any impact from unintended effects of the design attributes on preference

responses. Images for the patient room photo analysis were generated using graphic

software such as SketchUp8, Podium 2.2, and Photoshop CS4.

Orange room 1 Solid finish

Blure room 1 Solid finish

Orange room 2 Geometric pattern

Blure room 2 Geometric pattern

Orange room 3 Linear pattern

Blure room 3 Linear pattern

Orange room 4 Ceiling/Floor details

Blue room 4 Ceiling/Floor details

Orange room 5 Personalization   Blue room 5 Personalization

Figure 3.2. Patient rooms with different color, surface finishes, and interior components

Activity room images

To determine activity room preferences focusing on age-appropriate design style and room layout, four activity room images were selected from existing children's hospital interior photos. Using the same panel of design experts who participated in selection of the patient room images and semantic differentials, images of activity rooms were selected. The selection was based on variations of room layout, color scheme, furniture style, and potential activities. Activity rooms examined were a quiet room, a waiting room, a computer room, and a teen activity room.

Activity room 1, the 'Quiet room', provided patients with the ability to be alone and obtain peaceful restoration from stressors related to hospitalization or being sick. It had a nook where a patient could sit and view out. The design style adopted an abstract nature theme-- curvilinear furniture lines. Activity room 2, the spacious 'Waiting room', with a mural and sociopetal seating could afford a place to meet friends outside a patient room. The seating was semi-formal with straight lines, and a large coffee table was in the center. As an art piece, a mural covered one wall of the room. The flooring carpet had a

checkerboard pattern that created visual complexity along with the mural. Activity room 3, the 'Computer room', was equipped with comfortable individual seating and computer stations. The room could afford adolescent patients peer-connection opportunities while they were using computers. Decorative lighting fixtures were placed on the off-white colored wall.

Activity room 4, the 'Teen activity room', was equipped with various types of surfaces finishes, lighting, and colors, and the room design was clearly differentiated from a young children's activity room. It had a relatively low lighting level to create a cozy and intimate atmosphere in the room. The room had geometric architectural details on openings in the room. The room was furnished with multiple seating of various shapes and styles. Table 3.2 describes the details of each activity room that was chosen for photo analysis. Figure 3.3 shows three of the activity room images that were used in the survey.

Table 3.2. Descriptions of Four Activity Rooms

Activity rooms	Descriptions of each image	Psychological aspects
1: Quiet room	Analogous color scheme :green and yellow green Organic shape nook and chairs	Being alone Control of privacy Child-like
2: Waiting room	Split-complementary color scheme: purple and blue with yellow/green accent Straight line chairs and formal seating Wall-size mural, children's art pieces	Social interaction Visual distraction through arts
3: Computer room	Complementary color scheme: red orange and blue with red/green accent Computer station and club chairs Decorative wall lighting fixture	Social interaction Technology Teen-like
4: Teen room	Triad color scheme: yellow, blue, with red accent Geometric opening to access, Multiple different styles of seating	Social interaction Options to choose Teen-like

Activity Room 2: Artwork in waiting room*

Activity Room 3: Computer in the waiting room*

Activity Room4: Teen Room **

Figure 3.3. Activity Rooms with Different room layouts and color schemes

**From Designing the World's Best Children's Hospitals: the future of healing environments (p.93) by Bruce King Komishe, 2005, Australia: The Images Publishing Group Pty Ltd. Copyright 2011 by the Bruce King Komishe. Reprinted with permission

Semantic Differentials

As the measuring tool for the photo analysis, semantic differentials were developed. For each room image, twenty-two bipolar word pairs were assessed in evaluating the healing design attributes. These word pairs were selected based on the literature review on environmental preference research and healing design concepts that support adolescents' physical and psychological comfort, control over privacy, age-appropriateness, self-identity, pain reduction, and social support. Selection of twenty-two

semantic differential words was conducted with an expert panel. The instrument utilized

a 5-point scale as did as the health-related emotional state survey and design preference

value survey. Table 3.3 shows the twenty-two word pairs that were used for photo

analysis of patient room and activity room images.

Table 3.3. Semantic Differentials for Photo Analysis

Semantic differentials (5-point Likert scale)						
	1	2	3	4	5	
rough						smooth
uncomfortable						comfortable
unpleasant						pleasant
crowded						roomy
calming						stimulating
child-like						adult-like
unsafe						safe
unfriendly						welcoming
isolated						connected
uninviting						inviting
boring						dynamic
fixed						flexible
uncontrollable						controllable
public						private
cool						warm
unfamiliar						familiar
awful						nice
unenjoyable						enjoyable
dark						bright
hard						soften
masculine						feminine
formal						informal

Environmental Preference Value Survey on Hospital Rooms

Previous research on hospital design suggested several healing design approaches. These concepts were developed based on the patients' environmental preferences and satisfaction and the evidence of positive medical outcomes. In the environmental preference value survey, participants were asked to indicate the value of various design preferences. The design questionnaire inquired about healing design criteria that could not to be explained by participants through photo analysis. Environmental preference value questions were developed by the researcher according to adolescent's social needs and healing design attributes from the previous literature review (see Table 3.4). The survey asked participants to indicate the importance of seven design attributes on a 5-point Likert scale (1=not important at all; 5=very important) and to choose a favorite patient room and a favorite activity room from the choices provided. Respondents were then asked to explain the reason for their favorite choice.

Table 3.4. Healing Design Approaches and Potential Healing effects

Healing approach	Potential Healing Effects
Autonomy & Sense of control	Restoration Well-being: Physical & Psychological
Positive intervention	Comfort: physical & psychological Reduction of perceived pain & stress
Attention Restoration & Biophilia	Privacy control – visual & acoustical Seclusion
Favorite places & Self-identity	Self-esteem; sense of identity Socialization
Social support & Sense of belonging	Communication Sense of connection/community

The seven design attributes ascertained the importance of the following places: 'see and entertain friends', 'to meet friends', 'do individual activities', 'display personal items', 'a quiet place to go', control of privacy', and 'an outside view'. The data of this survey tested the correlation regression with emotional states.

Data Collection

Participants

Outpatients at the Adolescent Medicine Division in the University of Kentucky Clinic participated in this survey. Participants were recruited as a convenience sample by selecting adolescent outpatients with similar health conditions and a certain age range. Participants, ages 15 to 18 years old, had come to visit a doctor for check-ups or for non-severe medical treatments at the time of the survey.

The Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy and Security Rules has specific regulations about using human subjects in research and makes access to hospitalized patients as research subjects complex. Due to this restriction, adolescent outpatients were recruited for the survey instead of hospitalized adolescent patients. This sample selection was supported by previous research of environmental preferences in hospital environments (Blumberg & Devlin, 2006). The study sampled middle school students as potential hospital users for indentifying adolescents' hospital preferences regarding design issues. Blumberg and Devlin (2006) determined that the responses from adolescents with and without hospital experience were significantly similar. Their findings support the reliability of testing potential users in the hospital preference examination of this study. Since Blumberg and

Devlin's study (2006) focused on ages 12 to 14 years old, this study examined 15 to 18 years old adolescents.

Survey Procedure

The survey was administered by the researcher with support of the medical staff at the University of Kentucky Clinic. The survey procedure consisted of two phases. It took about twenty-five minutes for participants to complete the survey. The survey was administered in the waiting room at the Adolescent Medicine Division.

After explaining about the research survey to potential participants and their guardians, signed Assent and Consent forms were obtained from those who agreed to participate in the survey. The different phases of the survey were then administered.

The first survey assessed the participants' emotional states with demographic information. This self-reported emotional state was measured at the moment of the survey. In the second survey, fourteen hospital images were presented to the participants on a laptop computer screen and the perceptions were self-recorded using semantic differentials. In order to randomize the effect of color in viewing patient rooms, half of the participants were shown orange rooms first and then viewed blue rooms. The second half of the participants viewed the images in reverse order. The last survey was the questionnaire for environmental preference values of hospital rooms.

Data Analysis

The Statistical Packages for the Social Sciences (SPSS, version 18.0., 2008, SPSS Inc. Chicago, IL) and Statistical Analysis Software (SAS, version 9.2., 2009, SAS Institute Inc. Cary, NC) were used for data analysis. The primary purpose of the analysis was to describe participants' demographic characteristics, emotional states, and design preference values in hospital rooms. The second goal was to indentify dominant factors as design attributes that explained participants' preferences of patient rooms and activity rooms. The third was to investigate the relationships among participants' emotional states, design preference values, dominant design attributes, and preferred room choices.

Data from demographic characteristics and emotional states were explained by the frequency distribution of descriptive statistics. To investigate the difference of emotional states between genders, the Wilcoxon rank two-sample test was used. For age differences in emotional states, a non-parametric Spearman correlation was tested.

In analyzing data from the photo analysis, factor analysis was used to narrow down twenty-two word pairs of semantic differentials into a few conceptual words. A principal Component Analysis method was used to extract appropriate factors and Varimax with Kaiser Normalization method was used to rotate. Each word variable was determined to be loaded onto a factor if a factor loading for that word was greater than 0.45. The entire factor creation procedure was performed separately for patient rooms and activity rooms.

To evaluate the impact of room color (orange or blue) or design characteristics (D1 to D5) on each factor score for the patient rooms, one-way repeated measured ANOVA was used. Each factor was compared among the five room designs and two

room colors. The five room design categories were solid finish (D1), geometric pattern (D2), linear pattern (D3), ceiling/flooring details (D4), and personalization (D5).

Data from environmental preference values on hospital rooms was explained through descriptive statistics. Comparisons of emotional states and environmental design preference values by gender were performed using a Wilcoxon- Mann-Whitney test. Comparisons by age groups between emotional states and design preference values were conducted using a Kruskal Wallis test as a non-parametric version of the ANOVA test since the frequency distribution was not a normal distribution. Data was regarded as a continuous variable for a comparison analysis of independent variables.

To find out the association among emotional states and environmental preference values in hospital rooms, a nonparametric Spearman correlation was tested for each variable. This non-parametric method was used to control the skewness and non-normality of the emotional states responses. Correlation coefficients were used to determine the association among variables.

Pearson correlation was used to discover the relationships among factor (design attributes) scores and emotional states, and preference values. The correlation was tested separately for patient rooms and activity rooms. To analyze for adolescent individuals' random effect, a Linear mixed model was tested to predict influential variables for favorite room choices. The favorite room choices were tested against participants' internal factors such as age, gender, emotion states, design preference values, and three design attributes. To determine the relative importance of variables in predicting adolescents' room preference, repeated measured logistic regression and multi-linear regression were applied.

CHAPTER FOUR
RESULTS

Overview

The survey was administered at Adolescent Medicine in the University of Kentucky Healthcare Clinic between February 17, 2011 and March 22, 2011. Three different types of data were collected according to the theoretical framework of the present study. The first part of the survey assessed the participants' emotional states with demographic information. Secondly, participants' individual perceptions of hospital patient rooms and activity rooms were determined using semantic differentials. Fourteen hospital images were shown to the participants and the perceptions were self-recorded. Finally, participants' environmental preference values were reported in relation to the importance of design attributes in hospital rooms without seeing hospital images

Collected data were statistically analyzed. Participants' demography, emotional states, and design preferences were analyzed by descriptive statistics. Photo analysis was analyzed by Factor analysis, which found three conceptual design words for adolescents' hospital design preferences. Correlations and Regression were tested among demographic data, emotional states, design preference values, and design attributes from photo analysis.

Health-Related Quality of Life Survey

Demographic Characteristics

Participants included 32 adolescent outpatients at Adolescent Medicine at the University of Kentucky Healthcare Clinic. Adolescent outpatients' gender, age, grade,

previous hospitalization, and residence location were asked. The sample included 13

males (40.6%) and 19 females (59.4%). About half of the participants were 15 years olds

(53%) and the average age was 16 years old. The majority of the participants were in the

10th grade in high school. Fifteen participants out of thirty-two (47%) had previous

hospitalization experiences. Approximately half of participants resided in a city (53%).

Another half of the participants' were from a small town (44%). One participant resided

on a farm (3%). Table 4.1 is the summary of demographic information for the

participants.

Table 4.1.Summary of the Participants' Demographics

Demographic characteristics		N (%)
Gender	Female	19 (58.4)
	Male	13 (40.6)
Age	15	17 (53)
	16	5 (15.6)
	17	6 (18.8)
	18	4(12.5)
Grade	9	7 (21.88)
	10	13 (40.63)
	11	8 (25)
	12	4 (9.38)
Previous Hospitalization	Yes	15 (46.9)
	No	17 (53.1)
Residence Location	City	17 (53.1)
	Small town	14 (43.8%)
	Farm	1 (3.1%)

Emotional States of the Participants

On a 5-point scale, the overall level of emotional responses was rated less than 3 points except 'Comfort' (1=not at all; 5=very much). Most of the adolescents' responses to 'Comfort' distributed between point 4 and 5 (average: 4.09). In summary, most participants responded that they were highly comfortable with low levels of sadness or anger (see Figure 4.1). The level of 'Worry for the future' and 'Stress' averaged about 2 on a 5-point scale, which was higher than 'Sadness' or 'Anger'. The level of stress for males was slightly higher than female adolescents, but it was not significantly higher. The test result showed no significant difference by gender. Females felt more comfortable with a given environment but worried more about the future than male participants, whereas male participants tended to demonstrate a stronger emotional fluctuation with more sadness, anger, and stress than females.
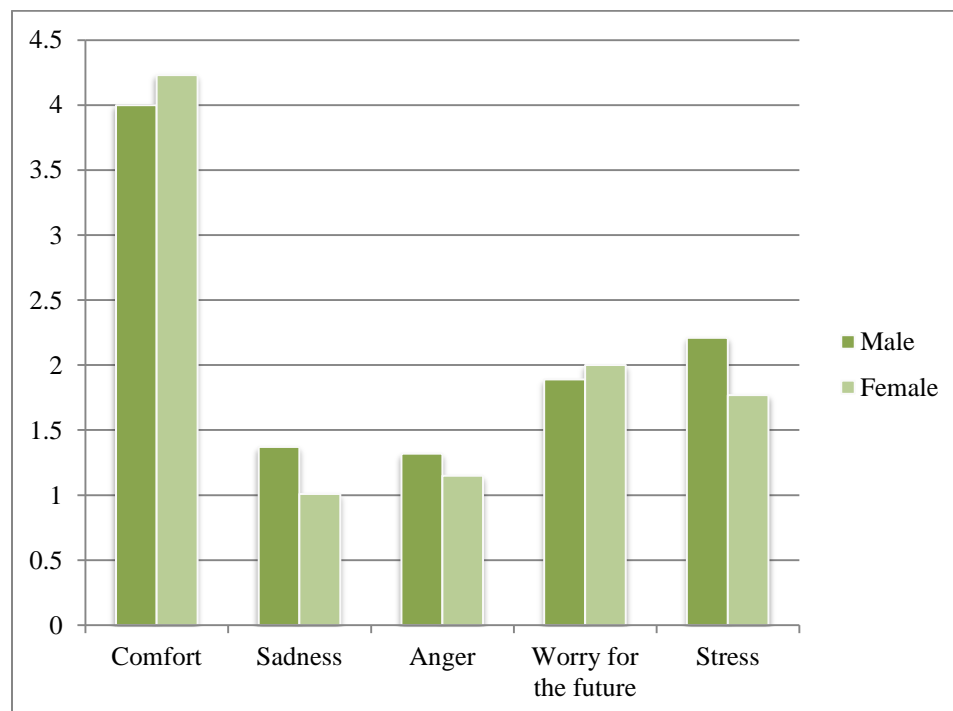
Figure 4.1. Response of Emotional States by Gender Difference

In order to see if there was significant emotional difference by gender, the level of each emotional value was compared using the Wilcoxon rank two-sample test since the emotional states data was not exhibiting normal distribution. The test result showed no significantly different emotional states by gender.

Figure 4.2 shows the mean points of emotional states by age. Nonparametric Spearman correlations were used to detect relationships between age and emotional states. Emotional response did not differ by the age. However, the 'Worry for the future' response from 18-year old adolescents was highest among the tested age group although it was not statistically significant. It could be explained by their coming graduation.
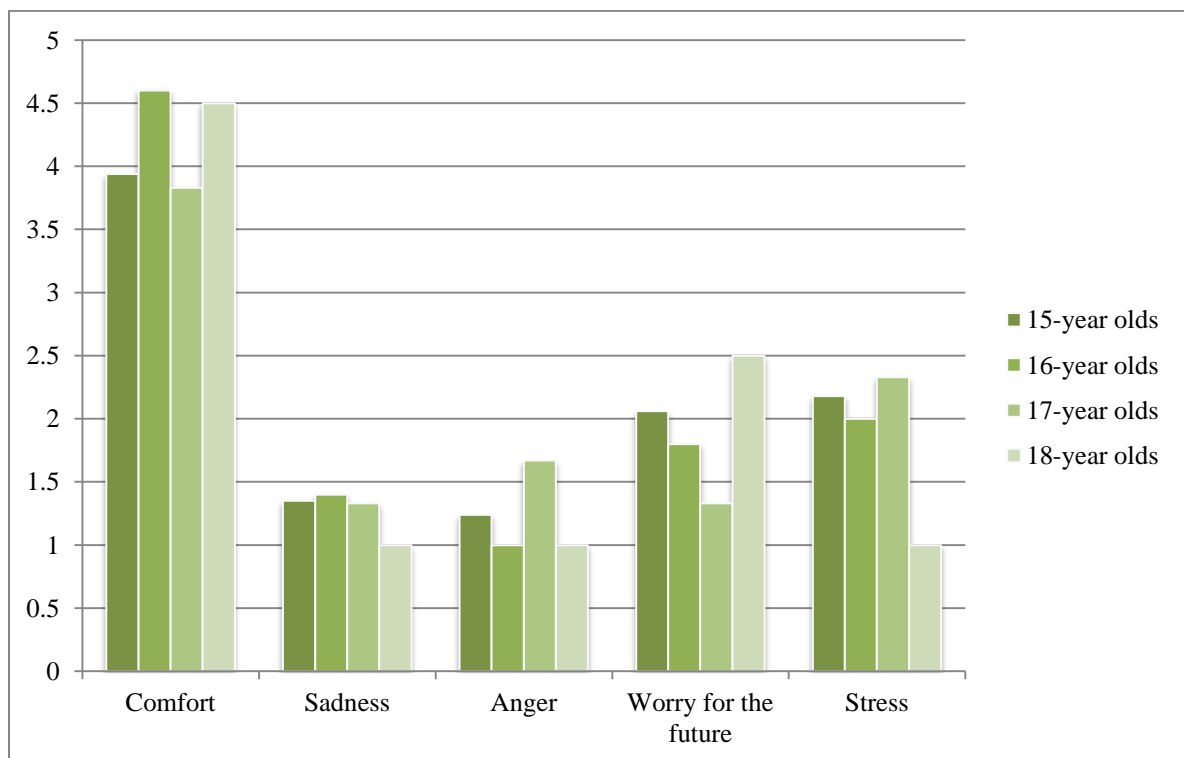
Figure 4.2. Participant's Emotional States by Age

Photo Analysis for Preference Test

Ten patient room images and four activity room images were tested using twenty-two bipolar word pairs. A total of 320 semantic differential responses for patient room images and 128 responses for activity room images were collected. Factor analysis was used in identifying conceptual words that symbolized participants' environmental preferences for patient rooms and activity rooms separately.

Three groupings were assigned based on the maximum absolute value factor loading for each semantic differential variable (see Tables 4.2 and 4.5). Also, each Semantic differential variable selected had to have the factor loading score of more than 0.45 and was exclusively assigned the one of three factors, using the factor analysis as a guide.

With additional assistance from design experts, three dominant conceptual words were recognized that contained common characteristics of each group. For theoretical simplicity, three mutually exclusive conceptual groupings of semantic differentials were created for both the patient rooms (Hominess, Feminine, and Adult/Private) and activity rooms (Enjoyable, Controllable, and Adult-like).

Patient Rooms

Each participant answered the same semantic differentials questions for ten patient rooms. Table 2 shows loadings of each word onto three factors from factor analysis for patient rooms. The word 'smooth' did not belong to any factor due to a similar loading score for two factors (factor 1 loading=.493, factor 2 loading=.444). The word 'dynamic' did not fit in any group for the same reason (factor1 loading=.458, factor

2 loading=.449). The words 'stimulating', flexible', and 'warm' were excluded due to

less than a 0.45 loading score on all three factors.

Table 4.2. Dominant Design Attributes for Patient rooms and Factor Loading

	Factor			
	1	2	3	
Words	Hominess	Feminine	Adult/Private	Mean
smooth	.493	.444	.041	4.09
comfortable	**.791**	.270	-.037	4.38
pleasant	**.784**	.291	.015	4.36
roomy	**.591**	.007	-.010	4.16
stimulating	-.013	-.044	-.004	3.25
adult-like	-.071	-.252	**.728**	3.54
safe	**.680**	.045	.071	4.55
welcoming	**.797**	.305	-.016	4.39
connected	**.561**	.214	.168	4.03
inviting	**.721**	.221	.069	4.23
dynamic	.458	.449	-.086	4.17
flexible	.268	.356	.090	3.61
controllable	**.459**	.162	.374	4.00
private	.085	.108	**.674**	3.62
warm	.151	.251	.434	3.36
familiar	**.568**	.046	.093	3.70
nice	**.733**	.383	-.035	4.43
enjoyable	**.783**	.335	-.009	4.34
bright	.171	**.735**	.104	4.04
soften	.429	**.585**	.068	3.74
feminine	.129	**.603**	-.177	3.33
informal	.044	.086	**-.637**	3.20

Note. Factor Loading >.45 (N=320). Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 5 iterations.
Means of each semantic differential were on a 5-pont scale.

As noted the three factors for the patient rooms were named 'Hominess', "Feminine', and 'Adult/Private' respectively, which represented conceptual design attributes. The mean scores were 4.23, 3.70, and 2.98 respectively. Table 4.3 shows the word pairs in each conceptual group as design attributes. These mean scores of dominant design attributes were used to test association with participants' gender and age, emotional states, and environmental preference values.

Table 4.3. Each Design Attribute and Word Pairs for Patient Rooms

Design Attribute	Word pairs	Mean
Hominess	comfortable* – uncomfortable pleasant*— unpleasant roomy – crowded safe – unsafe welcoming* – unfriendly connected – isolated inviting* – uninviting controllable – uncontrollable familiar – unfamiliar nice* – awful enjoyable* – unenjoyable	4.23
Feminine	bright* – dark soften – hard feminine – masculine	3.70
Adult/Private	adult-like* – child-like private – public formal – informal	2.98

Note. * Factor loading >.700

The most dominant group was named 'Hominess'. This conceptual design word explained most variation among semantic differentials for patient room images (See Figure 4.3).
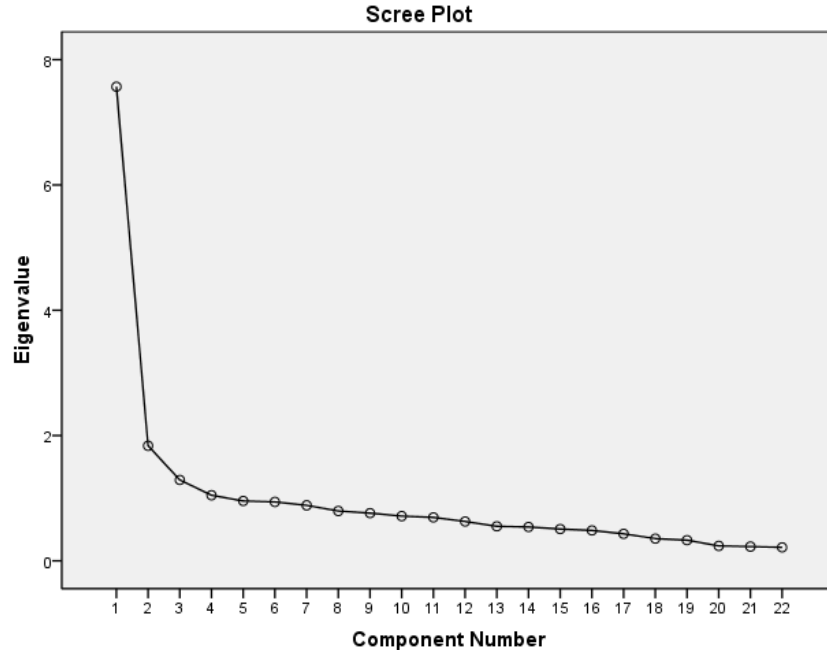
Figure 4.3. Scree Plot for Patient Room of Factor Analysis

Color and design differences in patient rooms

In order to find out the influence of color and design attributes for patient rooms, the mean scores of 'Hominess', 'Feminine', and 'Adult/Private' were tested by one-way repeated measured ANOVA using a SAS program. Each design attribute as a conceptual word was compared with two room colors and five room designs. The two room colors were orange and blue, and the five room design categories were solid finish (D1), geometric pattern (D2), linear pattern (D3), ceiling/flooring details (D4), and personalization (D5).

<u>*Hominess*</u>

The test result of mean difference showed that design effect was significantly different within the five orange rooms (p=0.000). Design 3 that contained a tropical patterned arm chair and window valance ranked highest for 'Hominess' (p=0.029). Next

was design 5, which was equipped with personalization components and technology, but there was no significant difference compared with design 1 and design 4. On the other hand, design 2, that had a medium-size geometric patterned armchair and window valance, received the lowest hominess score (p=0.018). Different finishes and interior components affected participant 'Hominess' responses.

Among blue rooms, the mean score of the responses was not significantly different by design (p=0.73). Overall, blue rooms scored relatively high on hominess (See Figure 4.4).
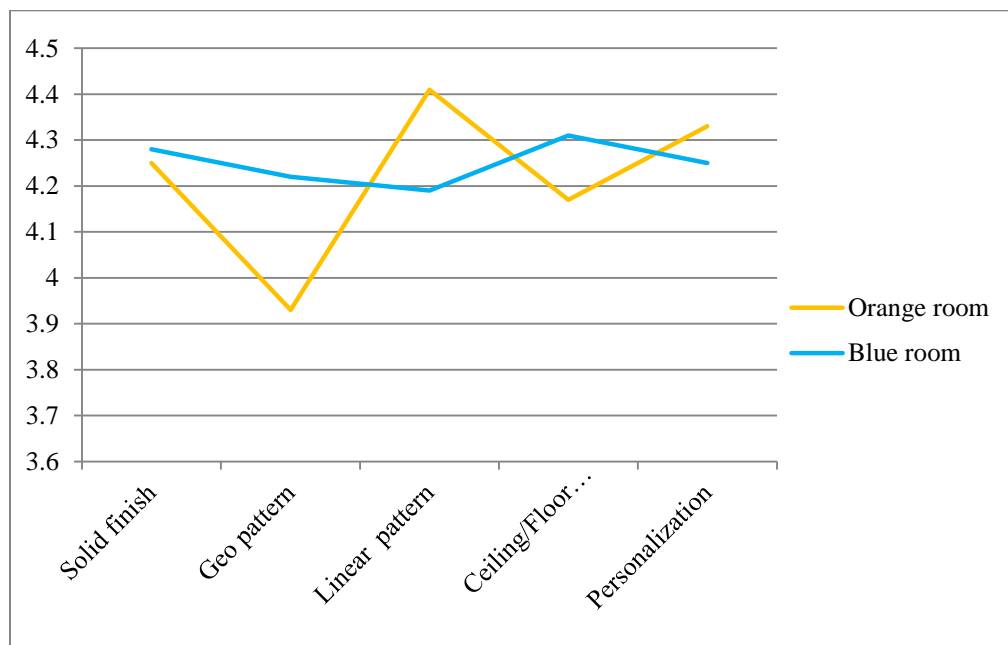
Figure 4.4. Mean comparison of **Hominess** by Color and Design

Table 4.4 indicates the mean score of 'Hominess' for each patient room by color and design. Taking color efffect and design effect as independent variables at the same time, the ANOVA test of mean difference of 'Hominess' showed that room design

affected significantly different 'Hominess' responses from participating adolescents (p=.015).

Table 4.4. ANOVA Test of Mean Difference among Colors and Designs

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	30.997	2278.244	.000
Room Color	1	283.028	.375	.541
Room Design	4	283.028	3.155	**.015***

Note. Dependent Variable: Hominess (factor 1). * is p-value < .05

Tropical pattern and personalization components significantly affected the hominess response. However, color did not affect adolescents' hominess responses significantly. Due to pleasant harmony among patterns, interior components, and colors, blue room 2 and orange room 3 ranked the highest in the hominess response for each color.

Feminine

The overall score of orange rooms and blue rooms for 'Feminine' were rated lower than that of 'Hominess' (see Figure 4.5). Orange room 3 was ranked the highest in a 'Feminine' score while orange room 5, which was designed for personalization and technology items, was ranked second. On the other hand, orange room 2 received the lowest 'Feminine' score. Blue room 1 that had solid finished surfaces was ranked the second highest 'Feminine'. Blue room 3 was ranked the third.

A Repeated Measured ANOVA showed that there was a significant difference in the 'Feminine' score among the five different designs when the room color remained the same (p<0.0001). Among blue rooms, design 3 yielded a significantly higher 'Feminine' response (p=0.002). Among orange rooms, design 3 is significantly higher in 'Feminine'

response (p=0.0001). The biggest difference in 'Feminine' scores was observed between orange room 2 and orange room 3 (3.30 vs. 4.10). There was no difference in 'Feminine' score by color (p=.7149) within the same design.

For 'Feminine' responses, different designs affected respondents' responses significantly, while color did not affect significantly different responses.
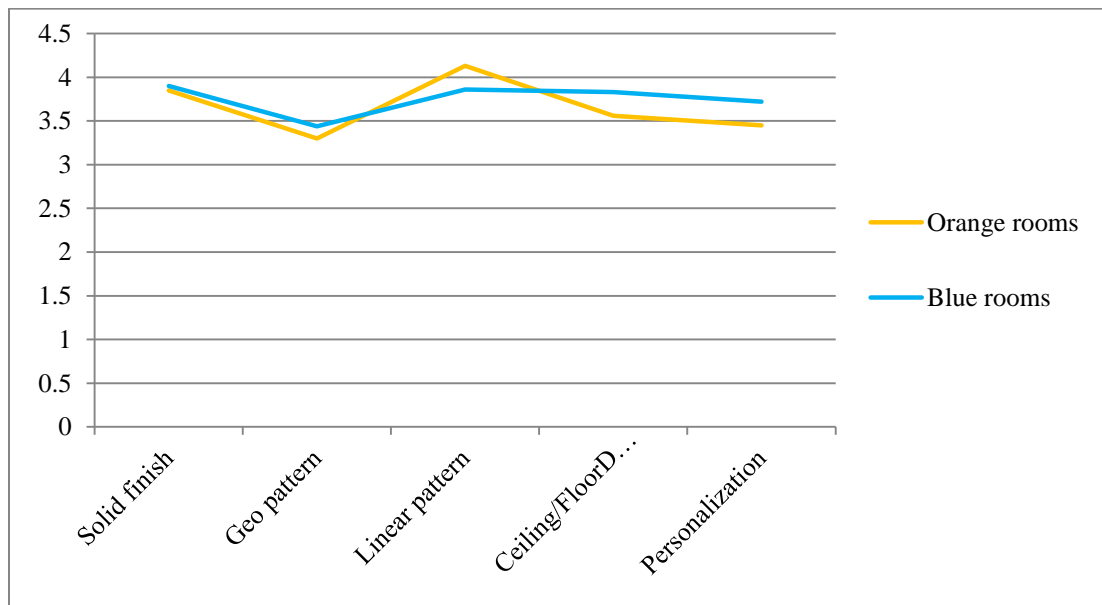
Figure 4.5. Comparison of **Feminine** by Colors and Designs

Adult/Private

For the attribute of 'Adult/Private', the scores of both orange and blue rooms were relatively low compared to 'Hominess' and 'Feminine'. Orange room 4, which had ceiling details with a lighting fixture and patterned flooring, was ranked the highest for the 'Adult/Private' response. Next was the orange room 2 with geometric patterns on the armchair and window valance. Blue room 5 received the third highest 'Adult/Private' score, and blue room 1 received the lowest 'Adult/Private' response (see Figure 4.6).

Among the blue rooms, there was a significantly different 'Ault/Private' response (p=0.002) by design. Blue room 5 received the highest rank in 'Adult/Private'. However, design 2 and design 5 received similar responses. Among the orange rooms, responses to designs demonstrated marginal differences (p=0.096). When the color difference effect was assessed within the same design, only design 4 showed a significant difference; the orange color effect was rated higher for 'Adult/Private' than the blue color (p=0.005).
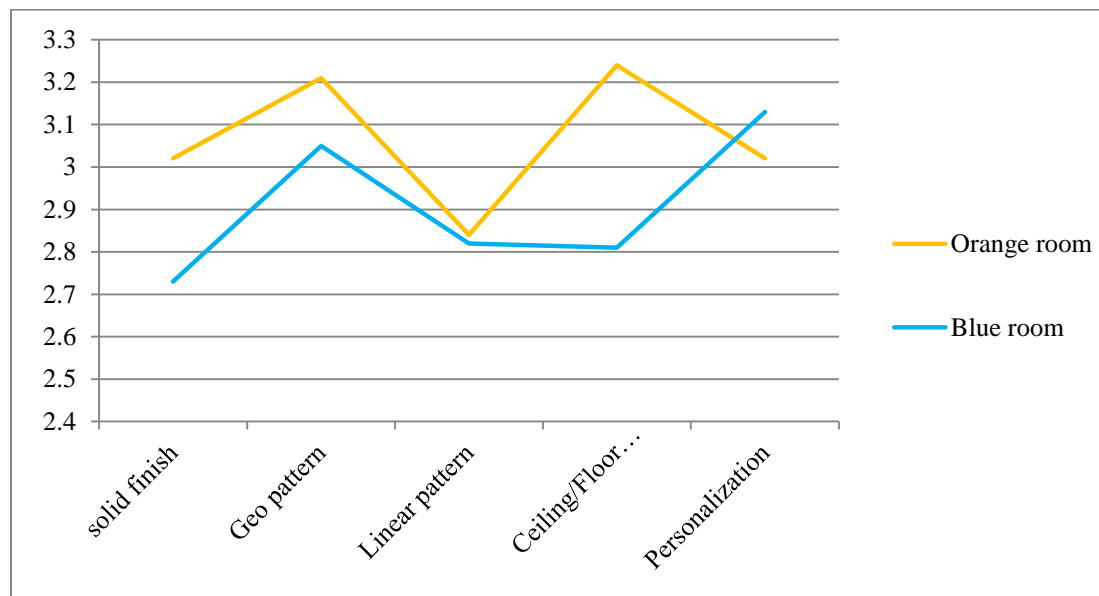
Figure 4.6. Comparison of **Adult/Private** by Colors and Designs

Summary

Overall, for patient rooms, the most influential design attribute was 'Hominess' for adolescent outpatients. Different designs of patient rooms significantly affected all three design attributes, Hominess, Feminine, and Adult/Private responses for adolescents. Surface finish patterns, ceiling details and floor pattern, and opportunities for personalization with interior components are potential design properties that might promote adolescent patients' healing process positively or negatively.

Activity Rooms

Based on the factor loading score of factor analysis, twenty-two words were grouped into three conceptual words for activity room preferences (see Table 4.5).

Table 4.5. Dominant Design Attributes for Activity Rooms and Factor Loading

	Factor			
	1	2	3	
words	Enjoyable	Controllable	Adult-like	Mean
smooth	**.659**	.306	.030	3.92
comfortable	**.876**	.113	.013	4.09
pleasant	**.862**	.056	-.052	4.11
roomy	**.643**	.081	-.309	3.91
stimulating	.067	-.178	.132	3.41
adult-like	.089	.044	**-.866**	3.09
safe	.287	**-.492**	.013	4.84
welcoming	**.760**	.142	.161	4.21
connected	**.584**	-.023	-.147	3.92
inviting	**.792**	.168	.065	3.98
dynamic	**.695**	.214	.366	3.87
flexible	**.586**	.342	.159	3.45
controllable	**.505**	**.527**	-.054	3.80
private	.124	**.633**	-.136	2.67
warm	.232	**.524**	-.030	3.39
familiar	**.427**	.372	-.225	3.45
nice	**.862**	.217	.096	4.05
enjoyable	**.819**	.200	.139	3.95
bright	.379	**.548**	.231	3.25
soften	.617	.495	.206	3.39
feminine	.258	.058	.158	3.12
informal	.217	-.007	**.673**	3.34

Note. Factor Loading >.40 (N=128). Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 5 iterations. Means of each semantic differential were on a 5-pont scale.

'Enjoyable', 'Controllable', and 'Adult-like' were the three dominant design attributes for activity rooms. The mean score for 'Enjoyable', 'Controllable', and 'Adult-like' were rated as 3.87, 2.86, and 2.87 respectively. Identification of the term for the first of the dominant attributes was different from 'Hominess' for patient rooms, due to the fact that more semantic differentials were correlated for activity rooms such as smooth, dynamic, flexible, and controllable. The word 'Stimulating' was excluded due to less than a .45 loading score for all three factors.

The first design attribute, 'Enjoyable', explained the most variations among the activity rooms. Figure 4.7 shows that the first factor's comprehensive correlation for activity rooms was similar in pattern to that for patient rooms.
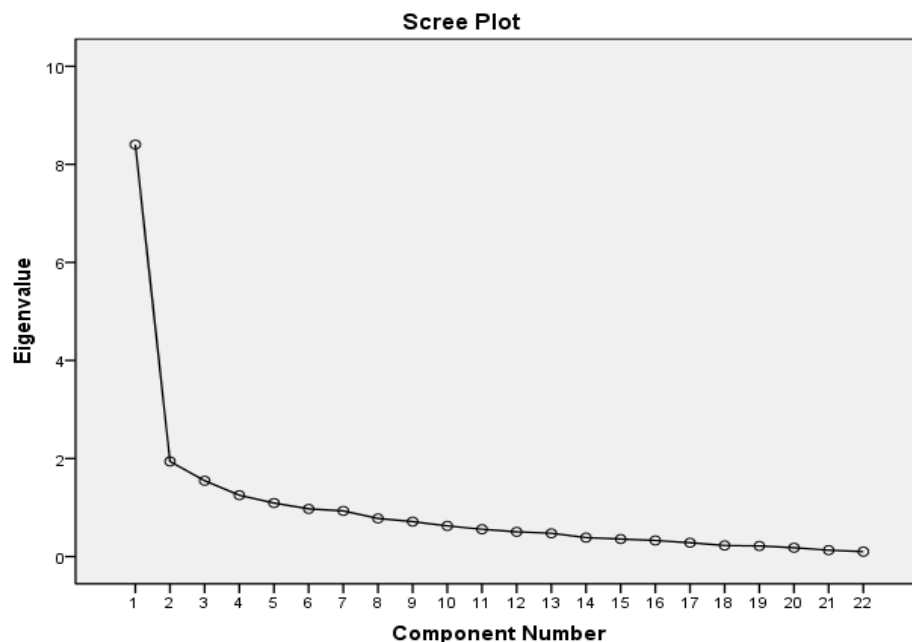
Figure 4.7. Scree Plot for Activity Room of Factor Analysis

The mean of each conceptual word was calculated by the formula as follows to be tested with the responses of both emotional states and environmental preference values (see Table 4.6).

Table 4.6. Each Design Attribute and Word Pairs for Activity rooms

Design Attribute	Word pairs	Mean
Enjoyable	smooth -- rough **comfortable**** -- uncomfortable **pleasant**** -- unpleasant roomy -- crowded **welcoming*** -- unfriendly connected -- isolated **inviting***-- uninviting dynamic -- boring flexible -- fixed familiar -- unfamiliar **nice**** -- awful **enjoyable**** -- unenjoyable	**3.87**
Controllable	unsafe-- safe controllable --uncontrollable private -- public warm --cool bright -- dark soft – hard	**2.86**
Adult-like	**adult-like*** – child-like formal – informal	**2.87**

Note. * Factor loading >.700.   ** Factor loading >.800.

There is lots of commonality between 'Hominess' for the patient rooms, and 'Enjoyable' for the activity rooms in each group's semantic differentials. However, the dominant design attribute for patient rooms and activity rooms was identified differently due to different healing effects of patient rooms and activity rooms. Patient rooms were regarded as private places that afford patient's physical and psychological privacy as the first priority, and activity rooms were considered as social places that support an adolescent patient's need for peer connection. Therefore, the commonality among semantic differentials of both 'Hominess' and 'Enjoyable' is explained by the common need for healing effects in hospital environments like comfort.

Environmental Preference Values of Hospital Rooms

Participants' general environmental preferences for hospital rooms were measured on a 5-point Likert scale (1=not important at all; 5=very important). The highest ranked preference value was 'Control of privacy', with an average score of 4.77. The need for a 'Quiet place to go' was the second most important preference for participating adolescents, scoring 4.25 on average. The third most important attribute in hospital rooms for adolescents was a 'Place for activities' outside the patient room. The mean score for 'Place for activities' was very close to the importance of having an 'Outside view,' with the average scores of 4.19 and 4.16 respectively (see Figure 4.8).
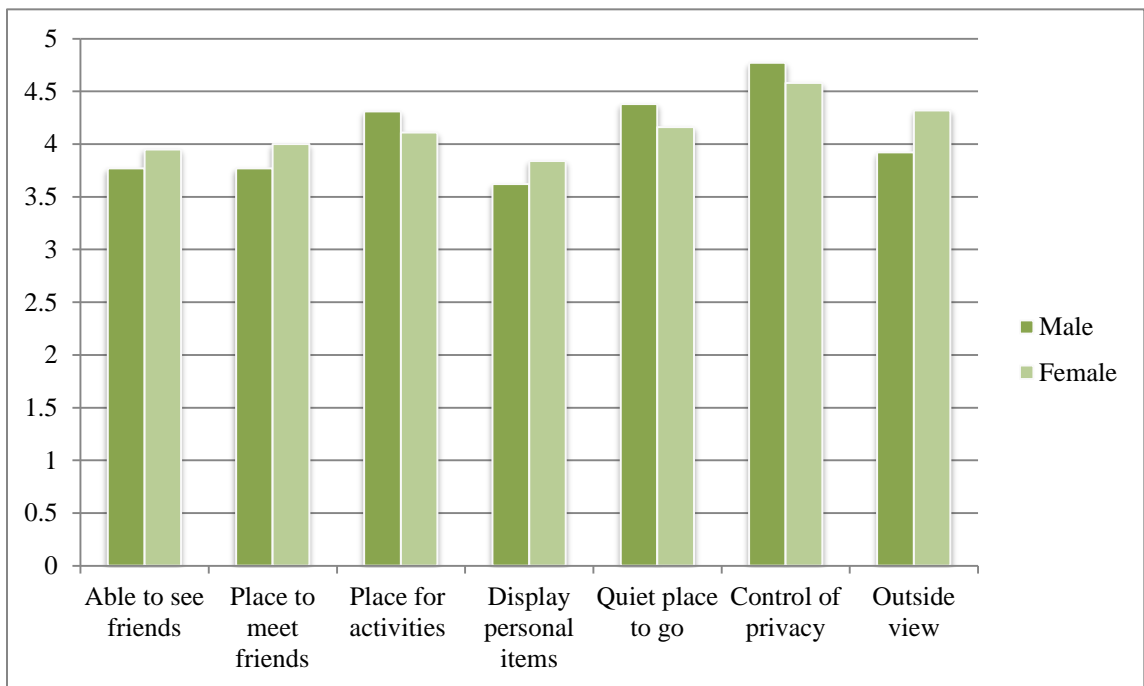
Figure 4.8. Preference Values in Hospital Rooms by Gender

In general, both males and females answered hospital room design preference questions with scores over 3.5 points on the 5-point scale. However, male adolescents

responded higher in the desire for the 'Control of privacy', 'Quiet place', and 'Place for activities' than females (See Appendix).
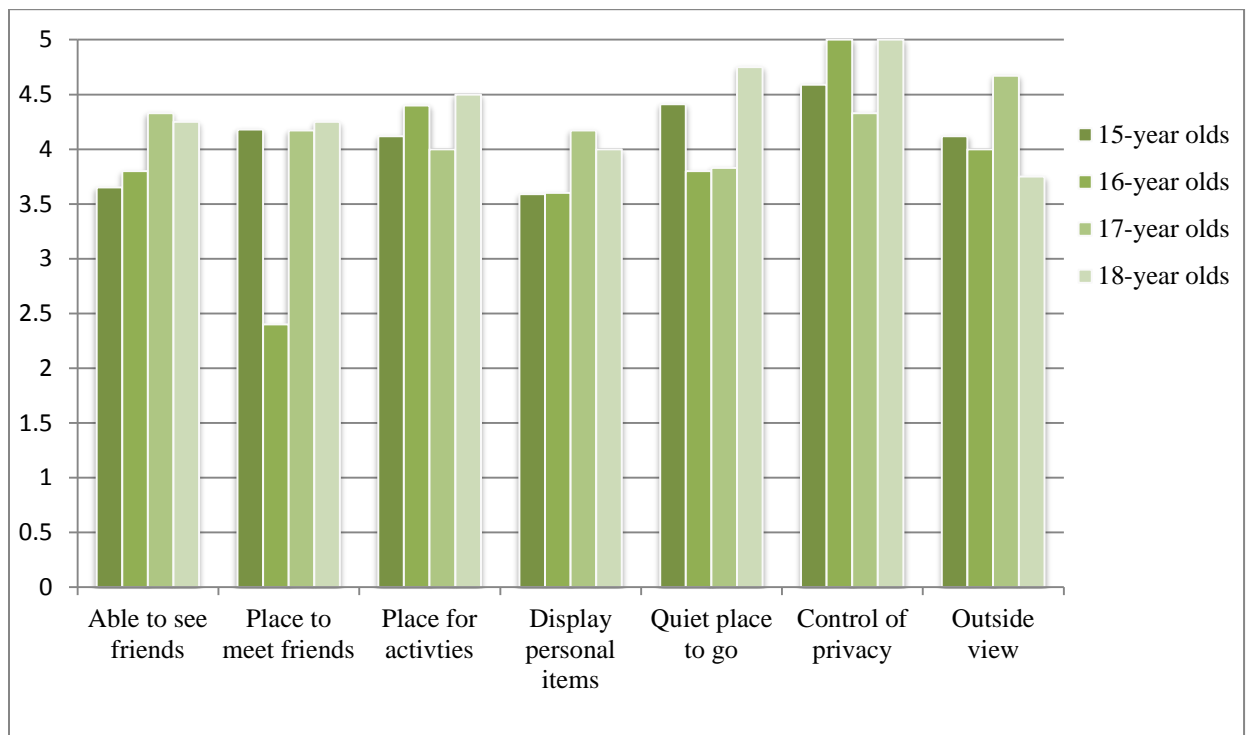
Figure 4.9. Preference Values in Hospital Room by Age

According to the Wilcoxon Rank two-sample test result, there were no significant differences in mean preference value scores between the genders. The result of a correlation test among environmental preference values and ages showed there was no significant difference in responses among different age groups.

However, when treating age as a categorical variable and performing the one-way repeated measured ANOVA test, there was a significantly different response to the question on 'Place to meet friends' by age groups (p=.005) (see Table 4.7). Specifically, the 16-year-old group had significantly lower scores than the other age groups (See Figure 4.9). This result can be explained by the intensive peer pressure for 16-year olds.

They might not want to meet friends when they are in a hospital due to the anxiety of potential rejection from their peers. On the other hand, they might not think a place for meeting is important compared to the other age groups.

Table 4.7. Summary of Analysis of Responses to 'Place to meet friends' by Age

	df	Mean Square	F	P-value.
Between Groups	3	4.488	5.404	**.005****
Within Groups	28	.830		
Total	31			

Note. N=32. df=degree of freedom.

Participating adolescents thought that 'Control of privacy' was the most important in hospital rooms and 'Quiet place to go' was the second most important. Having control of privacy and a place to be alone are important design attributes for adolescent patients. Having a 'Place for activities' and an 'Outside view' were also important design attributes after privacy and being alone for adolescent patients. However, there was no gender or age differences in participants' preference values scores statistically.

Correlations among environmental preference values were tested by the Spearman test (See Appendix). The preference variable, 'Able to see friends', was significantly associated with 'Display personal items', 'Control of privacy', and 'Outside view'. The adolescents who rated 'Able to see friends' at the hospital as important also rated 'Display personal items' (r=.401, p= .023) and 'Outside view' (r=.479, p=.005) as important. 'Display personal items' was positively correlated with 'Outside view' (r=.580, p=.000). Although adolescents thought that 'Able to see friends' was important, displaying personal items and having an outside view were also important.

Favorite Room Choices

Favorite Patient Room

Figure 4.10. shows that most of the participating adolescents chose blue rooms over orange rooms as their favorite. Nineteen respondents chose blue rooms as their favorite while thirteen selected orange rooms as favorite. The most favored room was the blue room 4, which had a round pattern with the ceiling light and a matching round pattern with different finish materials on the floor. Blue room 5 and orange room 3 were secondly favored.
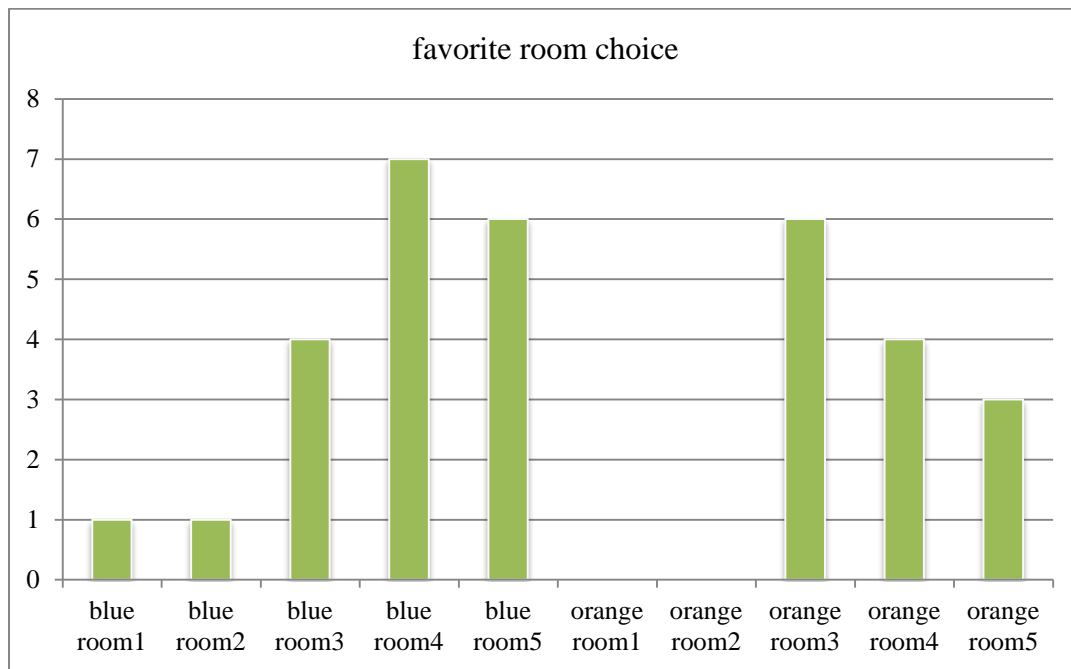
Figure 4.10. Frequency of the Participants' Favorite Room Choices

The most favored room design was ceiling details and floor patterns (D4). The second most favorite choice was a room with linear (curvilinear) patterns (D3), and the third was the room with personalization components (D5) (see Table 4.8).

Table 4.8. Frequency of Favorite Choices by Design

Design	Solid finish	Geometric Pattern	Linear Pattern	Ceiling details Flooring patterns	Personalization components
N	1	1	**10**	**11**	**9**

Note. N=32.

In open-end responses, reasons for the choice of the most preferred patient room were described by various words such as favorite color (n=13), comfortable (n=5), calming (n=5), relaxing (n=4), cool or teen-like (n=3), personal items (n=4), nice, inviting and use of pattern (see Table 4.9).

Figure 4.11. Most Preferred Room (D4)

Figure 4.12. Secondly Most Preferred Room (D3)

Figure 4.13. Third Most Preferred Room (D5)

Figure 4.14 shows the frequency of favorite patient room choice by gender and room color. Both male and female adolescents chose more blue rooms than orange rooms as their favorite. However, more males chose blue rooms as their favorite rooms.
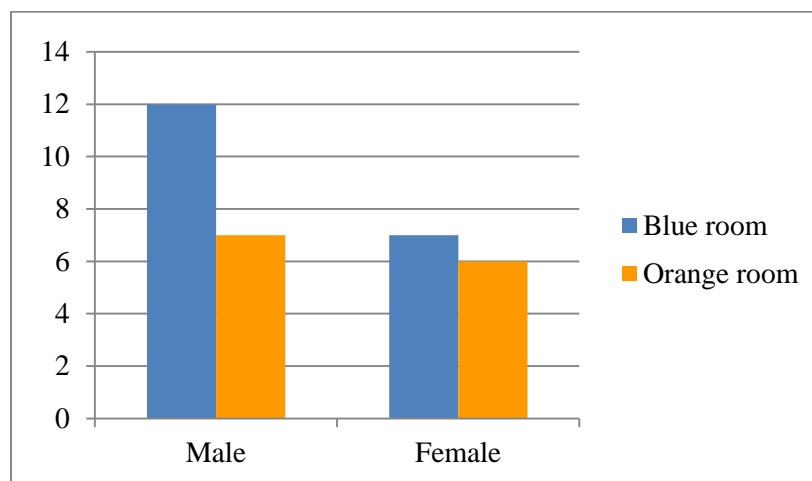
Figure 4.14. Favorite Room Choice by Color between Genders

Male adolescents valued the use of pattern in the room while female adolescents valued personalization aspects the most. However, the difference between genders was not statistically significant for the favorite design. Only one male adolescent chose a solid finished room as his favorite (see Figure 4.15).
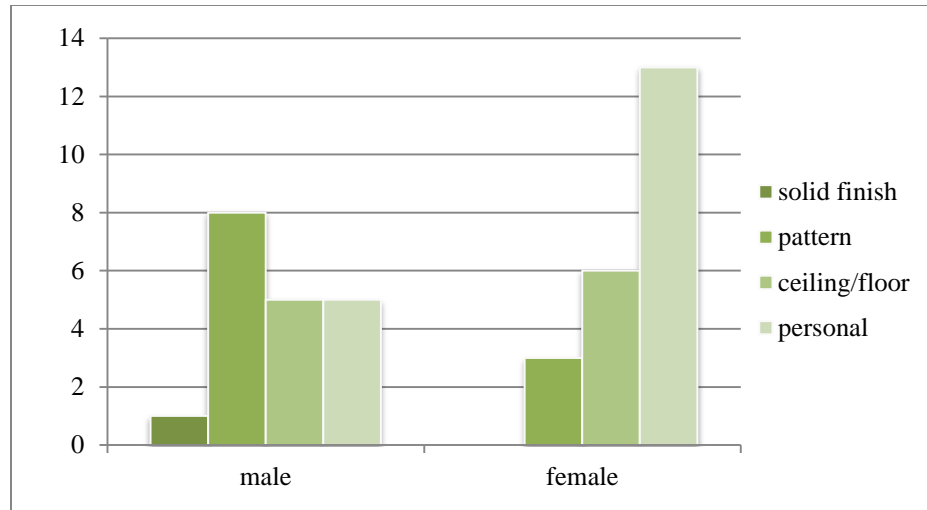
Figure 4.15. Favorite Choice by Room Design between Genders

Favorite Activity Rooms

Figure 4.16 shows the favorite activity choices. The result shows participating adolescents chose 'Teen room (A4)' as the most favored activity room. This room was selected by 20 out of 32 participants (63 %). The 'Teen room' contains the most visual complexity in its color scheme, architectural elements, furniture style, and room layout.
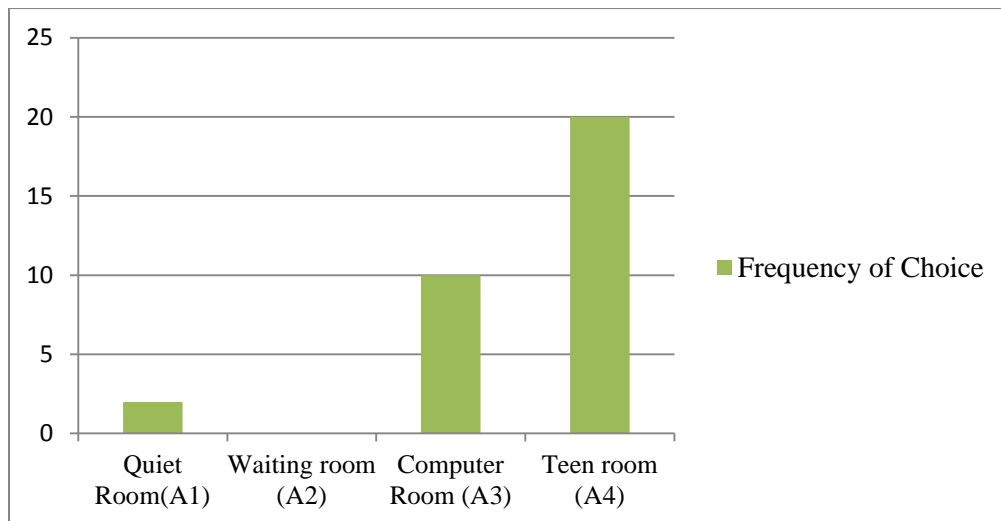
Figure 4.16. Favorite Activity Room Choices

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The second most favorite activity room was a computer room (A3) (31%). It affords individual computer workstations and comfortable club chairs. A decorative lighting fixture on the wall creates a visual focal point with primary colors. One wall of the room is visually connected to the next room, and users of the room do not feel isolated. Only one adolescent chose activity room 1, which was a quiet room as the favorite activity room. Activity room 2 was a waiting room that had decorative mural and formal seating area and received no votes for favorite activity room. Figure 4.17 and Figure 4.18 show the most two preferred activity rooms chosen by adolescent patients.

Figure 4.17. Most Preferred Activity Room (A4)*

*From Designing the World's Best Children's Hospitals: the future of healing environments (p.93) by Bruce King Komishe, 2005, Australia: The Images Publishing Group Pty Ltd. Copyright 2011 by the Bruce King Komishe. Reprinted with permission

Figure 4.18. Secondly Preferred Activity Room (A3) **

The reasons for choosing a favorite activity room was that it was fun and entertaining, colorful and had comfortable furniture, a soothing design and color, technologies, and a cool and teen-like mood (see Table 4.10).

Table 4.9. Reasons for Favorite Patient Room Choices

Participant #	Reason for favorite patient room
1	blue color, comfortable
2	blue color, spacey, outgoing, entertaining
3	bright, comfortable
4	calming, entertaining
5	color, fun, computer, iPod
6	color, laptop, calming
7	comfortable feeling
8	comforting, relaxing, roomy
9	cool, fun
10	cool, very calming
11	enjoyable, teen-like
12	favorite color, laptop
13	flexible, very free, opening
14	inviting
15	looks nice
16	nice, very good not boring
17	objects in the room
18	open, inviting
19	orange color, pattern, warm & homey
20	pattern, orange
21	personal, calming color
22	Pleasant color & design
23	relaxing
24	relaxing, pattern
25	Roomy, colors. Comfortable
26	soothing, relaxing color
27	very calming
28	warm color
29	warm color, balance of color, flower
30	warm nice design
31	warm, modern, personal item
32	Warm, artsy & decorative

Table 4.10. Reasons for Favorite Activity Room Choices

Participant #	Reason for favorite patient room
1	amazing to be in
2	appealing color & shape
3	bright, warm & cold,
4	chill room, computer
5	color and design
6	color, pleasant, fun, calming
7	comfortable chair, computer
8	computer
9	cool
10	cool looking
11	different, exciting, fun
12	enjoyable, calm, teen-like
13	entertaining, very fun, comfortable
14	fun, attracts attention
15	fun, chill
16	homey
17	homey, fun
18	lighting fixture, comfortable, slightly formal
19	look cool, chill & design
20	more enjoyable
21	more like me, color, chairs, design, view of room
22	museum looking
23	nice & calm, chill & relax
24	normal, comforting, serene place to relax
25	not too bright, not too dark, cozy, isolated
26	relaxing
27	soothing
28	technology
29	very natural
30	very open, comfortable safe
31	very teen-like, cool
32	welcoming, fun

Correlation and Regression Analysis

Environmental Preference Values and Emotional States

To find out the association among emotional states and environmental preferences for hospital rooms, non-parametric Spearman correlation was tested among variables. This method was used due to the skewness and non-normality of the emotional states questions. Table 4.11 shows the result of the correlation test. 'Sadness' and 'Worry for the future' were significantly related to environmental values.

'Sadness' was negatively correlated with 'Outside view' (r= - .395, p= .025). Those adolescents who felt sad thought that having an outside view was significantly less important. Even though having an 'Outside view' is considered an important hospital design property by adolescent patients, they may not care about having 'outside view' when they are sad due to medical symptoms or other stressors. Sadness may increase adolescents' desire for seclusion by isolating themselves from the outside.

'Worry for the future' was positively correlated to 'Place for activity" (r= .378, p= .033). Adolescents who felt 'Worry for the future' thought having a place for activity was important in a hospital. Activity places might affect their negative emotional states and make them feel less stressed.

Depending on adolescent patients' emotional states, they may need different types of environmental stimuli for their emotional well-being. The flexibility of hospital rooms is important in order to support adolescents' unstable emotional needs.

Table 4.11. Correlation Coefficient and P-value of Preference Values and Emotional States

	Spearman Correlation Coefficients						
	Able to see friends	Place to meet friends	**Place for activity**	Display personal items	Quiet place	Control privacy	**Outside view**
Comfort	.046	- .087	.273	.201	.039	.004	- .603
	.805	.637	.130	.269	.832	.981	.732
Sadness	-.117	-.030	.008	-.303	.107	.071	**- .395**
	.524	.870	.964	.092	.560	.701	**.025***
Anger	.000	-.010	-.268	-.034	-.183	.020	-.095
	1.000	.956	.138	.855	.315	.912	.607
Worry	-.025	-.187	**.378**	-.154	.026	.264	.031
	.890	.305	**.033***	.401	.888	.145	.866
Stress	-.037	.120	-.052	-.295	.181	.031	.004
	.841	.512	.778	.101	.323	.867	.984

Note. N=32 * is p-value < .05, ** is p-value <.005

Design Attributes and Emotional States.

Patient rooms

All three factors that were dominant design attributes for patient rooms were tested in order to investigate the relationship with adolescents' individual emotional states, age, and hospital room preferences. The result of the Pearson correlation test showed 'Hominess' was significantly related to all five emotional states (See Table 4.12).

'Hominess' was significantly related with 'Comfort' (r=.336, p=<.0001), 'Sadness' (r= -.161, p=.004), 'Anger' (r= -.191, p=.0005), 'Worry' (r= -.156, p=.0052), and 'Stress' (r= -.333, p=<.0001). As adolescents felt more comfortable, they responded more highly to hominess. When adolescents felt less comfortable, they responded less to hominess as presented in the patient room images. As adolescents felt sadder, more anger, more worry, and more stress at the time of the survey, they responded with a lower hominess score to the patient room images.

'Feminine' was significantly related to 'Comfort' (r=.169, p=.0025). The relationship between 'Comfort' and 'Feminine' was similar to that between 'Comfort 'and 'Hominess'. However, the correlation strength was less than 'Hominess' (r=.169 < .336).

'Adult-like' was also significantly related with 'Comfort' (r=.123, p=.028). Adolescents who felt comfortable responded more positively to hominess in the patient room images.

The results of correlations among factors and age showed 'Age' was significantly associated with both 'Hominess' (r=.118, p=.035), and 'Adult-like' (r=.128, p=.022). As adolescents were older, they responded more positively to 'Hominess' and 'Adult-like'.

Table 4.12. Correlations among Design Attributes and Emotional States

	Comfort	Sadness	Anger	Worry	Stress	Age
Hominess	**.336**	**-.161**	**-.191**	**-.156**	**-.333**	**.118**
factor 1	**<.0001**∗∗	**.004**∗∗	**.0005**∗∗	**.0052**∗	**<.0001**∗∗	**.035**
Feminine	**.169**	-.008	-.008	-.037	-.087	.060
factor 2	**.0025**∗∗	.881	.886	.505	.120	.288
Adult/private	**.123**	.107	-.083	-.025	-.029	**.128**
factor 3	**.028**∗	.055	.140	.657	.599	**.022**

Note. N=320. * is p-value < .05, ** is p-value <.005

Activity rooms

To understand the effect of participants' emotional states on the design attributes, the association was assessed by a Pearson correlation. Table 4.13 shows 'Enjoyable' was significantly related to the levels of 'Comfort' (p=.001), 'Worry' (r= -.174, p=.050), and 'Stress' (r= -.244, p=.005). As adolescents felt comfortable, they perceived activity rooms as more 'Enjoyable' , and the adolescents who felt worry and stress responded with significantly low 'Enjoyable' responses. 'Controllable' was significantly related to 'Anger' (r= -.173, p=.051). As adolescents felt anger, they assigned significantly low scores to 'Controllable'. 'Sadness' was strongly associated with 'Adult-like' responses (r=.213, p=.016). When adolescents were sad, they preferred more 'Adult-like' spaces.

Table 4.13. Correlation among Design attributes and Emotional States

	Comfort	**Sadness**	**Anger**	**Worry**	**Stress**
Enjoyable	**.032**	-.030	-.080	**-.174**	**-.244**
factor1	**.001**∗∗	.740	.370	**.050**∗	**.005**∗∗
Controllable	.006	.163	**-.173**	.120	.089
factor2	.945	.066	**.051**	.179	.318
Adult-like	-.032	**.213**	-.011	.009	.047
factor3	.721	**.016**∗	.899	.919	.599

Note. Pearson Correlation. N=128. * is p-value < .05, ** is p-value <.005

Design Attributes and Environmental Preference Values

Patient rooms

Table 4.14 shows the result of the correlations among design attributes and environmental preference values for patient rooms. The adolescents who ranked 'Able to see friends' as important also answered 'Adult/Private' with a significantly higher score (r=.420, p=<.0001). The adolescents who rated 'Place for activities' as important responded relatively high in the 'Feminine' score (r=.196,p=.0004) and 'Adult-like' score (r=.199, p=.0003). Having a 'Quiet place to go' correlated significantly with more 'Feminine' (r=.118, p=.035) and 'Adult/Private' scores (r=.258, p<.0001) for patient rooms shown.

'Control of privacy' was significantly related to 'Adult/Privacy' (r=.300, p=<.0001). As adolescents thought control of privacy was more important in hospital rooms, they significantly ranked higher 'Adult-like' scores. Adolescents who thought having an outside view in patient rooms was important responded significantly lower on 'Hominess' (r=-.263, p=<.0001) and 'Feminine' (r=-.213, p=.0001) and significantly higher in 'Adult/Private' responses (p=<.0001).

Table 4.14. Correlation among Design Attributes and Environmental Preference Values

	Able to see friends	Place to meet friends	Place for activities	Display personal items	Quiet place	Control privacy	Outside view
Hominess factor1	-.021 .709	-.000 .995	.060 .287	.009 .866	.057 .308	-.116 .038	**-.263** **<.0001**∗∗
Feminine factor2	.008 .889	.082 .144	**.196** **.0004**∗∗	-.072 .202	**.118** **.035**∗	-.089 .112	**-.213** **.0001**∗∗
Adult/Private factor3	**.420** **<.0001**∗∗	.102 .070	**.199** **.0003**∗∗	.057 .306	**.258** **<.0001**∗∗	**.300** **<.0001**∗∗	**.243** **<.0001**

Note. Pearson Correlation. N=320. * is p-value < .05, ** is p-value <.005

'Adult/Private' was significantly correlated with most environmental preference values for adolescent patients. Having an 'Outside view' was correlated with all three design attributes.

Activity rooms

Table 4.15 shows correlations among design attributes and environmental preference values for activity rooms. 'Enjoyable' was significantly related with 'Display personal items (r=.210, p=.018)' and 'Control of privacy' (r=-.208, p=.018). To those adolescents who thought of 'Display personal items' as important, the activity room images were more 'Enjoyable'. However, as adolescents thought 'Control privacy' was more important, they ranked significantly lower 'Enjoyable' scores. 'Controllable' was significantly associated with 'Place for activities' (r=.279, p=.001). Adolescents who thought 'Place for activity' as more important perceived the activity room images as being more 'Controllable'. 'Adult-like' was significantly associated with 'Able to see friends' (r=.222, p=.012). Participants who thought 'Able to see friends' as more important responded higher in the 'Adult-like' score in viewing activity room images.

Table 4.15. Correlation among Design Attributes and Environmental Preference

	Able to see friends	Place to meet friends	Place for activities	Display personal items	Quiet place	Control privacy	Outside view
Enjoyable factor1	.019 .828	-.039 .662	.119 .179	**.210** **.018***	-.160 .072	**-.208** **.018***	-.139 .119
Controllable factor2	.096 .284	.061 .497	**.279** **.001****	.042 .639	-.028 .752	-.028 .752	-.002 .981
Adult-like factor3	**.222** **.012***	.081 .366	.145 .102	-.007 .942	.129 .147	.129 .147	.028 .749

Note. N=128. * is p-value < .05, ** is p-value <.005

Favorite Choices and Design Attributes

Patient room

Results of semantic differentials' T-tests for favorite room choice were assessed in order to discover influential design attributes in adolescents' favorite choices. The results sorted out seven semantic differentials as significantly influential variables for favorite choices: smooth, comfortable, pleasant, welcoming, inviting, nice and enjoyable (See Table 4.16).

Table 4.16. Independent sample T-Test of Favorite Patient room Choice

Word Variable	F	P-value
smooth	4.530	.034*
comfortable	14.775	**.000****
pleasant	10.689	**.001****
welcoming	5.010	.026*
inviting	5.774	.017*
nice	7.955	**.005****
enjoyable	6.258	.013*

Note. N=320 (32 x 10 images).

Linear Mixed Model analysis was conducted separately with the three design attributes as the dependent variables to explore the most influential design attributes for adolescents' favorite room choices. The results indicated that 'Hominess' (p=.000) and 'Feminine' (p=.45) were significantly related to adolescents' favorite patient room choice (See Appendix).

Table 4.17 shows relatively influential design attributes in predicting favorite choices; repeated measured logistic regression was tested and the result showed 'Hominess' was significantly related to favorite choices (p=.035). Adolescents chose their favorite patient rooms when they perceived the room as homey.

Table 4.17. Favorite Patient Choice and Predicting Design Attributes

Parameter	Estimate	Standard Error	95% Confidence Limits		Z	Pr > |Z|
Intercept	-6.5718	1.7164	-9.9358	-3.2077	-3.83	0.0001
Favorite color	0.0641	0.1489	-0.2277	0.3559	0.43	0.6668
Hominess	**0.8781**	0.4171	0.0606	1.6955	2.11	**0.0353**
Feminine	0.1191	0.2834	-0.4364	0.6746	0.42	0.6743
Adult/Private	0.0169	0.1703	-0.3170	0.3508	0.10	0.9210

The multiple linear regression of 'Hominess' and emotional states showed 'Comfort' (p=.001), 'Anger' (p=.013), and 'Stress' (p=.017) were related to favorite choices (See Table 4.18). 'Anger' and 'Stress' were negatively related with 'Hominess'.

Table 4.18. Multiple Linear Regression among Hominess and Emotional States

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standardized Estimate
Intercept	4.12127	0.23216	17.75	<.0001	0
Comfort	**0.13752**	0.04138	3.32	**0.0010**	**0.21042**
Sadness	0.04211	0.07602	0.55	0.5801	0.03715
Anger	**-0.16411**	0.06574	-2.50	**0.0131**	**-0.13882**
Worry	-0.04419	0.03049	-1.45	0.1482	-0.07831
Stress	**-0.10595**	0.04415	-2.40	**0.0170**	**-0.18579**

The regression among 'Hominess' and preference values showed 'Able to see friends' (p=.0004), 'Display personal items' (p=.010), 'Quiet place to go' (p=.005), and 'Outside view' (p=<.0001) were significantly related to favorite choices (See Table 4.19). 'Outside view' was the only variable that was related with 'Hominess' negatively.

Table 4.19. Multiple Linear Regression among Hominess and Preference Values

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standardized Estimate
Intercept	4.61647	0.27526	16.77	<.0001	0
Able to see friends	**0.19097**	0.05302	3.60	**0.0004**	**0.28673**
Place to meet friends	-0.02106	0.03738	-0.56	0.5736	-0.03414
Place for activities	-0.02116	0.03948	-0.54	0.5923	-0.03042
Display personal items	**0.09016**	0.03482	2.59	**0.0101**	**0.17054**
Quiet place to go	**0.11161**	0.03944	2.83	**0.0050**	**0.19349**
Control of privacy	-0.10425	0.05724	-1.82	0.0695	-0.14005
Outside view	**-0.30775**	0.04899	-6.28	**<.0001**	**-0.48159**

Activity room

An independent sample T-test of semantic differentials by favorite room choice was assessed. The results sorted out eleven semantic differentials as significantly influential variables for favorite choices: smooth, comfortable, pleasant, roomy, welcoming, inviting, dynamic, flexible, controllable, nice and enjoyable (see Table 4.20).

Table 4.20. Independent T-Test of Favorite Activity Room Choice

Word Variable	F	P-value
smooth	4.748	.031*
comfortable	15.862	**.000****
pleasant	23.841	**.000****
roomy	19.140	**.000****
welcoming	24.337	**.000****
inviting	27.932	**.000****
dynamic	19.563	**.000****
flexible	4.958	.028*
controllable	10.462	.002**
nice	25.786	**.000****
enjoyable	20.344	**.000****

The results of the difference test of mean of the three dominant design attributes were rated as favorite (n=32) and rooms that were not rated as favorite (n=96). This test result discovered that 'Enjoyable' (p=.000) and 'Controllable' (p=.033) were significantly related to adolescents' favorite activity room choices (See Appendix). Table 4.21 shows influential design attributes in predicting favorite activity room choices; repeated measured logistic regression was tested and the result showed 'Enjoyable' was significantly related to favorite choice (p<.0001). Adolescents chose their favorite activity rooms when they perceived the room as 'Enjoyable'.

Table 4.21.Favorite Activity Room Choice and Predicting Design Attributes

Parameter	Estimate	Standard Error	95% Confidence Limits		Z	**Pr > |Z|**
Intercept	-9.2046	1.9562	-13.0386	-5.3706	-4.71	<.0001
Enjoyable	**1.6855**	0.3897	0.9217	2.4493	4.33	**<.0001**
Controllable	0.0373	0.1505	-0.2576	0.3322	0.25	0.8044
Adult-like	0.3213	0.2029	-0.0765	0.7191	1.58	0.1134

Summary

'Hominess', "Feminine', and 'Adult/Private' were identified as dominant design attributes for adolescent's patient room design and 'Hominess' was the most influential design attribute in predicting an adolescent's favorite patient room. All five emotional states of the survey, such as comfort, sadness, anger, worry, and stress, had a significant correlation with 'Hominess' responses. As participants felt more 'Comfort', they perceived the patient room images as more homey and that affected their favorite room choices. However, when adolescents felt more 'anger' or 'stress', they responded more negatively to 'Hominess'. As adolescents rated 'Able to see friends', 'Display personal items', and 'Quiet place to go' as more important, they assigned significantly higher 'Hominess' responses. However, having an 'Outside view' negatively affected 'Hominess' responses. When adolescents thought 'Outside view' was important, they felt less 'Hominess' and that affected their favorite room choices.

For adolescent's activity room design, 'Enjoyable', 'Controllable', and 'Adult-like' were recognized as main design attributes, and 'Enjoyable' was the most influential design attribute in predicting an adolescent's favorite activity room. Adolescents ranked significantly higher 'Enjoyable' responses when they thought 'Display personal items' was an important design attribute. However, 'Control of privacy' affected 'Hominess' responses negatively. When adolescents thought 'Control of privacy' was important, they felt the room was less 'Enjoyable' and that affected their favorite room choice.

CHAPTER FIVE
DISCUSSION AND CONCLUSION

Overview

Healing environments provide individuals with environmental stimuli that support relaxation, restoration, autonomy, and sense of belonging. Individuals have their own sense of healing depending on their personal values and preferences, personalities, physical conditions, and the stage of life. Healing environmental stimuli that are compatible with patients' physical and psychological needs promote their holistic quality of life by creating positive physical, emotional, and social environmental experiences. Adolescents are in the process of ongoing physical development and fluctuating emotional changes with their own unique social and cultural characteristics. Strong desires for independence and peer connection influence adolescents' behavioral decision-making and emotional well-being. In the healthcare environments that were built for young children or adults, the needs of autonomy and communication with peers could impose a major negative impact on adolescent patients' healing process. In creating compatible healing environments that meet adolescents' environmental needs, an understanding of adolescent patients' environmental issues within hospital settings are critical.

The goal of the study was to discover healing design elements that may encourage adolescent patients' emotional well-being and positive healing processes in order to promote their quality of life based on their environmental desire and cognitive characteristics. To investigate adolescents' environmental preferences for autonomy and social connections, the images of patient rooms and hospital activity rooms were

examined along with their emotional states and environmental preference values. The results indicated adolescent patients' emotional states affected their environmental preferences and perceptions of hospital rooms. The findings also discovered that surface finishes, room layout, and interior components of hospital rooms could promote in adolescent patients a sense of hominess and a sense of enjoyment. These hominess and enjoyment factors of the hospital rooms suggested predictive design attributes for favorite rooms that were related to adolescent patients' restoration by reducing stress and encouraging positive moods and feelings (Korpela & Hartig, 1996; Scopelliti & Vittoria, 2004).

Emotional States and Environmental Preferences Values

Adolescent outpatients who participated in the survey were primarily 9th grade or 10th grade students, who felt relatively comfortable at the time of survey. The levels of stress and worry for the respondents were relatively higher than those of sadness and anger regardless of age, gender, hospitalization history, and residence location. This result could be explained by the agreement on a connection between health symptoms and stress appraisals, especially in adolescents. The ways of coping with stress are more important to patients' psychological well-being and health than the presence of stressors (Dise-Lewis, 1988; Lohman & Jarvis, 2000), and design attributes affecting adolescents' preferences in hospital environments could support a way of coping with stress.

'Sadness' appeared to affect adolescents' preference values significantly. Adolescents' preference for 'Having an outside view' is different depending on their sadness level. Adolescents who were sad tended to put less value on having an 'Outside

view' in hospital rooms. When adolescents are sad, they may prefer to be in solitary

places, isolating themselves from outside to reduce stress from sadness. This finding

showed some discrepancy with other empirical research results reporting the healing

effects of an outside view, particularly of a natural setting (Curtis, Gesler, Fabian, Francis,

& Priebe, 2007; Ulrich, 1984, 1991). The findings of the study indicate that having an

outside view in hospital rooms does not necessarily enhance adolescent patients'

psychological well-being. Rather, adolescents may need control of visual connections to

promote positive healing processes depending on their current emotional state at the time.

This finding also relates to the restorative experiences such as relaxation, calming down,

or escaping from social pressure in favorite places (Korpela & Hartig, 1996; Korpela,

KyttÄ, & Hartig, 2002).

Adolescents who had 'Worry for the future' valued a 'Place for activity' as

important. Doing an activity or having opportunities for activities at the hospital may

relieve adolescent patients' stress concerning their future. This finding supports

Blumberg and Devlin's research finding that 92 % of the subjects who were adolescents

aged 12 to 14 desired to have a game room in hospitals for socialization (Blumberg &

Devlin, 2006). Through activities with their peer group, adolescent patients may reduce

stress from the concern about the future. In hospital design for adolescents, this is

essential to promote quality of life in hospital settings.

Adolescent Patient Rooms Preferences

'Hominess', 'Feminine', and 'Adult/Private' were found to be the dominant design attributes affecting adolescent patients' preferences for patient room design. These attributes were also closely related to emotional states and predicted adolescent patients' favorite patient room choices. 'Age' was significantly associated with both 'Hominess' and 'Adult/Private' responses in patient rooms. When adolescents were older, they perceived the patient room as more 'Homey' and more 'Adult/Private'. This suggests that in designing adolescent patient rooms, age is a more important internal factor that affects preferences for a more adult-like room than gender difference.

Hominess

'Hominess' was the most influential design attribute that predicted adolescent patients' favorite patient room choices. The descriptive words under 'Hominess' for the room were 'comfortable',' pleasant', 'roomy', 'safe', 'welcoming', 'connected', 'inviting', 'controllable', 'familiar', 'nice', and 'enjoyable'. Among these words, 'comfortable', 'pleasant', and 'nice' are predictive factors for adolescents' favorite patient room choices (see Table 4.16). 'Safe' was the unique variable that represents 'Hominess' in patient rooms, and 'Safe' can be interpreted as both physical and psychological comforts. With compared with the 'Enjoyable' attribute in activity rooms, 'Safe' was not significantly related to any factors for activity rooms.

The sense of hominess was significantly related with adolescent patients' emotional states. As adolescents felt more comfortable, they responded more highly to homeiness and when adolescents felt less comfortable, they responded negatively to

hominess. The relationship between hominess and comfort in these results implies that 'hominess' in patient rooms is needed to provide a comfortable environment for adolescents who are physically uncomfortable due to physical pain or psychological stress. Adolescents also feel safe and in control when they perceive a room as homey.

When adolescents felt sadder, more anger, more worry, and more stress, they responded with a lower hominess score for the patient room images. Hominess is required in the room in order to provide a restorative environment for adolescents who are sad, angry, worried, or stressed.

Adolescents who valued having an 'Outside view' as less important responded significantly higher to 'Hominess'. Even though there is a general agreement on the positive effect of having a view in patient rooms (Kopec, 2006; Shepley, et al., 1998; Tennessen & Cimprich, 1995; Ulrich, 1984; Ulrich et al., 2008), this result indicated that having a view does not necessary promote adolescents' hominess experiences. Rather, 'Hominess' seems to be related to adolescents' preference for solitude and having an "Outside view' may not be as effective as for young children and adult patients. Rather, having control of an 'Outside view' is more effective in creating a homey ambience in hospital design. The results of this study indicate that adolescents valued private seclusion as a more important function of a home-like environment than a connection to the outside of the room.

The importance of a sense of control in a home-like environment is supported by the research on hominess in a hospital setting. Shin (2004) suggested that an ideal home is a place that affords maximized freedom of choice, and that allows a patient control over the space. Altman (1975) also recommended maximized control over one's space,

in terms of privacy and territoriality, as a major element of hominess. Hominess promotes adolescent patients' psychological well-being in hospital environments and encourages adolescent patients to experience autonomy and self-esteem, offering them comfort and control over their rooms. This supports previous hospital design research that has suggested a home-like atmosphere in order to provide potential healing hospital environments (Curtis, et al., 2007; Kopec, 2006; Vaaler, Morken, & Linaker, 2005).

Feminine

Feminine' was the second most influential attribute for adolescent patient room design. 'Feminine' in the room was represented by the terms, 'bright', 'soft', and 'feminine'. It was significantly related to 'Comfort' and the relationship between 'Comfort' and 'Feminine' was similar to that of 'Comfort 'and 'Hominess'. Adolescents responded to more 'Feminine' aspects of the room as they felt more comfortable. Feminine could symbolize fostering, caring, and nurturing as compared to masculine attributes and adolescents may culturally associate feminine with comfort and healing.

The 'Feminine' attribute was positively related to 'Place for activities 'and 'Quiet place to go'. Adolescents who thought 'Place for activities' and a 'Quiet place' were important responded with a significantly higher 'Feminine' score. The 'Feminine' atmosphere may support adolescents' desire for solo activities, again supporting a nurturing point of view. During adolescence, teens are hovering between the world of the child and that of an adult. However, 'Outside view' had a negative relation to 'Feminine'. This result suggests that having a view to the outside was not necessary to create a feminine mood in an activity room or a quiet room.

In designing a patient room, brightness and soft design elements could be applied in creating a comfortable mood for patients' relaxation opportunities. The 'Feminine' attribute could be a unique healing design attribute in adolescent hospital design.

Adult/Private

The descriptive words under 'Adult/Private' for patient rooms were 'adult-like',' private', and 'formal'. This design attribute was not as influential as 'Hominess' for the patient room. However, it reflects adolescents' transitional stage toward adulthood. They preferred to have a patient room that had an adult-like rather than a child-like atmosphere. Adolescents also desired private characteristics for their patient rooms due to their unique developmental stage (Blumberg & Devlin, 2006; Clift, Dampier, & Stephen, 2007; Hutton, 2005).

'Adult/Private' was significantly related to the feeling of 'Comfort' and the 'Age' variable. Adolescents who felt comfortable responded more positively to 'Adult/Private' in the patient room images and the older adolescents were higher on the 'Adult/Private' score. This supports previous research on adolescent hospital design that suggested an age-appropriate design and comfortable furniture in the room for adolescents (Blumberg & Devlin, 2006; Clift, et al., 2007). 'Adult/Private' responses were high for the room design with personalization components, and this could be interpreted as adolescents' desires for self-identity and self- esteem as other researchers have suggested (Tivorsak, et al., 2004). Personalization in patient rooms also promotes a feeling of comfort in previous research on birthing rooms (Shin, 2004).

'Adult/Private' was the attribute most related to adolescents' environmental values for hospital. Adolescents who responded high on the 'Adult/Private' rating also thought seeing friends, having a place for activities, a quiet place, the ability to control privacy, and an outside view were significantly important. This result shows bidirectional adolescent environmental needs: both the desire for seclusion and social connection. These important environmental values represent age-appropriate design aspects that should be considered in the design of adolescent hospital facilities.

Pattern and Color

The patterns in the room influenced adolescent patients psychologically. Surface finishes for each patient room significantly affected the degree of 'Hominess', 'Feminine', and 'Adult/Private' preferences of patient rooms. Linear patterns (curvilinear and stripe) promoted relatively high 'Hominess' and 'Feminine' responses and predicted favorite patient room choices. Among the orange rooms there were significantly different responses due to different pattern on surfaces and interior components.

Figure 5.1 shows orange room 3 that received the highest hominess and feminine scores. Well-balanced curvilinear pattern and the orange color created the most preferred patient room among the orange examples.

This supports the pattern preference research stated by Augustin (2009), which indicates that people feel it is soothing to look at certain patterns similar to the patterns found in nature, such as the pattern from rippling wind, clouds moving across the sky or a winding stream. This is also related to Biophilia as hypothesized by Wilson (1984).

Figure 5.1. Orange Room (O3) with Linear Pattern

The positive effect of curvilinear pattern on the perception of hominess supports the previous research on curvilinear pattern in interior settings in promoting participants' pleasure ratings (Dazkir & Read, 2011).The harmony between natural fractal pattern and subtle variations of the orange color palette created relaxing effects, and adolescent patients felt high levels of 'Hominess' and 'Feminine' qualities.

Figure 5.2 shows the room with repeated geometric patterns on an armchair and a window valance. This room received the lowest 'Hominess' and 'Feminine' scores; however, it scored the highest 'Adult/Private' rating.

Figure 5.2. Orange Room (O2) with Geometric Pattern

Pattern style was the only difference between room 3 and room 2, yet it created radically different responses from adolescent patients. The pattern from geometric shapes and its repetition created a relatively high 'Adult/Private' response from adolescents and influenced certain feelings of 'Comfort' in them. Compared to the use of one color and non-repetitive natural pattern in room 3, the pattern in room 2 had three different colors and repeated geometric pattern. The combination of multiple colors and the use of pattern in orange room 2 turned out to be the least favorable surface finish for adolescents. In designing adolescent patient rooms, simple natural patterns and one or two color combinations would be preferable and more relaxing.

Regarding the impact of color, there was no significant association with adolescents' emotional responses and preference values between two given colors, orange and blue. However, blue rooms were preferred more than orange rooms (see

Figure 4.14). Recent color research in hospital design concluded that there is no significant color effect on patients' emotional responses (Tofle, Shchwarz, Yoon, & Max-Rotale, 2003). In planning a color scheme for adolescent patient rooms, the emotional impact of colors and lighting effect from both natural the lighting and artificial lighting should be considered.

Personalization and Technology

Figure 5.3 and figure 5.4 show both orange and blue rooms 5 that contained personalization choices and technology. These two rooms received relatively high 'Hominess' scores, and relatively low 'Adult/Private' scores. The results imply that personalization symbolizes more 'Hominess' than ''Adult/Private'' to adolescent patients. The aspects of 'controllable' and 'enjoyable' within 'Hominess' of the room impacted on adolescents' positive feelings by creating personalization possibilities.

Figure 5.3. Orange Room (O5) with Personalization and Technology

Figure 5.4. Blue Room (B5) with Personalization and Technology

Personalization is also related to the desire for territoriality. When patients have

the capability to personalize their own space in a hospital room, they feel more

comfortable (Shin, 2004). A sense of comfort promotes a homey atmosphere in the room.

Personalization also offers adolescents opportunities for self-esteem and self-regulation.

The relationship between hominess and personalization indicates the importance of

adolescent patients' place attachment to their patient rooms and its positive healing

effects. Place attachment leads to improved positive mood and increased satisfaction,

which support mental and physical health (Kopec, 2006). Technology options such as a

TV, laptop computer, and iPod station in the room symbolized an age-appropriate and

enjoyable place for the adolescents. In the category of personalization and technology,

age-appropriateness for adolescent patients did not mean either adult-like or child-like.

Architectural details

Ceiling details with a lighting fixture and patterned flooring with different materials were preferred design elements for adolescent patients. Figure 5.5 shows the most favored patient room design and the more preferred color palette among adolescent respondents. Blue rooms were chosen more often than orange rooms as the favored room. Due to the fact that both orange and blue were preferred in previous research (Augustin, 2009; Coad & Coad, 2008; Dijkstra, et al., 2008; Park, 2007), the different color effects between orange and blue rooms were not significant.

Figure 5.5. Blue Room (B4) with Ceiling Details and Patterned Floor

Blue room 4 contained the most complexity in surface finishes as compared to the other patterned rooms. A patterned drop ceiling with a lighting fixture and a round patterned floor finish with different materials, and the contrasting texture between the two flooring finishes created the most interesting complexity to the respondents. Designs

2 and 3 had small scale pattern applications in individual interior components, which also created an attraction to those rooms. However, compared to the application of individual interior components, the patterned ceiling and floor as architectural details promoted more preferable complexity.

Summary

In summary, surface variations using texture and color in interior spaces could stimulate users' positive responses when the pattern style matches user groups' specific preferences. This suggests that adolescent patients prefer patient rooms that have a visual complexity and richness through surface finishes. They preferred both the orange and blue colors that harmonized with medium-sized linear patterns, architectural details, personalization options, and technology. This finding confirms previous research demonstrating preferences for complexity as a predictor of interior preference (Gifford, 2002; Ham & Guerin, 2004).

Color effects on all three design attributes were not significant. The two colors applied to the present study maintained the same saturation and brightness, and there was no significant color effect between the two different color hues. This confirmed the previous research results on color in hospital design; even when color affects the occupant's perception of the interior, brightness and saturation of color were more affective factors than the hue of the color (Augustin, 2009; O'Connor, 2010; Tofle, et al., 2003). In the current study, color effects on hospital room design were not significant in promoting patients' emotional well-being or the healing process.

Adolescent Activity Rooms Preferences

'Enjoyable', 'Controllable', and 'Adult-like' were dominant design attributes affecting adolescents' preferences for activity room design. 'Enjoyable' was the most dominant design attribute for activity rooms, which suggests different environmental issues as compared with patient rooms. An activity room was important due to adolescents' need for peer connection, enjoyment, and the reduction of stress.

Enjoyable

The descriptive words under 'Enjoyable' for the activity rooms were 'smooth', 'comfortable', ' pleasant', 'roomy', 'welcoming', 'connected', 'inviting', 'dynamic', 'flexible', 'familiar', 'nice', and 'enjoyable'. 'Smooth', 'dynamic', and 'flexible' only belonged to the 'Enjoyable' category for the activity room, and these variables differentiate design attributes for activity rooms from the 'Hominess' factors for patient rooms. The T-test in identifying predictive variables for favorite activity room choices indicates that 'roomy', 'welcoming', 'inviting', 'dynamic', and 'enjoyable' are significant predictors (see Table 4.20). The result suggests that design attributes for activity rooms should be different from the ones for patient rooms.

The sense of enjoyment was significantly related to adolescent patients' emotional states. As adolescents felt more comfortable, they responded more highly to 'Enjoyable', and when adolescents felt less comfortable, they responded more negatively to the 'enjoyable' preference. The relationship between enjoyment and comfort in the results implied that a more comfortable and inviting activity room design is needed to provide an enjoyable environment for adolescents who are emotionally stressed. An indication of

'Enjoyable' in an activity room was significantly related to a sense of worry and the level of stress. When adolescents felt more worry and more stress at the time of the survey, they responded with a lower 'Enjoyable' score to the activity room images. An enjoyable mood in an activity room is required in order to provide a restorative environment to those who are worried or stressed.

This finding is supported by previous research on adolescents' quality of life. Bovier (2004) suggested that self-esteem and perceived stress were important factors for adolescents' mental health, and adolescents' mental health was a central determinant of quality of life. Interaction with their peers is important to adolescents and perceived stress can be reduced by social supports (Boice, 1998; Bovier, et al., 2004). 'Enjoyable' design attributes for activity rooms also can be related to previous research on the relationship between enjoyment and restoration, in that a sense of enjoyment was as significantly related to restoration as relaxation was related to restoration (Korpela & Hartig, 1996; Korpela, et al., 2002; Scopelliti & Vittoria, 2004). Therefore, providing an 'Enjoyable' activity room for adolescents patients is critical in a healing design approach.

Environmental preference values for adolescents' activity rooms were different from those for patient rooms. For activity room design, 'Control of privacy' was not as important as in patient rooms due to the desire for peer connection. Adolescents who thought control of privacy was important responded significantly less to the 'Enjoyable' variable in the activity room. When adolescents worried about their privacy, they did not enjoy activities. When adolescents enjoyed being in an activity room, privacy was not important to them.

Controllable and Adult-like

'Controllable' was the second most influential attribute for adolescent activity room design. 'Control' of the room represented 'controllable', 'private', 'warm', 'bright', 'soft', and 'unsafe' (see Table 4.5). A sense of control did not include a sense of safety. 'Controllable' was significantly related to 'Anger', and as adolescents felt anger, they awarded significantly lower scores to 'controllable'. Due to this negative emotional state, their feeling of control caused them to become more vulnerable. However, adolescents who responded that an activity room was 'controllable' also thought that having an activity place was significantly important.

'Adult-like' was the third influential attribute for adolescent activity room design. This attribute was represented by the words 'adult-like' and 'formal'. The variable was significantly related to 'Sadness'; adolescents who felt sadder responded with a higher score to 'Adult-like'.

Summary

In summary, adolescents preferred to have activity rooms that were roomy, inviting, dynamic, and flexible, depending on their emotional states and the activities they preferred. The 'Teen room (A4)' was the most preferred due to visual complexity. This also can be explained by age-appropriate ambience in the room through room configuration, furniture layout, the color scheme, and shapes of the interior components. The 'Computer room (A3)' was preferred the second most because of the availability of technology and comfortable furniture. This finding corresponds to the previous research on adolescent design issues such as age-appropriateness and need for social connection

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(Blumberg & Devlin, 2006; Clift, et al., 2007; Ulrich, 1991). As adolescents felt

comfortable, they perceived activity rooms as more 'Enjoyable' rooms. When

adolescents felt more stress, they valued 'Enjoyable' lower for the activity room images.

Therefore, providing comfortable furniture and various seating options are essential in

activity room design.

Figure 5.6. Teen room (A4) with Visual Complexity

Based on the results of the study, adolescent patients had a dual desire for solitude

and socialization in an activity room. In the private aspect, adolescents preferred to have

comfort, relaxation, and refuge that are afforded by home environments. In the public

aspect of the activity room, they wanted to keep a social connection with peers and spend

enjoyable time in activities. An activity room design for adolescent patients should be

approached from the concept of living room at home. This finding was supported by the

previous research on function and meaning of the living room (Rechavi, 2009). The

living room (family room) offers residents with the place for socialization with

comfortable seating, technology for games or movies, while providing a peaceful place depending on the activity that is occurring. This approach matches adolescents' unique environmental needs in hospital settings.

Adolescent Patients' Environmental Values and Preferences

'Control of privacy' in hospital rooms was the most important design issue for adolescent patients' in hospital room design. The second significant design issue was having a 'Quiet place to go' for being alone. This finding implies that although social interaction among adolescents is strongly desirable (R. Blumberg & Devlin, 2006; Bovier, et al., 2004; Tivorsak, et al., 2004), designers should consider that too much social interaction may result in an invasion of privacy. A 'Place for activities' and an 'Outside view' were the third and the fourth most important hospital design issues respectively for adolescent patients. Having an 'Outside view' in activity rooms was important to adolescent patients while 'Outside view' in patient rooms was not important in terms of the 'hominess' and 'feminine' values.

Adolescent patients preferred the patient rooms designed with linear patterns or personalization components that created visual complexity and age-appropriateness. Patterns were related to patients' room preferences-- curvilinear pattern for hominess and a striped pattern suggested feminine characteristics. Geometric patterns were more closely related to adolescent patients' adult/private preferences. Personalization components in patients' rooms also predicted a positive hominess rating. This result supports the previous research that emphasized the importance of the ability to personalize patient rooms in promoting a sense of control and comfort (Shin, 2004).

Conclusion

Adolescent patients preferred having a home-like environment for their patient rooms due to their needs for comfort and control of privacy. They also preferred having enjoyable and controllable activity rooms that supported peer connection, self-identity, and stress reduction. Due to fluctuating adolescent patients' emotional states, it may be important to provide them with controllable interior components to a certain degree. Since the preferences for patient rooms and activity rooms were somewhat different, the design of each room should have separate foci. Patient rooms need to be more focused on hominess with privacy control, while activity rooms need to be an enjoyable place with various activity options.

Figure 5.7 summarizes the findings focusing on adolescents' internal factors that impact their holistic quality of life within the study's theoretical framework. The most important internal factor to be considered in healing design for adolescent patients is their stage of life. The transitional stages from childhood to adulthood generate their own emotional status, psychological needs, and environmental preferences. All four categories for internal factors are intertwined and affect one another constantly. Major issues in hospital design for adolescents are to create healing environments that support their autonomy, self-esteem, seclusion, and socialization. Environmental values that are important to adolescents are control of privacy, a quiet place to go, a place for activity, and having a controllable outside view.

```
                    ┌──────────────────────┐
                    │  Age: Stage of Life  │
                    └──────────────────────┘
           ┌─────────────────┐        ┌──────────────────────┐
           │ Emotional States │◄─────►│ Psychological Needs  │
           └─────────────────┘        └──────────────────────┘
   ┌─────────────┐                              ┌──────────────┐
   │ Comfort     │      ┌──────────────────┐    │ Autonomy     │
   │ Sadness     │◄────►│ Environmental    │    │ Self-esteem  │
   │ Angry       │      │ Preferences      │    │ Seclusion    │
   │ Worry       │      └──────────────────┘    │ Socialization│
   │ Stress      │                              └──────────────┘
   └─────────────┘
```

Environmental Values
- Control of privacy
- Quiet place to go
- Place for activity
- Outside View

Design Attributes
- Patient room:
- Hominess
  Feminine
  Adult/Private
- Activity room:
- Enjoyable
  Controllable
  Adult-like

Healing Design elements
- Pattern: Curvilinear
- Linear
  Simplistic
- Personalization options
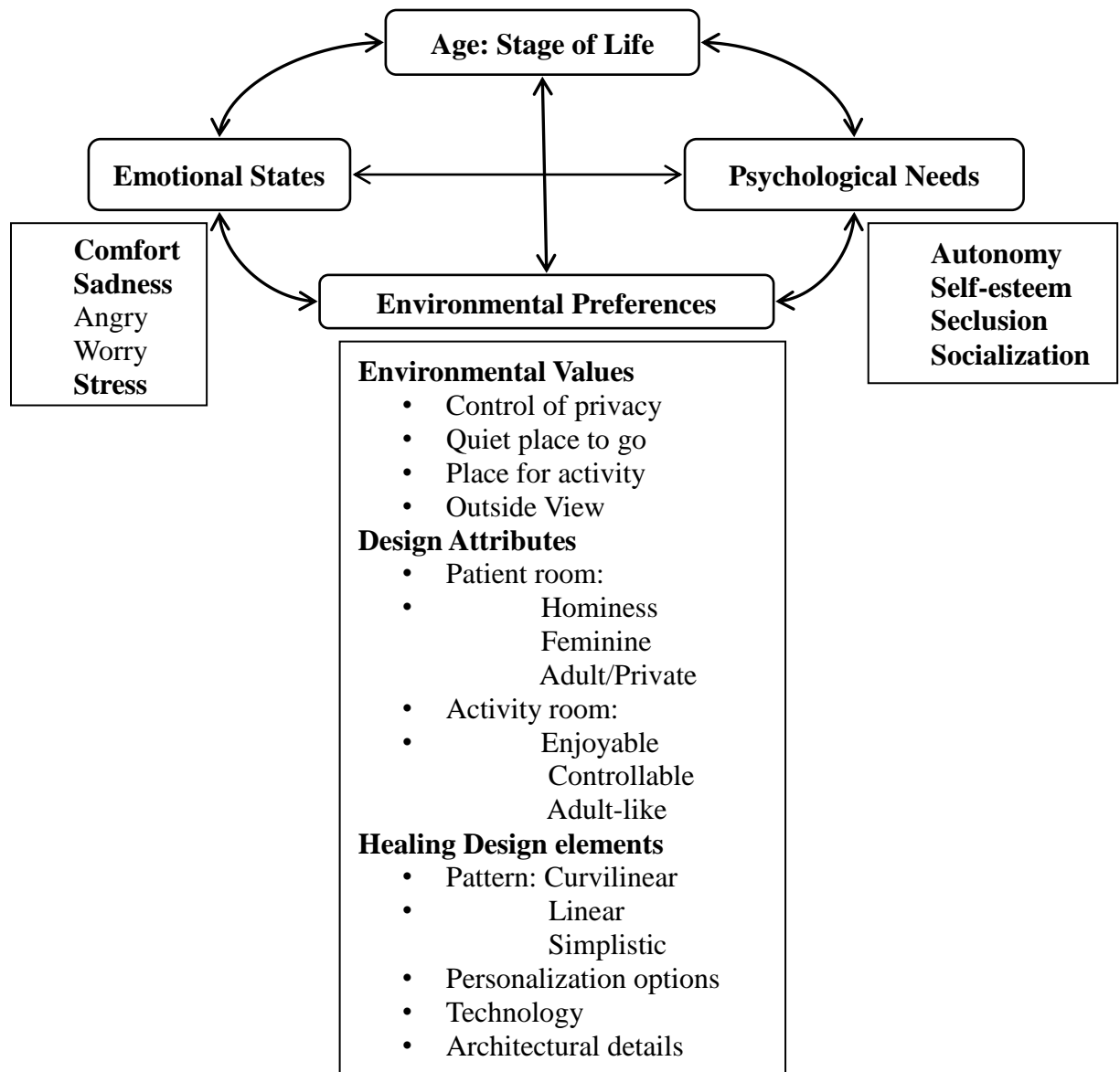- Technology
- Architectural details

Figure 5.7. Influential Internal Factors for Adolescent Patients' Healing

Design attributes that potentially promote healing effects are 'Hominess', 'Feminine', and 'Adult/Private' for patient room design. 'Enjoyable', 'Controllable', and 'Adult-like' are influential design attributes for designing activity rooms. Specific design

elements that contain positive healing effects are bright colors with natural curvilinear

and simplistic linear pattern, personalization options, technology, and architectural details.

The application of symbolic design should be based on adolescents' internal

factors. Variant surface finishes and components could be part of the age-appropriate

healing in terms of complexity preferences. To enhance adolescent patients' quality of

life, their emotional states, preference values, and preference test results should be

applied in a holistic way. Figure 5.8 shows the six design attributes that potentially affect

adolescent patients' holistic quality of life in hospital environments.

```
              ┌──────────────────────────┐
              │       Health Status      │
              └──────────────────────────┘
                  •  Physical symptom
                  •  Isolation from family & peers


┌────────────┐                                    ┌────────────┐
│  Internal  │ ═══►    ( Healing    )  ◄═══        │  External  │
│  factors   │        (  process    )             │  factors   │
└────────────┘                                    └────────────┘
  •   Age                    ║                       •  Patient room:
  •   Emotional state        ║                              : Hominess
  •   Environmental Values   ▼                                Feminine
        Control of Privacy                                    Adult/Private
        Quiet place                                   •  Activity room
        Activity room                                        : Enjoyable
        Outside view                                           Controllable
  •   Preference                                                Adult-Like

              ┌──────────────────────────┐
              │   Improved Health Status &│
              │      Quality of Life      │
              └──────────────────────────┘
                        Self-esteem
                        Relaxation
                        Enjoyment
                      Physical Healing
```
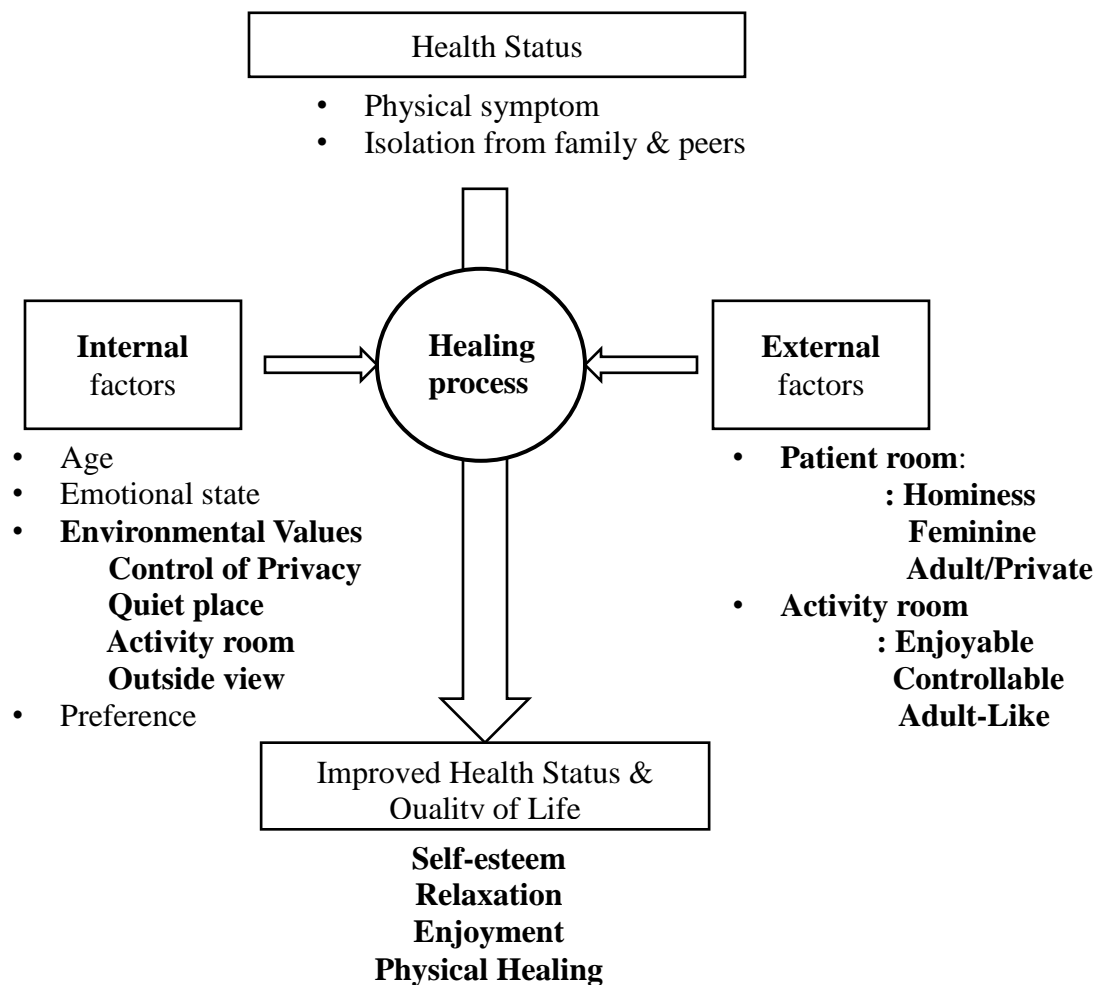
Figure 5.8. Healing Design Attributes for Promoting Adolescent Patients' Quality of Life

In conclusion, this study was able to provide some aspects of adolescents' preferences on surface patterns and personalization in hospital design. Findings support the values of patients' emotional states and preference values in terms of promoting adolescents' holistic quality of life.

This research limited its area of survey to surface finishes and interior components in patient room design, or space layout and potential activities in activity room design. Therefore, further research for holistic healing design for adolescent patients regarding preferences on lighting and other interior components in patient rooms and activity rooms are necessary.

More studies on age-appropriate design elements for adolescents are also required. Since emotional states resulting from hospitalization would largely affect adolescent patients' perception of the interior experiences, survey results of inpatient adolescents may be different from those of outpatients. This research found 'feminine' as one of design attributes in adolescent patient room design; however, further research with male adolescent patients is needed to clarify the effects of the feminine attribute.

Appendix A: Statistics Results

Table 1 Mean of Emotional States by Gender (5-point scale)

	feel comfortable	feel sad	feel angry	worry for future	feel stress
Male	4.00	1.37	1.32	1.89	2.21
Female	4.23	1.23	1.15	2.00	1.77
Total	4.09	1.31	1.25	1.94	2.03

Table 2 Mean of Emotional States by Age (5-point scale)

Age	feel comfortable	feel sad	feel angry	worry for future	feel stress
15	3.94	1.35	1.24	2.06	2.18
16	4.60	1.40	1.00	1.80	2.00
17	3.83	1.33	1.67	1.33	2.33
18	4.50	1.00	1.00	2.50	1.00

Table 3 Mean of Preference Values by Gender (5-point scale)

	N	Able to see friends	Place for friends	Activity room	Personal items	Quiet place	Control privacy	Outside view
Male	13	3.95	4	4.11	3.84	4.16	4.58	4.32
Female	19	3.77	3.77	4.31	3.62	4.38	4.77	3.92
Total	32	3.88	3.91	4.19	3.75	4.25	4.77	4.16

Table 4 Mean of Preference Values by Age (5-point scale)

Age	N	Able to see friends	Place for friends	Activity room	Personal items	Quiet place	Control privacy	Outside view
15	17	3.65	4.18	4.12	3.59	4.41	4.59	4.12
16	5	3.80	2.40	4.40	3.60	3.80	5.00	4.00
17	6	4.33	4.17	4.00	4.17	3.83	4.33	4.67
18	4	4.25	4.25	4.50	4.00	4.75	5.00	3.75

Table 5 Mean Score of Hominess for each patient room by color and design

Color	Orange					Blue				
Design	D1	D2	**D3**	D4	**D5**	D1	D2	D3	**D4**	D5
Mean	4.25	3.93	**4.41**	4.17	**4.33**	4.28	4.22	4.19	**4.31**	4.25

Table 6 Mean Score of Feminine for each patient room by color and design

Color	Orange					Blue				
Design	D1	D2	**D3**	D4	D5	**D1**	D2	**D3**	D4	D5
Mean	3.85	3.30	**4.13**	3.56	3.45	**3.90**	3.44	**3.86**	3.83	3.72

Table 7 Mean Score of Adult-like for each patient room by color and design

Color	Orange					Blue				
Design	D1	**D2**	D3	**D4**	D5	D1	D2	D3	D4	**D5**
Mean	3.02	**3.21**	2.84	**3.24**	3.02	2.73	3.05	2.82	2.81	**3.13**

Table 8 Frequency of the favorite patient room choice

Favorite room	Frequency	Percent
Blue room 1	1	3.13
Blue room 2	1	3.13
Blue room 3	4	12.50
Blue room 4	**7**	21.88
Blue room 5	**6**	18.75
Orange room 1	0	0
Orange room 2	0	0
Orange room3	**6**	18.75
Orange room4	4	12.50
Orange room5	3	9.38
total	N=32	100

Table 9 the Frequency of Favorite choice

		Favorite Activity Room		
Room code	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A1	2	6.25	2	6.25
A2	0	0	2	6.25
A3	10	31.25	12	37.50
A4	20	62.50	32	100.00

Appendix B: Data Collection Instruments

Health-Related Emotional States Survey

These questions ask you about your present feelings. Think about how you feel now while you are in the hospital. Please, circle the number that best matches your emotions.

1. Do you feel comfortable?

1	2	3	4	5
Not at all				very much

2. Do you feel sad?

1	2	3	4	5
Not at all				very much

3. Do you feel angry?

1	2	3	4	5
Not at all				very much

4. Do you worry about what will happen to you?

1	2	3	4	5
Not at all				very much

5. Do you feel stress?

1	2	3	4	5
Not at all				very much

6. If so, is your stress related to your health?   Yes   No

Please, circle the answer that best describes you.

7. Gender   Male   Female

8. How old are you?   15   16   17   18

9. Grade in school   9   10   11   12

10. Have you ever been previously hospitalized?   Yes   No

11. Are you from   a city   a small town   a farm

Photo analysis (5-point Likert Scale)

Please, check mark (√) the number that describes how you feel when seeing the photos.

Words Pairs						
	1	2	3	4	5	
rough						smooth
uncomfortable						comfortable
unpleasant						pleasant
crowded						roomy
calming						stimulating
childlike						adult like
unsafe						safe
unfriendly						welcoming
isolated						connected
uninviting						inviting
boring						dynamic
fixed						flexible
uncontrollable						controllable
public						private
cool						warm
unfamiliar						familiar
awful						nice
unenjoyable						enjoyable
dark						bright
hard						soften
masculine						feminine
formal						informal

Environmental Preferences Value Survey

Imagine that you are in the hospital. Read the items below. Circle the number that best describes the level of importance placed on each item.

1. To be able to see and entertain friends

1	2	3	4	5
Not important				very important

2. To have a place outside your room to meet your friends

1	2	3	4	5
Not important				very important

3. To have a place outside your room to do individual activities

1	2	3	4	5
Not important				very important

4. To display personal items in your room

1	2	3	4	5
Not important				very important

5. To have a quiet place to go

1	2	3	4	5
Not important				very important

6. To be able to control your privacy

1	2	3	4	5
Not important				very important

7. To have to the outside view

1	2	3	4	5
Not important				very important

8. Which patient room do you prefer to stay?   O1   O2   O3   O4   O5
                                                 B1   B2   B3   B4   B5

9. Would you explain why?

10. Which activity room do you prefer to use?   A1   A 2   A3   A4

11. Would you explain why?

Appendix C: Approval of Institutional Review Board

U K.
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KENTUCKY®

Initial Review

Approval Ends
January 18, 2012

IRB Number
10-0855-P4S

TO: Eun Young Kim,
            Unassigned
            School of Interior Design
            Rm 110 Funkhouser 0054
            PI phone #: (859) 327-4047

FROM: Chairperson/Vice Chairperson
            Non-medical Institutional Review Board (IRB)

SUBJECT: Approval of Protocol Number 10-0855-P4S

DATE: January 25, 2011

On January 19, 2011, the Non-medical Institutional Review Board approved your protocol entitled:

Healing Healthcare Design for Adolescent Patients: Promoting Holistic Quality of Life

Approval is effective from January 19, 2011 until January 18, 2012 and extends to any consent/assent form, cover letter, and/or phone script.   If applicable, attached is the IRB approved consent/assent document(s) to be used when enrolling subjects. **[Note, subjects can only be enrolled using consent/assent forms which have a valid "IRB Approval" stamp unless special waiver has been obtained from the IRB.]** Prior to the end of this period, you will be sent a Continuation Review Report Form which must be completed and returned to the Office of Research Integrity so that the protocol can be reviewed and approved for the next period.

In implementing the research activities, you are responsible for complying with IRB decisions, conditions and requirements. The research procedures should be implemented as approved in the IRB protocol. It is the principal investigators responsibility to ensure any changes planned for the research are submitted for review and approval by the IRB prior to implementation. Protocol changes made without prior IRB approval to eliminate apparent hazards to the subject(s) should be reported in writing immediately to the IRB. Furthermore, discontinuing a study or completion of a study is considered a change in the protocol's status and therefore the IRB should be promptly notified in writing.

For information describing investigator responsibilities after obtaining IRB approval, download and read the document "PI Guidance to Responsibilities, Qualifications, Records and Documentation of Human Subjects Research" from the Office of Research Integrity's Guidance and Policy Documents web page [http://www.research.uky.edu/ori/human/guidance.htm#PIresp]. Additional information regarding IRB review, federal regulations, and institutional policies may be found through ORI's web site [http://www.research.uky.edu/ori]. If you have questions, need additional information, or would like a paper copy of the above mentioned document, contact the Office of Research Integrity at (859) 257-9428.

Chairperson/Vice Chairperson

Appendix D: Parental /participant Permission forms for the survey
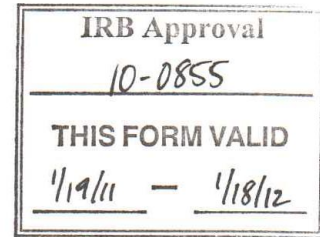
Parental Consent to Participate in a Research Study: Survey

Healing healthcare design for adolescent patients: Promoting holistic quality of life

WHY IS YOUR CHILD BEING INVITED TO TAKE PART IN THIS RESEARCH?

Your child is being invited to take part in a research study about healing hospital design for adolescent patients because your child is one of adolescent patients in UK Clinic who can give important data of age-appropriate hospital design for adolescents by responding to this survey. If your child volunteers to take part in this study, your child will be one of about 30 people to input their opinions and feelings about hospital design. The result of your child's input will lead to the design of better hospital rooms and facilities.

WHO IS DOING THE STUDY?

The person in charge of this study is *Eun Young Kim* who is a graduate student of University of Kentucky School of Interior Design. She is working on her Master's Degree thesis study and is being guided by her advisor *Dr. Allison Carll-white. Dr. Omar*, chief of Adolescent Medicine Division at UK Healthcare will assist in recruiting participants.

WHAT IS THE PURPOSE OF THIS STUDY?

The purpose of this study is to understand how hospital design may help adolescent patients' healing process while they are hospitalized and find out age-appropriate hospital design elements that provide potential healing effects and promote adolescents' quality of life.

By doing this study, we hope to impact hospital design guidelines for adolescent patients.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST?

The research procedures will be conducted at the consulting room at Kentucky Clinic, Adolescent Division. Survey will take about 20 minutes.

WHAT WILL YOUR CHILD BE ASKED TO DO?

Your child will be asked to respond to hospital photos by choosing numbers, from 0 to 5, depending on how your child feels about the photos. Then your child will answer the design questions without seeing photos and answer how your child is feeling in the same manner as your child answers to photographs. It will take about 20 minutes to do.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?

To the best of our knowledge, the things your child will be doing have no more risk of harm than your child would experience in everyday life.

WILL YOUR CHILD BENEFIT FROM TAKING PART IN THIS STUDY?

There is no benefit to take part in this research study.

WHAT WILL IT COST YOUR CHILD TO PARTICIPATE?

There are no costs associated with taking part in the study.

WILL YOUR CHILD RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY?

Your child will receive a food certificate from Fast food restaurant for taking part in this study.

WHO WILL SEE THE INFORMATION THAT YOUR CHILD GIVE?

We will make every effort to keep confidential all survey records that identify your child to the extent allowed by law. Your child's information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. Your child will not be personally identified in these written materials. We may publish the results of this study; however, we are not collecting your child's name and other identifying information private, thus there will be no way to indentify your child.

WHAT IF YOU OR YOUR CHILD HAS QUESTIONS, SUGGESTIONS, CONCERNS, OR COMPLAINTS?

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you or your child has questions, suggestions, concerns, or complaints about the study, you can contact the investigator, Eun Young Kim at 859-327-4047.

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Alternately you can send an email at eunyoung.kim@uky.edu. If you have any questions about your child's rights as a volunteer in this research, contact the staff in the Office of Research Integrity at the University of Kentucky at 859-257-9428 or toll free at 1-866-400-9428. We will give your child a signed copy of this consent form to take with your child.

_____   _____
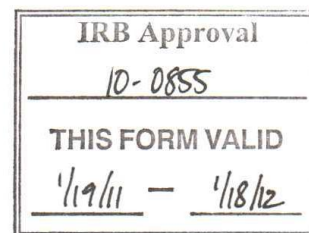Signature of person agreeing to take part in the study   Date

_____
Printed name of person agreeing to take part in the study

_____   _____
Name of [authorized] person obtaining informed consent   Date

ASSENT FORM (Survey)

Healing healthcare design for adolescents patient: Promoting holistic quality of life

You are invited to be in a research study being done by *Eun Young Kim* who is a graduate student from the University of Kentucky. You are invited because this study is about to investigate healing design elements for adolescent patients in hospital design and you are one of adolescent patients in the Adolescent Medicine at University of Kentucky Hospital.

If you agree to be in the study, you will be asked to answer survey questions about hospital design and your feelings when you are in hospitals. You will be asked to give your feelings regarding hospital photos that are provided by researcher. Next, without photos, you will be asked to give your opinion of hospital design in general and your current emotional state. This survey will take 15~20 minutes to finish.

Your parent/guardian agreed with your participation in this survey. There is no way to indentify you from the survey answers. The survey will not ask your name or any other questions that might identify you.

If something makes you feel bad while you are in the study, please tell Eun Young Kim (researcher). If you decide at any time you do not want to finish the study, you may stop whenever you want.

You can ask Eun Young Kim questions any time about anything in this study.

Signing this paper means that you have read this or had it read to you, and that you agree to be in the study. If you do not want to be in the study, do not sign the paper. Being in the study is up to you, and no one will be mad if you do not sign this paper or even if you change your mind later. You agree that you have been told about this study and why it is being done and what to do.

_____   _____
Signature of Person Agreeing to be in the Study   Date Signed
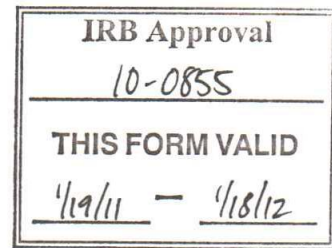
Consent to Participate in a Research Study (Survey)

Healing healthcare design for adolescent patients: Promoting holistic quality of life

WHY ARE YOU BEING INVITED TO TAKE PART IN THIS RESEARCH?

You are being invited to take part in a research study about healing hospital design for adolescent patients. You are being invited to take part in this research study because you are one of adolescent patients in UK Clinic who can give important data of age-appropriate hospital design for adolescents by responding to this survey. If you volunteer to take part in this study, you will be one of about 30 people to input their opinions and feelings about hospital design. The result of your nput will lead to the design of better hospital rooms and facilities.

WHO IS DOING THE STUDY?

The person in charge of this study is *Eun Young Kim* who is a graduate student of University of Kentucky School of Interior Design. She is working on her Master's Degree thesis study and is being guided by her advisor *Dr. Allison Carll-white*. *Dr. Omar*, chief of Adolescent Medicine Division at UK Healthcare will assist in recruiting patients.

WHAT IS THE PURPOSE OF THIS STUDY?

The purpose of this study is to understand how hospital design may help adolescent patients' healing process while they are hospitalized and find out age-appropriate hospital design elements that provide potential healing effects and promote adolescents' quality of life.

By doing this study, we hope to impact hospital design guidelines for adolescent patients.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST?

The research procedures will be conducted at the consulting room at Kentucky Clinic, Adolescent Division. Survey will take about 20 minutes.

WHAT WILL YOU BE ASKED TO DO?

You will be asked to respond to hospital photos by choosing numbers, from 0 to 5, depending on how you feel about the photos. Then you will answer the design questions without seeing photos and answer how you are feeling in the same manner as you answer to photographs. It will take about 20 minutes to do.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?

To the best of our knowledge, the things you will be doing have no more risk of harm than you would experience in everyday life.

WILL YOU BENEFIT FROM TAKING PART IN THIS STUDY?

There is no benefit to take part in this research study.

WHAT WILL IT COST YOU TO PARTICIPATE?

There are no costs associated with taking part in the study.

WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY?

You will receive a food certificate from Fast food restaurant for taking part in this study.

WHO WILL SEE THE INFORMATION THAT YOU GIVE?

We will make every effort to keep confidential all survey records that identify you to the extent allowed by law. Your information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. You will not be personally identified in these written materials. We may publish the results of this study; however, we are not collecting your name and other identifying information private, thus there will be no way to indentify you.

WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS, CONCERNS, OR COMPLAINTS?

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study, you can contact the investigator, Eun Young Kim at 859-327-4047. Alternately you can send an email at eunyoung.kim@uky.edu. If you have any questions about your rights as a volunteer in this research, contact the staff in the Office of Research Integrity at the University of Kentucky at 859-257-9428 or toll free at 1-866-400-9428. We will give you a signed copy of this consent form to take with you.

_____   _____
Signature of person agreeing to take part in the study   Date

_____
Printed name of person agreeing to take part in the study

_____   _____
Name of [authorized] person obtaining informed consent   Date

Appendix E: Copyright Permission for Activity Room Images

Re: Copyright permission

Komiske, Bruce <BKomiske@childrensmemorial.org>   Mon, Jun 27, 2011 at 8:26 AM
To: "alessina@imagespublishing.com" <alessina@imagespublishing.com>, "eunyoung.kim@uky.edu"
<eunyoung.kim@uky.edu>
Cc: "hedcarll@uky.edu" <hedcarll@uky.edu>, "carla@uky.edu" <carla@uky.edu>

Ok with me! Please give photo credit if listed.

From: Alessina Brooks
To: Kim, Eunyoung
Cc: Allison Carll-White ; Cantagallo, Carla ; Alessina Brooks ; Komiske, Bruce
Sent: Sun Jun 26 22:35:39 2011
Subject: Re: Copyright permission

Hello Eun

Thank you for your email.

Can I refer you please to Dr Bruce King Komiske to ask permission. His direct email is:
BKomiske@childrensmemorial.org

Best
Alessina Brooks

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e alessina@imagespublishing.com **w** http://www.imagespublishing.com/

On 24/06/11 11:35 PM, "Kim, Eunyoung" <eunyoung.kim@uky.edu> wrote:

To whom it may concern:

I am a graduate student at the University of Kentucky majoring in Interior Design.

For my master's degree thesis, I have worked on "Healing Healthcare Design for Adolescent Patients".
During the literature review I found one of your company's books, titled "Designing the World's Best
Children's Hospitals" by Bruce King Komishe. The book contains lots of excellent children's hospital
examples. Therefore I am wondering if I would be allowed to use three hospital images from the book
in my thesis. Specifically, the images are on pages 79(photo: Computer in the waiting room), 93(photo:
Teen activity room), and 114 (photo: Artwork as appositive distraction). They photos will be used for

educational purposes only and I will make no financial gain from their publication in my thesis.

If I have your permission to use these three photos for illustrative purposes only, you may contact me by phone at 859-327-4047 <tel:859-327-4047> or email (Eunyoung.kim@uky.edu). You can also contact the chair of my committee, Dr Allison Carll-white at 859-257-7763 <tel:859-257-7763> (or email, hedcarll@uky.edu).

I will look forward to hearing from you.

Sincerely,

Eun Young Kim
Graduate Student
School of Interior Design
University of Kentucky
eunyoung.kim@uky.edu <mailto:eunyoung.kim@uky.edu>

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EDUCATION

- ABD (Qualified for Ph.D. Dissertation), Housing & Interior Design,
  Yonsei University (Seoul, Korea), August, 1998
    - Focused topic: "Color design and analysis on interior space using computer"
    - Advisor: Hyunsoo Lee, Ph.D.
- M.S., Housing & Interior Design, Yonsei University, 1993
    - Thesis: Thermal Environment and Thermal Comfort Response in Elderly Housing
    - Advisor: Chungsook Yoon, Ph.D.
- B.S., Housing & Interior Design, Yonsei University, 1990

TEACHING EXPERINCE

- Teaching Assistant, University of Kentucky, Fall 2009~Spring 2011/ Spring 2005
    - Class: ID370 (Vertical Studio)
      ID365 (Interior Design Finish Materials)
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      ID234 (Research, Behavior and Design Theory)
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- Instructor, Lexington Korean School, Lexington, KY. 2002~2005/ Fall 2010~present: International class / Art class
- Instructor, Korea National Open University. Seoul, Korea. Fall 1997
- Instructor, Chonbuk National University. Jeonju, Korea. Fall 1996
- Instructor, Kaywon School of Art & Design. Seongnam, Korea. Spring 1996
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RESEARCH EXPERINECE & PUBLICATIONS

Research Assistant, Yonsei University, 1991-1997

- Design project: Samsung Housing Exhibition (Kitchen Exhibition design team)
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- Jeon, Y & Kim,E.Y.(2003). Policy supports and directions for improvement on the quality of rural housing in Korea and America*, Journal or Korean Housing Association*, 14, pp229-234.
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