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THE IMPACT OF GREEN DESIGN ON THE EMOTIONAL HEALTH OF PATIENTS IN CHILDREN'S HEALTHCARE FACILITIES

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by

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With a significant amount of research focusing on the design of healthcare facilities, this thesis examined the relationship between specific aspects of green design and their effect on the emotional health and wellbeing of patients in children's healthcare facilities. Case studies of two children's clinics in Omaha, Nebraska were conducted to study the effects a connection to the natural world and the acoustic environment had on patients' emotional state. One case study site was a newly built children's clinic that incorporated a connection to nature with a focus on the acoustic environment while the other was an adaptive reuse building that did not include a connection to nature nor focus on the acoustic environment.

A qualitative mixed method approach was utilized in this study to identify and document a connection to nature and the acoustic environment within the design of these two pediatric clinics as well as study the overall emotional health of patients. The interviews and site tours of each pediatric clinic documented the connection to nature and acoustic environment that was either present or absent in each design. The data obtained through observation of patients at each site showed a slight but meaningful connection between the pediatric clinics and the emotional state of patients. While there were many extraneous variables, including variables not pertaining to the design of the built environment, which may have contributed to the perceived emotional state of children at

each clinic, the observational findings combined with the initial literature review show the benefits of incorporating a connection to nature and acoustic environment in pediatric healthcare facilities. These findings also offer a more specific study on the effects of green design on the emotional health of children that should be of value to healthcare designers and healthcare facilities. Due to the limitations of this research, continued research in the area of green design and the emotional health of patients in children's healthcare facilities will clarify and further develop these findings.

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LIST OF MULTIMEDIA OBJECTS

Chapter I: Introduction

This thesis will explore the relationship between aspects of green design in children's healthcare facilities and the resulting effects on the emotional health and wellbeing of patients. Using LEED 2009 for Healthcare New Construction and Major Renovations rating system as a standard of measure, this thesis will specifically focus on three credits within that rating system. Those three credits include Sustainable Sites Credit 9.1: Connection to the Natural World – Places of Respite, Sustainable Sites Credit 9.2: Connection to the Natural World – Direct Exterior Access for Patients and Indoor Environmental Quality Credit 2: Acoustic Environment. By examining these three specific credits within children's healthcare environments, this thesis will study how the built environment affects the emotional health and wellbeing of patients.

The operation and construction of buildings "consumes billions of tons of raw materials, generates significant waste, consumes a tremendous amount of energy and contributes toxic emissions to the air. Given this impact, there are significant opportunities to improve environmental quality and human health through the green planning, design and construction of health care facilities" (Green 2012). With the built environment in the United States alone responsible for 39% of carbon dioxide emissions, 40% of energy consumption and 13% of water consumption (USGBC 2012), there was a recognizable need for buildings to become more environmentally responsible. The United States Green Building Council (USGBC) was established in 1993 with the mission "to promote sustainability in the building and construction industry" in an effort to create a sustainable future through cost-efficient and energy-saving buildings (USGBC 2012).

In 2000, the USGBC implemented a measurable method to redefine the way the built environment is designed, constructed, operated and maintained. Leadership in Energy and Environmental Design (LEED) is an internationally recognized rating system that "provides independent, third-party verification a building, home or community was designed and built using strategies aimed at achieving high performance in key areas of human and environmental health" (USGBC 2012). Since its implementation in 2000, "nearly 50,000 projects are participating in LEED, comprising more than 8.9 billion square feet of construction space" in more than 130 countries. With the use of a single source for rating and certifying sustainable building designs, the USGBC has successfully implemented an internationally recognized and followed set of green building standards.

When the initial version of the LEED rating system was released in 2000, the New Construction and Major Renovations section of the LEED rating system was applied to various building types, including healthcare facilities. The category of LEED for New Construction and Major Renovations "takes an integrative approach to producing buildings that are designed to be efficient and have a lower impact on their environment" (USGBC 2012). The original LEED rating system was based on a 69 point scale spread across six categories including sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and innovation and design process. In addition to meeting all of the prerequisites in each category, depending on the amount of points earned in each of these categories, buildings can qualify for four levels of certification: Certified: 26-32 points, Silver: 33-38 points, Gold: 39-51 points and Platinum: 52-69 points (USGBC 2012).

From its original implementation in 2000, the LEED rating system has undergone changes to update existing credits, add new ones and overhaul the rating system itself. In 2009 USGBC released the latest version of LEED: LEED 2009 Green Building Rating System. Under this new rating system there are 100 base points possible. These 100 points are distributed across five categories including sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. There are ten additional points available in the categories of innovation in design and regional priority. Similar to the original version, in addition to meeting all of the prerequisites, depending on the amount of points earned in each of these categories, buildings can qualify for four levels of certification. These four levels and the corresponding points necessary for each level include: Certified: 40-49 points, Silver: 50-59 points, Gold: 60-79 points and Platinum: 80 points and above (USGBC 2012).

Although the LEED 2009 Green Building Rating System is the basis for designing, constructing, operating and maintaining buildings in a more sustainable manner, healthcare facilities provide unique challenges that are not addressed in this rating system. "Healthcare buildings often have strict regulatory requirements, 24/7 operations, and specific programmatic demands that are not covered in LEED for New Construction" (USGBC 2012). With the healthcare industry representing $16 billion and more than 100 million square feet of construction per year (Green 2012), the healthcare industry has the ability to significantly impact the environment in the way their facilities are designed, constructed, operated and maintained. In light of this opportunity, USGBC teamed up with Green Guide for Healthcare and Do No Harm to supplement the LEED 2009 Green Building Rating System with a specific rating system for healthcare facilities: LEED

2009 for Healthcare Green Building Rating System. The LEED for Healthcare rating system acknowledges the unique challenges surrounding healthcare facilities "by both modifying existing credits and creating new, healthcare-specific credits. The goal is to help promote healthful, durable, affordable, and environmentally sound practices in these projects" (USGBC 2012). LEED for Healthcare can be used for various types of healthcare facilities including licensed and federal inpatient and outpatient care facilities and licensed long term care facilities among others.

Depending on the time in which healthcare facilities that are recognized by LEED were designed and constructed, they may have earned LEED certification under either the original layout of the rating system or the current version. With the implementation of LEED for Healthcare, current and future healthcare facilities wishing to become LEED certified will use the LEED for Healthcare as their basis and rating system. With the goal of LEED for Healthcare stated as "to help promote healthful, durable, affordable, and environmentally sound practices in these projects" (USGBC 2012), this thesis will specifically focus on the first aspect of this goal: to help promote healthful practices. More specifically, with guidance from LEED for Healthcare, this thesis will explore the relationship between specific aspects of green design in children's healthcare facilities and the resulting effects on the emotional health and wellbeing of patients.

Chapter II: Literature Review

2.1 Research Problem

There has been significant research on the design of healthcare facilities in recent decades. Through the research and studies conducted on the design of healthcare facilities, it has been shown that poor design in healthcare facilities negatively impacts patients in ways such as increased anxiety, elevated blood pressure, depression and increased intake of pain medication (Dooley 2003). These negative effects of poor design in healthcare facilities translates to a decline in patients overall health and ability to heal, ultimately leading to increased time spent in the hospital, increased expenses for healthcare facilities and increased expenses for patients.

These research problems are compounded when the healthcare facilities are children's healthcare facilities. Children are a particularly vulnerable sector of the population in terms of emotional health and wellbeing. When entering a healthcare facility, patients are subjected to "an onslaught of new experiences: unknown faces, foreign sounds, sights and smells" (Norton-Westwood 2012) on top of the physical ailments that initially brought them to the healthcare facility. In situations such as this, adults would be able to use the coping skills they've acquired over their lifetime to alleviate such experiences, but in children, these coping skills are underdeveloped. Without the aid of more developed coping skills, unfamiliar circumstances and situations such as this lead to fear and increased anxiety in children (Norton-Westwood 2012). Compared to adults, children are also especially susceptible to environmental toxins including disease and sickness (Institute 2007). The combination of children's emotional uncertainty, high susceptibility to disease and sickness and the increased rate of sickness

that is spread through healthcare facilities (Bosch 2011) highlights the importance of incorporating aspects of green design into children's healthcare facilities to reduce environmental stressors and enhance the healing process.

2.2 Research Significance

Just as the built environment has the potential to affect user's physically through environmental air pollutants, toxins, etc., the physical environment also has the ability to influence health through psychological methods (Largo-White 2010). It is important to understand the effects of the built environment on patients in children's healthcare facilities in an effort to incorporate better design outcomes. The healthcare industry in the United States is currently "facing one of the largest hospital building booms in US history" (Ulrich et al 2004). This is occurring because of the need to replace aging healthcare facilities originally built in the 1970's, the incorporation of new technology and the increasing age of the baby boomer generation. "Shifting health care's building efforts to manifest the principle of "first do no harm" can be an enormous force for market transformation" (Green 2012). For example, with the healthcare industry's recent demand for safer, less toxic materials, significant advancements in environmentally friendly products such as PVC-free carpeting, window treatments and furnishings have been explored and developed in response to this demand (Green 2012). With the healthcare industry representing such a large part of the design and construction market in the United States, continuing to demand environmentally, physically and psychologically healthy built environments will continue to create opportunities for architects, interior designers, engineers and manufacturers to rise to the challenge.

Historically, the design of healthcare facilities focused on creating work environments that were functional and efficient for staff as well as buildings that would reduce the risk of infection (Ulrich 2002). Subsequently, this focus on efficient and sanitary healthcare facilities resulted in the design and construction of hundreds of major hospitals that are now "considered starkly institutional, unacceptably stressful, and unsuited to the emotional needs of patients, their families, and even healthcare staff" (Ulrich 2002). With so much recent research focusing on the design and design outcomes of healthcare facilities, there is a growing awareness for the need of healthcare facilities to combine functionality and sanitary requirements with environments that incorporate emotionally supportive and stress reducing characteristics.

In recent decades, this emphasis has gradually shifted from functional and sanitary spaces toward environments that are psychologically supportive. These psychologically supportive spaces are often referred to as healing environments. The term healing environment encompasses the ideology that the built environment "can make a difference in how quickly the patient recovers from or adapted to specific acute and chronic conditions" (Dijkstra 2006). Healthcare facilities that are designed to be healing environments have been shown to be beneficial in ways such as reducing patient anxiety, blood pressure, postoperative recovery time, use of pain medication and length of stay (Ulrich 1999, Cama 2009). The term healing environment encompasses many ambient design features of healthcare facilities that have the potential to affect patients psychologically including the availability of natural light, sound, odor, nature, use of materials and furniture layout. Since new construction and major renovations on healthcare facilities are frequently million, or even billion, dollar projects, the design and

construction of these new or renovated healthcare facilities will likely remain for decades (Ulrich 2004). This highlights the importance of creating an environment within the healthcare facility that enhances the healing process of current and future patients. By identifying and researching key green design strategies within the interior design of healthcare facilities that allow for positive distraction, elimination of environmental stressors and connection to nature, the design of children's healthcare facilities will have the ability to create spaces that "de-stress rather than distress children" (Norton-Westwood 2012).

Throughout this literature review process, two key aspects of creating healing environment's and emotionally supportive designs became apparent; and their link to the green design of healthcare facilities is undeniable. The first key idea includes the use of nature in the design of healthcare facilities to support healing through the use of positive distraction and connection to nature, which is identified in the Sustainable Sites category of LEED 2009 for Healthcare Green Building Rating System. The second key idea includes the focus on the acoustic environment of healthcare facilities to support healing through reducing environmental stressors. This second key aspect is identified in the Indoor Environmental Quality section of LEED 2009 for Healthcare Green Building Rating System.

2.3 Connection to the Natural World

The philosophy of nature improving the psychological and emotional wellbeing of patron's dates back to earliest of urban cities. In 1967, C.J. Glacken noted the writings of ancient Romans stating that they "valued contacts with nature as a contrast to the noise,

congestion and other stressors of the city" (Ulrich et al 1991). Furthermore, in 1865 Frederick Law Olmsted stated that nature "employs the mind without fatigue and yet exercises it; tranquilizes it and yet enlivens it; and thus, through the influence of the mind over the body, gives the effect of refreshing rest and reinvigoration to the whole system" (Olmsted, 1865). With so much historical context on the psychological and emotional implications of nature, current healthcare facilities have only recently begun to understand and embrace the overall effects and benefits to patients, staff and their bottom line created through the incorporation of nature into their facility.

While nature in any capacity contributes to bettering the emotional health of patients through creating an underlying sense of serenity and calm (Whitehouse et al 2001), these varying levels of connection to nature have been studied independently in an attempt to better understand the various effects resulting from each type of connection to nature within the healthcare environment. The first connection to nature within healthcare facilities that has been significantly studied for decades is the effect of natural daylight on the healing process. Studies on the effects of natural daylight have shown that there is a significant link between natural daylight and depression. A study conducted by Beauchemin and Hays showed that patients who had been hospitalized for severe depression responded to treatment better when assigned to brightly lit rooms with natural daylight as opposed to darker rooms with lesser amounts and quality of natural daylight. On average, patients assigned to the brightly lit rooms reduced their hospital stay by an average of 3.67 days compared to patients assigned to the darker hospital rooms (1996). Multiple studies similar to this have been conducted on various types of healthcare patients. The resulting outcomes of the studies show a strong link between

natural daylight and reduced depression, reduced hospital stays and reduced intake of pain medication (Ulrich 2004). While the incorporation of natural daylight has significant positive effects on patients, coupling that with views of nature has been shown to create similar effects on the emotional health and wellbeing of patients.

Views of natural elements such as vegetation and water have been shown to "sustain interest and attention more effectively than urban views" (Ulrich 1984). A study conducted by Ulrich assessed patient recovery times for patients who had undergone gall bladder surgery. The meticulous study recorded the recovery rates of these patients. The patients were either assigned to a recovery room with a view out the window to deciduous trees or a view out the window to a brick wall. Ultimately, the study showed that patients with a view of the trees recovered and were discharged quicker (7.96 days) than patients with a view of the brick wall (8.7 days). Nurse's notes on the patients' emotional condition throughout their stay showed that there were more negative comments on patients with the view to the brick wall (3.96 percent) compared to patients with a view of the trees (1.13 percent) (Ulrich 1984). This study shows a significant link between nature and the recovery and emotional state of patients. Table 2.1 is a table from the study that shows a comparison of the dose and strength of pain medication needed per patient for those with a wall view and those with a tree view. The patients in the wall view group had a tendency to need higher strength and higher amounts of pain medication compared to the patients in the tree view group.

Analgesic strength	Number of doses					
	Days 0–1		Days 2–5		Days 6–7	
	Wall group	Tree group	Wall group	Tree group	Wall group	Tree group
Strong	2.56	2.40	2.48	0.96	0.22	0.17
Moderate	4.00	5.00	3.65	1.74	0.35	0.17
Weak	0.23	0.30	2.57	5.39	0.96	1.09

Table 2.1: Comparison of Dose and Strength of Pain Medication

Recently, there has been an influx of research on the physical connection to nature and its influence on the health of patients. Even brief encounters with nature for less than five minutes have been shown to produce significant stress reducing qualities in patients (Parsons et al 2000, Van den Berg et al 2003). While there are few studies that have evaluated the use and resulting effects of the physical connection to nature on patients in children's healthcare facilities, research conducted by Whitehouse, et al. did study this effect in a children's healthcare environment. Using behavioral observations and structured interviews, this study showed that although the natural spaces and healing gardens were used much less than anticipated by the researcher and designer, the resulting effects were "overwhelmingly positive." This physical connection to nature was linked to patients' improved mood and overall hospital satisfaction (Whitehouse et al 2001). With this strong connection between the physical connection to nature (even in small doses) and the emotional health of child patients, children's healthcare facilities with access to natural habitats are able to offer the restorative effects of nature as part of the healing process. The following tables are from the Whitehouse, et. al. study showing the results from specific aspects of their research. Table 2.2 shows why people decided to visit the healing garden, table 2.3 shows the reported changes in their mood after

visiting the healing garden and table 2.4 shows the overall satisfaction of the healing gardens.

Reason for going to the garden	Per cent $n = 52$
To relax and rest	28
To get away from my stressful environment	24
To enjoy the garden, be engaged	18
Walk by it on my way to work, rarely go in	12
It helps me cope with my worries	8
To meditate, outdoor therapy	4

Table 2.2: Reason for Visiting the Garden

Mood change	Per cent reporting $n = 52$
More relaxed, less stressed, content	54
Refreshed, rejuvenated, stronger	12
Pleased, more positive, better	12
No difference in mood	10
Able to think, find answers, cope	6
More connected in religious or spiritual way	6

Table 2.3: Reported Change in Mood After Visiting Garden

The survey asked:	Definitely Yes	probably yes	no opinion	probably no	definitely no
• Does the healing garden increase your overall satisfaction with Children's Hospital?	50%	30%	12%	4%	4%
• Would you recommend that others visit the garden?	72%	11%	11%	6%	0%
• Does the healing garden influence whether you recommend Children's Hospital to others?	20%	28%	26%	14%	12%
• In your opinion, is it important for hospitals to include healing gardens? ($n = 83$: garden users and nonusers)	74%	16%	9%	0%	1%

Table 2.4: Overall Reported Satisfaction of Garden

2.3.1 Sustainable Sites Credit 9.1: Connection to the Natural World – Places of Respite

A place of respite is defined by the Green Guide for Healthcare as "a place on the health care campus to connect health care patients, visitors, and staff to health benefits of the natural environment" (GGHC 2012). These places of respite offer positive distraction through various means of direct and indirect connections to nature. Places of respite can include interior and exterior locations that provide natural elements such natural daylight, views of nature through a window, plants, water, etc. (GGHC 2012).

LEED for Healthcare Sustainable Sites Credit 9.1: Connection to the Natural World – Places of Respite can earn the building 1 point toward achieving LEED Certification. Its intent is to "provide outdoor places of respite on the healthcare campus to connect patients, staff and visitors to the health benefits of the natural environment"

(USGBC 2012). This credit requires that the design provides accessible outdoor places of respite for patients and visitors in addition to dedicated outdoor place(s) of respite for staff. These places of respite must be located where "no medical intervention or direct medical care is delivered." These places of respite must also offer fresh air and access to the natural elements along with options for shade or indirect sun in seating areas (USGBC 2012). See Appendix A for the specific requirements.

2.3.2 Sustainable Sites Credit 9.2: Connection to the Natural World – Direct Exterior Access for Patients

While indirect contact through nature, such as viewing nature through a window, has been shown to be beneficial to patients emotional health, direct contact with nature during a patients stay has been shown to have a greater impact on physical symptom relief, stress reduction and patients sense of self (Sherman 2005). The incorporation of healing gardens in healthcare facilities allows for this direct access for patients to the natural environment. The healing effects of direct access to nature can be obtained through passive, quasi-passive or active engagement by enjoying the space through observing, sitting, listening, walking, exploring or engaging with the natural habitat (Cooper-Marcus and Barnes 1999).

LEED for Healthcare Sustainable Sites Credit 9.2: Connection to the Natural World – Direct Exterior Access for Patients can earn the building 1 point toward achieving LEED Certification. Its intent is to "provide building occupants with an indoor healing environment free of intrusive or disruptive levels of sound" (USGBC 2012). This credit requires that "direct access to an exterior courtyard, terrace, garden or balcony" be

provided for 75% of all inpatients as well as 75% of all outpatients with clinical length of stay longer than four hours. Areas provided as Places of Respite in SS Credit 9.1 can be included and calculated in SS Credit 9.2 if they qualify and meet all of the requirements (USGBC 2012). See Appendix B for the specific requirements.

2.4 Acoustic Environment

Managing the acoustic environment within healthcare facilities is a challenging task considering the constant activity, numerous noise sources (such as overhead paging systems, alarms, voices and noise generated by roommates) and the need to control infection (Busch-Vishniac 2005). Healthcare facility requirements such as these "supersede attention to noise control and often prohibit or restrict acoustical solutions used in other building types" (GGHC 2012). Although the design and operation of traditional healthcare facilities is intended to create an efficient and sanitary environment for patients, regular exposure to noise is closely associated with stress (Leather et al 2003). An improved acoustical environment by reducing and/or masking noise has been shown to reduce patient stress and improve patient outcomes.

The acoustical environment of healthcare facilities has been a subject of much discussion and research within the medical and design fields recently. While the World Health Organization states that the values of continuous background noise in patient rooms are 35dB and nighttime peaks are not to exceed 40dB (Berglund, Lindvall, & Schwela 1999), actual noise levels in traditional healthcare facilities are generally much higher. Multiple studies have shown that background noise levels typically range from 45dB to 68dB and frequently exceed 85dB to 90dB during peak times (Ulrich, et. al.

2004). Research literature reviewed by Ulrich, et. al. explains typical noise levels within hospitals and approximates similar noise levels within everyday experiences:

> Medical equipment and staff voices often produce 70dB to 75dB levels measured at the patient's head, which approach the noise level in a busy restaurant. Noises from alarms and certain equipment exceed 90dB (for example, portable X-ray machine), which is comparable to walking next to a busy highway when a motorcycle or large truck passes. A study in a NICU measured peak levels once per minute and found that 31 percent of peaks exceed 90dB. Noise peaks in hospitals can be extraordinarily loud. A recent study recorded 113dB during shift changes at a large hospital. Operating room noises from drills, saws, and other equipment are in the range of 100dB to 110dB, presenting a significant risk for noise-inducing hearing loss (2004).

Since each 10dB increase in noise represents double the previous perceived sound level (Ulrich, et. al. 2004), these typical background noise levels are drastic increases to the preferred levels as laid out by the World Health Organization.

Under the Indoor Environmental Quality (IEQ) of LEED for Healthcare, credit 2 refers to the acoustic environment within healthcare facilities. This credit explores ideas that create solutions to better the acoustic environment in healthcare facilities. Multiple studies have been conducted on the use of sound in correlation with the health and wellbeing of patients. Studies that focused on reducing sound throughout the healthcare

facility through means such as sound-absorbing ceiling tiles were met with positive patient outcomes. The use of a sound-absorbing ceiling in a study on patients admitted to an intensive coronary care unit reported that the rehospitalization rate and need for extra pain medication increased in the group that had bad acoustics in their recovery room (Hagerman et al 2005). In addition to reducing the rate of rehospitalization and the use of pain medication, good acoustics were shown to positively affect the perceived quality of care (Dijkstra 2006). The results of studies conducted that attempted to mask sound or add sound as a positive distraction (such as music or sounds of the ocean) proved to be "highly ambiguous" and dependent upon the individual's preference and characteristics (Dijkstra 2006). IEQ Credit 2: Acoustic Environment attempts to reduce the noise levels in healthcare facilities that previous studies have shown to be universally supportive to patients' emotional and physical outcomes.

2.4.1 Indoor Environmental Quality Credit 2: Acoustic Environment

Indoor Environmental Quality Credit 2: Acoustic Environment can earn the building 1-2 points toward achieving LEED Certification. Its intent is to "provide building occupants with an indoor healing environment free of intrusive or disruptive levels of sound" (USGBC 2012). It also requires that the facility be designed "to meet or exceed the sound and vibration criteria outlined in the 2010 FGI Guidelines for Design and Construction of Health Care Facilities (2010 FGI Guidelines) and the reference document on which it is based, Sound and Vibration Design Guidelines for Health Care Facilities (2010 SV Guidelines)" (USGBC 2012). See Appendix C for the specific requirements.

Chapter III: Proposed Study

Over the past two decades, there has been a growing body of research focusing on evidence based design within the field of healthcare design. More recently, there has been a greater interest in evidence based design as it pertains to the effects of sustainable design on the overall performance of healthcare facilities including but not limited to the economic benefits, financial benefits, and patient and staff benefits. The ultimate goal of this proposed study is to identify and study specific credits of sustainable design as outlined by the LEED 2009 for Healthcare: New Construction and Major Renovation Green Building Rating System and gauge each credit's influence on patients emotional health and wellbeing in children's healthcare facilities. Through the literature review process, multiple research questions were raised and the hypothesis with its various subsets was extrapolated.

Research Questions:

1. How can green design within the built environment of healthcare facilities affect patients' emotional health and wellbeing?
2. Which credits within LEED 2009 for Healthcare: New Construction and Major Renovation Green Building Rating System have the potential to impact the emotional health and wellbeing of patients in children's healthcare facilities?
3. Why do these specific credits within LEED 2009 for Healthcare: New Construction and Major Renovation Green Building Rating System affect the emotional health and wellbeing of patients in children's healthcare facilities?

Hypothesis:

1. There are aspects of green design that are beneficial to the emotional health and wellbeing of patients in children's healthcare facilities.
    a. Connection to the natural world affects the emotional health and wellbeing of patients in children's healthcare facilities.
    b. Direct exterior access affects the emotional health and wellbeing of patients in children's healthcare facilities.
    c. The acoustic environment affects the emotional health and wellbeing of patients in children's healthcare facilities.

Chapter IV: Method

4.1 Overview

This research was conducted through a mixed method approach utilizing case studies of two children's clinics. While much of the literature review focused on the emotional health of people in hospitals as opposed to pediatric clinics, the researcher decided to conduct this study in pediatric clinics as opposed to a hospital setting because it would grant the researcher a better opportunity to document the facility as well as observe a greater number of patients to allow for more data collection. This research was conducted through interviews with designers and the clinic staff, site tours and observational studies. The preliminary study of the two pediatric clinics included case studies of both facilities utilizing site visits, documentation and photographs of the facilities and interviews with the designer and/or point of contact within each pediatric clinic. The secondary aspect of the case studies included observational studies at each pediatric clinic to observe patient interaction with the built environment and their perceived emotional state. These case studies focused on two children's clinics in Omaha, Nebraska. The two children's clinics were carefully selected based on the incorporation of a connection to nature and the acoustic environment present in the design of the built environment. The two children's clinics are located in Omaha, Nebraska and are similar in the populations they serve including age range, gender and amount of patients seen on an annual basis.

Throughout this study, site visits were scheduled at each clinic to gain insight into the individual healthcare facilities and identify the degree of inclusion of the aspects of green design being studied in this thesis. It was essential to this study to identify the

degree in which the design of each clinic incorporated a connection to nature and the acoustic environment to discover if these variances resulted in altered levels of emotional health and wellbeing in patients.

The initial site visits were conducted to assess and document the physical conditions of the built environment at each clinic during times when there were minimal amounts of patients in the clinic. The site visits were intentionally conducted during times while there were not many patients present so as not to create a bias during the observational stage of this study. The intent of documenting and assessing the built environment of the two children's clinics was to provide verification and documentation that the independent variables pertaining to the connection to nature and the acoustic environment exist. Once the independent variables were established, the dependent variable of the emotional health and wellbeing of patients could be studied during the observational portion of this study.

To protect the identities of the pediatrics clinics and the participants, the study sites were assigned the following codes: Site A incorporated more connection to nature and focus on the acoustical environment throughout the design, and Site B incorporated less connection to nature and focus on the acoustical environment throughout the design. The following sections provide more detailed information on the process of the methods used during each phase of this study.

4.2 Documentation and Assessment of the Built Environment

The documentation and assessment of the built environment of each pediatric clinic occurred in multiple ways. The first step of the documentation and assessment

portion of this research was to create or obtain a floorplan of each facility. The floorplans were used to better understand the layout and circulation of the facilities as well as understand the adjacencies of the various areas that patients typically use when visiting the pediatric clinic such as the adjacency of the waiting rooms and exam rooms. This floorplan was also used during the observational portion of this research to identify where patients typically chose to sit and/or play in the waiting areas while they were waiting to be seen by medical professionals.

During this phase of the research, the researcher documented the degree to which each site incorporated a connection to nature in the design of each pediatric clinic. This was measured based on the amount of windows included in the areas patients and visitors typically spend a majority amount of time during their visit, such as the waiting areas and exam rooms. The degree to which each site incorporated a connection to nature was also measured based on the availability for children of all ages and heights to be able to access views to the outdoors. The actual views to the outdoors were documented to note if the windows included views of nature, views of buildings or a combination.

The researcher also documented the types of finishes and materials used that pertained to the acoustic environment of the clinic during this phase of the research. The types of finishes and materials that were documented included the flooring type and ceiling type throughout the facility. The researcher also documented the amount of natural light and availability of views to the outside that were accessible to patients in the waiting areas and exam rooms.

The second step to the documentation and assessment portion of this research was to tour and photograph each pediatric clinic. The tour of each pediatric clinic was given

to the researcher by the point of contact at each facility and/or the designer of the clinic. During the tour, the researcher asked questions about the design of each facility to better understand the history of each clinic and how the space is used by the patients and staff. An example of the questions asked throughout the tour is shown in Appendix E. Photographs were taken during the tours of each facility. A high emphasis was placed on photographing the areas where patients typically spend a majority of their when visiting the pediatric clinics. These spaces include the entrance, waiting areas and exam rooms.

4.3 Observation

The purpose of the observational section of the research was to focus on the patients and the way they interact with the space, the amount of time spent in various locations throughout the pediatric clinic, measure the acoustic environment and observe the patients perceived state of emotional comfort as they enter and leave the clinic.

Observations were conducted at each site over a two week period. The researcher conducted observations three to four days a week during the data collection and observation period of the research. Each session consisted of two hours of observation times during the morning and afternoon at each clinic. Examples of the observational times at each clinic include 8am-10am or 10am-noon during the morning, and noon-2pm or 2pm-4pm during the afternoon observations. Each clinic was observed for an equal amount of time. The observation time was spent documenting the amount of patients, the amount of time each patient spent in the waiting area, amount of time each patient spent in the exam rooms, how the patients interacted with the space and the patients overall perceived state of comfort as well as documenting the acoustic environment and

recording the decibel readings throughout each visit. The perceived emotional comfort level of each patient visiting the pediatric clinic was rated on a scale from one to five:

1. Appear Excited
2. Appear Clam
3. Appear Indifferent
4. Appear Concerned
5. Appear Highly Anxious

The perceived comfort level of each patient was made at the discretion of the researcher based on this preplanned rating system. The higher the score correlates with a higher level of perceived anxiety. During the observation phase of this research, the observer did not participate in any activities or interact with patients in any way. The observations were done using notations on a floor plan, not video. No names of patients or photographs were collected during the observational study to protect the identity and confidentiality of the patients.

4.4 Assumptions and Limitations

Since this study is focusing on two specific pediatric clinics, the researcher assumes that these sample populations are representative of the greater population of children's healthcare facilities. It was assumed that the ages of the patients in the children's healthcare facilities varied between infant to 18 years of age and the visits were not emergency related.

Although the results of this study cannot be generally applied to the overall population of children's healthcare facilities, the results of this study can be suggested as

accurate to the larger population. During the observation phase of this study, the researcher assumes that the study population is acting and interacting with the built environment as they normally would if the observer were not present. This assumption will be achieved by providing anonymity and confidentiality to those observed as well as not allowing any interaction between the observer and the patients at each pediatric clinic.

There are two main limitations of this study. The first is that the researcher will only be observing the patients at each pediatric clinic from the waiting areas; the researcher will not be observing patients' interaction with the built environment and perceived emotional health and wellbeing while they are waiting in the exam rooms. By observing and noting each patient's perceived emotional health and wellbeing as they enter and exit the pediatric clinic, the researcher will be able to infer if the time spent in the exam rooms seemed to improve or worsen their overall emotional health and wellbeing. Combined with the initial documentation and assessment of the built environment of the exam rooms at each clinic, the research will be able to infer the overall effect the built environment of the exam rooms had on the patients. The other main limitation to this study is time. Since the observational period of this study occurred over a two week period, the findings were dependent on the conditions of each pediatric clinic and the patients who visited the pediatric clinics during the times of observation.

Chapter V: Results - Documentation and Assessment of the Built Environment

5.1 Site A

5.1.1 Overview

Site A is a newly constructed pediatric clinic. The pediatric clinic worked closely with the designers and architects on the design of their facility to incorporate their design preferences as well as details important to the function of their clinic. Opened in 2012, this clinic is designed as a standalone pediatric clinic. Patients at this facility range in age from infants to young adults. The purpose of each patient visit varies, but annually, this pediatric clinic sees a fairly equal balance of patients that visit for sickness and wellness checks. During the time of year this research occurred, more patients were visiting because of sickness as opposed to wellness checks. At this pediatric clinic, there are typically four doctors who work each day they are open (Monday through Saturday) and each doctor sees approximately twenty two patients a day. Since this facility is open Monday through Saturday, approximately 528 patients are seen each week and nearly 27,500 patients a year.

The focus on nature throughout the design was intentionally chosen to create a design that appealed to the various age ranges of patients visiting the pediatric clinic in addition to adults. The layout of this one story building was specifically designed to maximize the amount of natural light and views to the outdoors in an effort to visually connect the interior space with the exterior. Figure 5.1 shows a view of the main entrance of this pediatric clinic (pediatric clinic's logo and name have been digitally covered for confidentiality purposes). Figure 5.2 shows an annotated floorplan of the

pediatric clinic documenting the various spaces patients typically spend time in at this facility.

Figure 5.1: Site A - View of Main Entrance

Figure 5.2: Site A – Floorplan

5.1.2 Waiting Area

When entering the pediatric clinic, the first thing visitor's view is the reception station and the surrounding waiting area. Figure 5.3 shows the view visitors first see when entering.

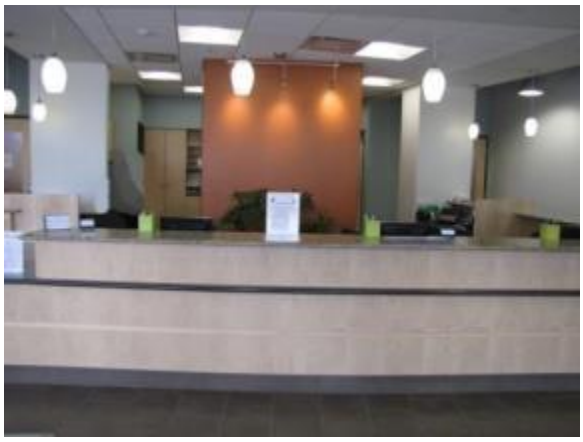

Figure 5.3: Site A – View of Reception Station when Entering

In this pediatric clinic, patients typically spend a majority of their waiting time in the waiting room as opposed to the individual exam rooms. The waiting area incorporates a variety of areas for patients and visitors to utilize during their wait including waiting chairs, spaces with tables and chairs and a semi-confined play space for children to use while staying out of the way of main paths of circulation. Figure 5.4 shows a view of the waiting chairs and tables and figure 5.5 shows a view of the semi-confined play space.

Figure 5.4: Site A - Various Furniture Types in Waiting Area

Figure 5.5: Site A – View of Semi-Confined Play Area

This waiting area was designed with the main focus centering on views to the outdoors and connection to nature. Special attention was paid to the site placement and landscaping of the site to take full advantage of the connection to nature and views of the ravine near the facility. The waiting area is a two story open space that incorporates floor to ceiling windows wherever possible to take advantage of the views to the outdoors and allow natural light to penetrate throughout the space. The use of floor to ceiling windows also allows patients of all ages and heights access to the views outdoors and allows more

natural light into the space. No matter where patients choose to wait in the waiting room, they have multiple views to the outdoors to choose from including views of the ravine or natural landscaping. Figure 5.6 shows a view from the waiting area looking out onto the ravine through floor to ceiling windows. Figure 5.7 shows another view from the waiting area looking out onto natural landscaping.

Figure 5.6: Site A – View Looking Out to Ravine

Figure 5.7: Site A – View Looking Out to Landscaping

In addition to the waiting area incorporating a connection to nature to enhance the emotional health and wellbeing of patients, the finishes used in this space provide an acoustically pleasing environment that also enhances the emotional health and wellbeing of patients. The acoustically pleasing environment of this two story area was created through the use of noise reducing finishes throughout the space including carpet tiles, acoustical ceiling panels, exposed ceilings with noise reducing qualities as well as a suspended ceiling above the children's play area to help control and lessen the spread of noise. Figure 5.8 shows a view of the exposed ceilings in the waiting area and figure 5.9 shows a view of the children's play area with the suspended ceiling used to help control the acoustic environment.

Figure 5.8: Site A – View of Exposed Ceiling

Figure 5.9: Site A – View of Suspended Ceiling in Children's Play Area

Connected to the waiting area is the reception station. In order to help alleviate excess noise from behind the reception station and control the spread of sound, the ceiling height was lowered to 9' and acoustical ceiling panels were used to absorb excess noise. Although the waiting area is a large, open space that is physically and acoustically connected to the reception stations, the design of the space and use of materials that reduce or absorb noise succeeded is controlling the acoustic environment. Figure 5.10 shows a view of the lowered ceiling and use of acoustical ceiling panels in the reception area.

Figure 5.10: Site A – View of Lower Ceiling Above Reception Area

5.1.3 Exam Room

Aside from spending a considerable amount of time in the waiting areas, patients also spend a significant amount of time in the exam rooms. In this pediatric clinic, there are twenty one exam rooms. Of these twenty one exam rooms, sixteen incorporate windows with views to the outdoors. Figure 5.11 shows a view of a typical unoccupied exam room with a window and figure 5.12 shows a view of a typical unoccupied exam room without a window.

Figure 5.11: Site A – View of Unoccupied Exam Room with Window

Figure 5.12: Site A – View of Unoccupied Exam Room without Window

Similar to the windows located in the waiting area, the height of the windows in the exam rooms maximizes the views to the outdoors for patients of all ages and heights. The height of the window sills was intentionally placed at 18” off the ground to maximize the views and the amount of natural daylight into the space. It also allows for young children to be able to play near the window and benefit from views to nature. Figure 5.13 shows a typical view out the window in an exam room and figure 5.14 shows the lower height of the window sill.

Figure 5.13: Site A – Typical View Out Window of Exam Room

Figure 5.14: Site A – View of Lower Window Sill Height

The design of the exam rooms focuses on how patients will utilize the space. This was accomplished by not only creating lower windows so all patients will be able to

utilize views to the outdoors as well as maximize the amount of natural light that is allowed into the space, but the design also incorporates details such as open storage space for children's toys. This open storage space allows children to easily access the toys while keeping the space organized. Figure 5.15 shows a view of the open storage space located at the edge of the built-in cabinets, specifically designed to hold children's toys.

Figure 5.15: Site A – Open Storage for Children's Toys in Exam Room

The acoustic environment of the exam rooms is enhanced through the physical separation from the rest of the facility and the use of finishes. Since each exam room is physically separated from the rest of the facility for privacy and confidentiality purposes, the exam rooms are also acoustically separated from various noises throughout the facility. The acoustic environment of the exam rooms is further enhanced through the

use of finishes. The use of acoustic ceiling tiles and carpet tiles absorbs and reduces excess noise.

With cleanliness and sanitary conditions being such a point of concern within healthcare facilities, the use of carpet as opposed to a hard surface material as flooring in the exam rooms provided a slight challenge. In order to facilitate the use of carpet, carpet tiles were used so each tile can be easily removed and replaced as needed. The carpet fibers were also solution dyed so they can stand up to more intense cleaning without discoloring. Figure 5.16 shows the use of acoustic ceiling panels in the exam rooms and figure 5.17 shows the use of carpet tiles in the exam rooms.

Figure 5.16: Site A – View of Acoustic Ceiling Panels

Figure 5.17: Site A – View of Carpet Tiles

Overall, the design of this pediatric clinic has successfully implemented a connection to nature that can be utilized by all patients. It has also provided an emotionally supportive acoustic environment.

5.2 Site B

5.2.1 Overview

Site B is an adaptive reuse of an historic building. During this study, the pediatric clinic was working with an architecture and design firm to renovate and transform their existing facility to better suit the needs of patients and staff in the constantly changing world of healthcare facilities. The project was in the beginning stages of the design phase and no decisions on the design of the new facility had been made. This research project was intended to study the buildings existing connection to nature and acoustic environment and identify how these existing conditions effect the emotional health and wellbeing of patients.

Originally built in 1926, this historic building was designed and built to accommodate office and commercial spaces. The H-Shaped layout of the building was intentionally designed to maximize the amount of natural light penetrating throughout the space. When it was originally opened in 1926, this 11 story building was filled with a variety of businesses and constantly bustling with activity, but in recent decades this building has been generally viewed as being underused. In 2005, a prominent healthcare community began leasing the lower three floors of this 11 story building. Figure 5.18 shows a photo of the main entrance to the building and Figure 5.19 shows another primary entrance to this facility.

Figure 5.18: Site B - View of Main Entrance

Figure 5.19: Site B - View of Secondary Entrance

Patients at this facility range in age from infants to young adults. There are approximately 16,000 patients that visit this pediatric clinic annually, and since many patients visit more than once a year, there are approximately 28,000 annual patient encounters. This pediatric clinic operates between the hours of 8am – 5pm on Monday's, Tuesday's and Thursdays, 8am – 8pm on Wednesday's and 9am-5pm on Fridays. The purpose of each patient visit varies, but annually, this pediatric clinic sees a fairly equal balance of patients that visit for sickness and wellness checks. During the time of year this research occurred, more patients were visiting because of sickness as opposed to wellness checks.

The pediatric clinic at this facility is located in one wing on the second floor of this building. In order for patients to reach the pediatric clinic, they can either use the stairs or elevators. The stairwell, as shown in figure 5.20, is on the interior of the building and receives no natural light and has very little artificial light. The limited amount of light available in this space combined with the hard surfaces that lack acoustical properties extends very little emotional comfort to patients. Figure 5.20 also

shows the limited amount of available light throughout the stairwells and figure 5.21 shows the current finishes in the stairwells.

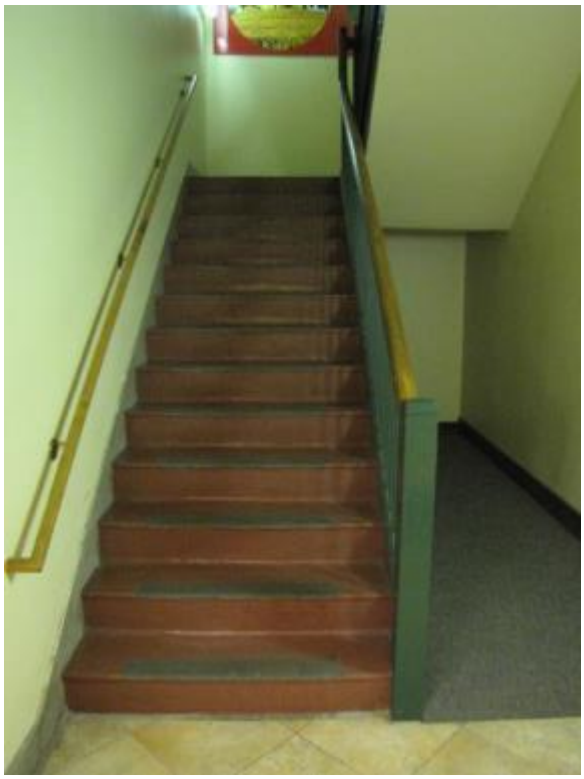

Figure 5.20: Site B – View of Stairwell Up to Second Floor

Figure 5.21: Site B – View of Finishes in Stairwell

The elevators in this building offer a little more emotional support to patients with its increased acoustical properties in comparison to the stairwells. Figure 5.22 shows the interior of one of the elevators in this building.

Figure 5.22: Site B – View of Inside of Elevator

Figure 5.23 shows the layout of the second floor that is shared by the pediatric clinic and family practice clinic. The outlined portions of the floorplan are the areas used by the pediatric facility. Figure 5.24 shows an annotated floorplan of the pediatric clinic documenting the various spaces patients typically spend time in at this facility.

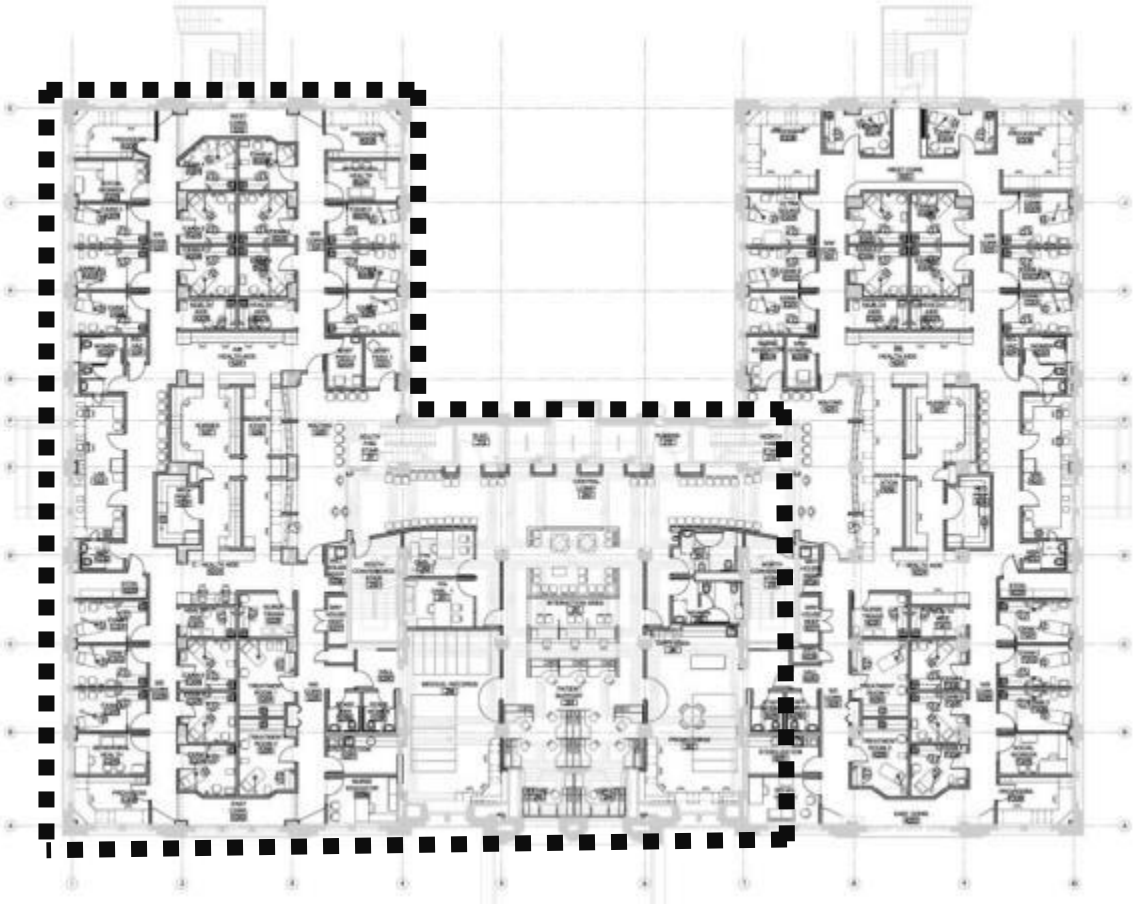

Figure 5.23: Site B – Second Floor Floorplan

Figure 5.24: Site B – Floorplan for Pediatric Area

- Overflow Waiting Area
- Waiting Area
- Exam/Treatment Room
- Restroom/Baby Feed Room
- Circulation
- Staff Area

5.2.2 Overflow Waiting Area

When entering the second floor of this building, the first thing visitor's view is the overflow waiting area, which is used both by the pediatric clinic and family practice clinic, and a wall with the healthcare facilities logo. Figure 5.25 shows the view visitors first see upon entering the second floor (the logo has been removed for confidentiality purposes).

Figure 5.25: Site B – View of Pediatric Clinic Entrance from Elevator

Due to the expansion and ever growing needs of this healthcare facility, make shift offices and work areas have been created in this space. Multiple staff members at this healthcare facility are set up in offices and make shift work areas adjacent to this overflow waiting area. In this overflow waiting area, there is little physical separation between the overflow patient waiting areas and the healthcare facilities staff work areas, and there is no acoustical separation between the two groups. Figure 5.26 shows the nearness of the overflow patient waiting area and the staff work areas.

Figure 5.26: Site B – View of Overflow Waiting Area and Staff Work Area

This space is a two story area with many original features and finishes. The floor is covered in the original tile floor, and the plaster ceilings in this area include the original ornamentations and detailing. These properties combined with the two story space create an area with no noise reducing acoustical properties leading to an emotionally taxing acoustical environment for patients. Figure 5.27 shows a view of the two story space and figures 5.28 and 5.29 show the views patients have when sitting in the overflow waiting area.

Figure 5.27: Site B – View of Two Story Space in Overflow Waiting Area

Figure 5.28: Site B – Patient View from Overflow Waiting Area

Figure 5.29: Site B – Patient View Looking Up from Overflow Waiting Area

While this area on the second floor has access to the two story high windows of the building as shown in figure 5.30, with the healthcare facilities ever expanding needs, these windows and the potential for natural light to penetrate throughout the space have been greatly reduced or blocked to the areas patients frequent because of the need to incorporate more staff areas. In this overflow patient waiting area, no natural light is available as seen in figure 5.31.

Figure 5.30: Site B – View of Two Story Windows from Exterior

Figure 5.31: Site B – View of the Limited Availability of Natural Light

5.2.3 Waiting Area

The first thing visitor's view once entering the actual pediatric clinic is the reception station. Once inside the pediatric clinic, there is a noticeable change in the acoustic properties of the space. This space incorporates finishes that enhance the acoustic environment such as carpet and acoustical ceiling panels. The acoustic environment is also enhanced with the incorporation of lower 9' ceilings. Figure 5.32 shows the view visitor's first see upon entering the pediatric clinic.

Figure 5.32: Site B – View of Entrance to Pediatric Clinic

Although there is little physical separation between this waiting area and the staff working at the reception stations, the use of acoustical materials such as the carpet and acoustical ceiling panels in combination with the lower ceilings creates a more pleasing acoustic environment by reducing the levels of noise. In addition to the pediatric clinic's waiting area having a better acoustic environment when compared to the overflow waiting area, the pediatric clinic waiting area also incorporates more of a connection to nature and availability of natural light. Figure 5.33 shows the space within the pediatric clinics waiting area that has access to a connection to nature and natural light. This one window in the pediatric clinic's waiting area offers a view to the outdoors as shown in figure 5.34.

Figure 5.33: Site B – View of Space in Waiting Area with Window

Figure 5.34: Site B – View Outside Window in Waiting Area

Although this space does incorporate one window with views to the outdoors and access to natural light, the height of the window and its location is not conducive to allow patients to fully benefit from the connection to nature and natural light. With the window sills beginning three feet off the ground and located behind waiting chairs, many of the patients are not able to access the views to the outdoors. In addition to the windows location reducing the accessibility of views to the outdoors, its location also limits the amount of natural light that is allowed into the space. Since this window is located in a back corner and is blocked from a majority of the waiting area by an exit stairwell, natural light is only able to penetrate a small portion of the waiting area, minimizing the amount of patients that can benefit from the natural light. The exit stairwell not only blocks a majority of the waiting area from the availability of natural light, but it also limits the views to the outdoors and connection to nature that can benefit patients emotional health and wellbeing. Figure 5.35 shows this exit stairwell.

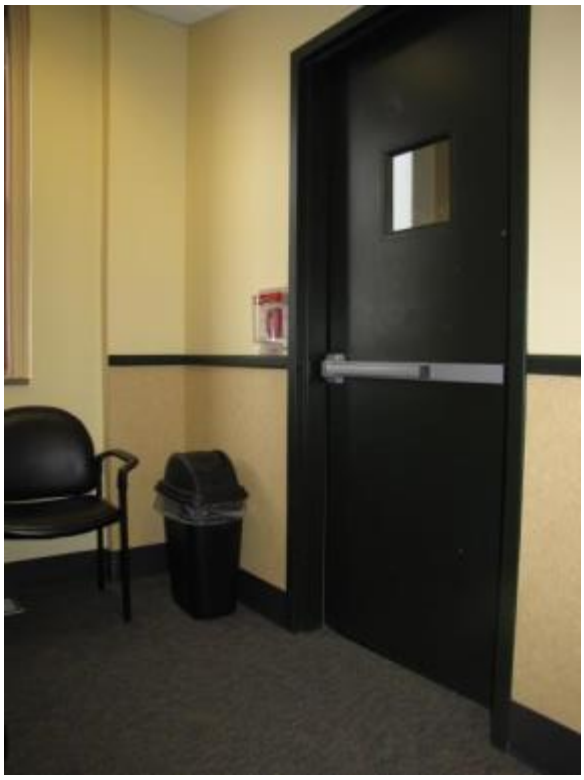

Figure 5.35: Site B – View of Exit Stairwell

While sitting in this main pediatric waiting area, the views patients see while waiting include views of the reception stations and the staff working there as well as views of the rest of the waiting room and other patients. There is also a television tuned to a children's station that is available to watch while waiting. Figures 5.36 and 5.37 show the typical views patients have while waiting.

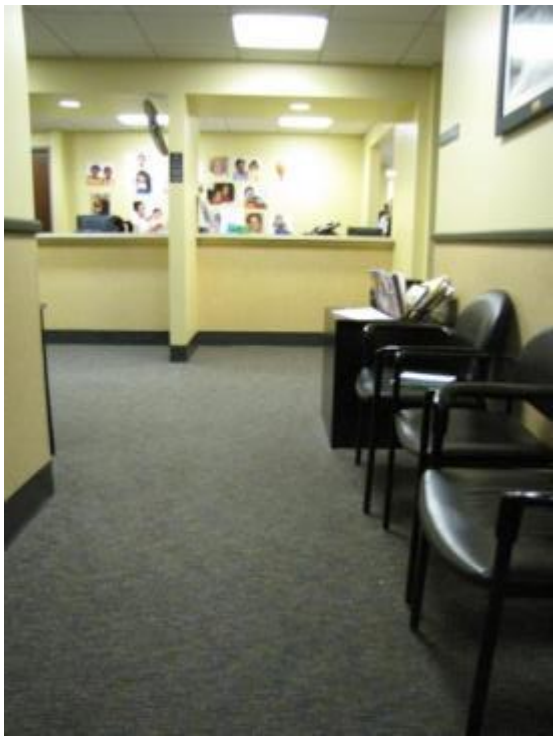

Figure 5.36: Site B – Patient View from Waiting Area

Figure 5.37: Site B – Patient View from Waiting Area

At this pediatric clinic, patients typically spend a majority of their waiting time while at the clinic in either the waiting area or overflow waiting area as opposed to spending a majority of their waiting time in the individual exam rooms. In both of these waiting areas, there is little room for the patients wait and play while staying out the main paths of circulation. Figure 5.38 shows the long and narrow space of the overflow waiting area and figure 5.39 shows the long and narrow space of the main pediatric waiting area.

Figure 5.38: Site B – View of Unoccupied Waiting Area

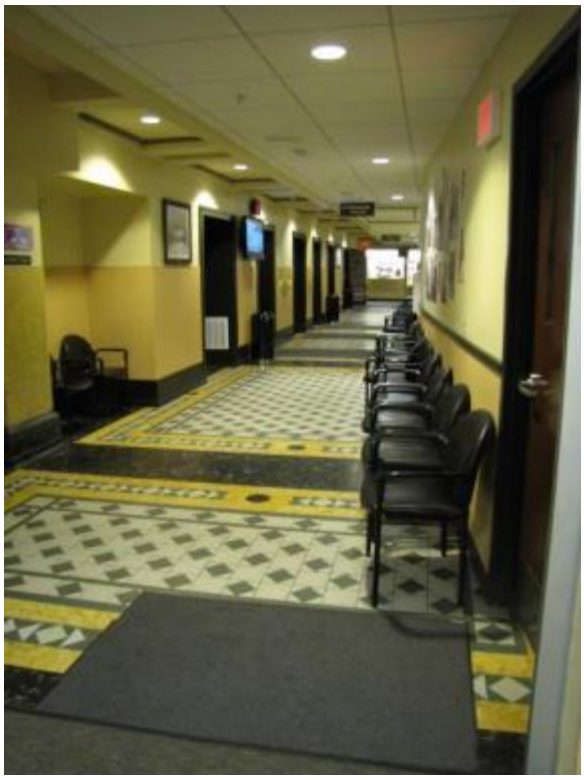

Figure 5.39: Site B – View of Unoccupied Overflow Waiting Area

5.2.4 Exam Room

The final space patients spend a significant amount of time in at this pediatric office is in the exam rooms. There are eighteen exam rooms in the pediatric section of this healthcare facility, and nine of these exam rooms have a window with a view outside. Figure 5.40 shows a view of a typical unoccupied exam room with a window and figure 5.41 shows a typical view out an exam room window.

Figure 5.40: Site B – View of Unoccupied Exam Room

Figure 5.41: Site B – View Outside Window in Exam Room

Similar to the window located in the main pediatric waiting area, the location and height of the window in the exam rooms makes it difficult for patients of all ages to benefit from the views to the outdoors. Since the window sills begin three feet off the ground, younger patients are not able to fully reap the benefits of views to the outdoors, but they are still able to benefit from the natural daylight that is able to penetrate throughout the space.

The finishes and physical separation enhances the acoustic environment in the exam rooms. Since each exam room is physically separated from the rest of the facility for privacy and confidentiality purposes, the exam rooms are also acoustically separated from other noises throughout the facility. This physical separation combined with the use of acoustical ceiling panels helps to create an acoustically pleasing environment that is emotionally supportive for patients. The floor is composed of sheet vinyl to help with cleanliness and sanitary conditions of the facility, but the use of the hard surface flooring diminishes the acoustic properties of the environment.

Overall, the connection to nature and acoustic environment in this pediatric clinic is minimal. There is a large amount of potential in this facility to enhance the connection to nature and increase the acoustical properties in the various areas patients typically spend their time to create a more emotionally supportive environment.

Chapter VI: Results - Observation

6.1 Overview

Following the preliminary site investigations, the observational portion of this research consisted of observing and documenting patient interaction with the built environment, measuring the amount of time each patient spent at the clinic, measuring each patient's perceived emotional state throughout their visit and measuring the acoustic environment. During the observation portion of the research, special attention was paid to the patients' interaction with the built environment as it pertained to the connection to nature and acoustic environment.

In order to obtain adequate data for analysis and comparison between the two sites, the research occurred over an eight day period. Observations at each site were completed on the same days with the researcher observing in the morning at Site A and in the afternoon at Site B on day one, vice versa on day two, etc. Each site visit occurred over a two hour period. Equal amounts of observation time occurred in the morning and afternoon at each site.

The findings from the observation of each case study site were initially analyzed individually to find patterns in the children's interaction with the built environment and perceived emotional health and wellbeing at each site. The acoustic environment was also measured and individually analyzed at each site to find patterns that may exist within the acoustic environment of each site. Following the individual analysis of the findings at each site, the findings were then compared between the two sites to see if any patterns emerged between the built environments and the observed interaction and emotional health and wellbeing of the children. The individual analyses and cross-case

comparisons were conducted after the sites were initially assessed and documented during the preliminary phase of this research.

6.2 Participants

Throughout the observational portion of this research, the participants were dependent on who visited the pediatric clinics during the times the researcher was present to observe. There were many patients that visited the pediatric clinics during the times the researcher was present, but only the children who arrived, visited the medical professionals and left while the researcher was present were included in the results. The patients who arrived before the researcher was present and the patients who were still at the clinic when the two hour sessions were complete and the researcher left were not calculated in the results. Participants at both sites ranged in age from infants to teenagers. Since a connection to nature and the acoustic environment is able to affect all age ranges, it was important to this study to be able to observe children of various age ranges at both sites.

During the observation portion of the research, the researcher realized that many patients visiting the pediatric clinics were accompanied not only by adults, but also by siblings and other children. Although all of the children visiting the pediatric clinics were not necessarily the patients for that particular visit, their interaction with the built environment and perceived emotional state were measured and included in the calculations. A total of 289 children were observed and included in the results across the two pediatric clinics. 145 children were observed at Site A, with the number of children observed each day ranging from 11 to 26, and an average number of 18 children observed

each observation day. 144 children were observed at Site B, with the number of children observed each day ranging from 12 to 22, and an average number of 18 children observed on each observation day. Table 6.1 shows a graphic representation of the amount of children observed at each site on each day of observation. Each day of observation varied in the amount of children present for observation, but there was a correlation between the amounts of children observed at each site on each day of observation. For example, on day 3 of observation, there were a noticeably lower number of children present at both pediatric clinics during the times the researcher was present to observe.

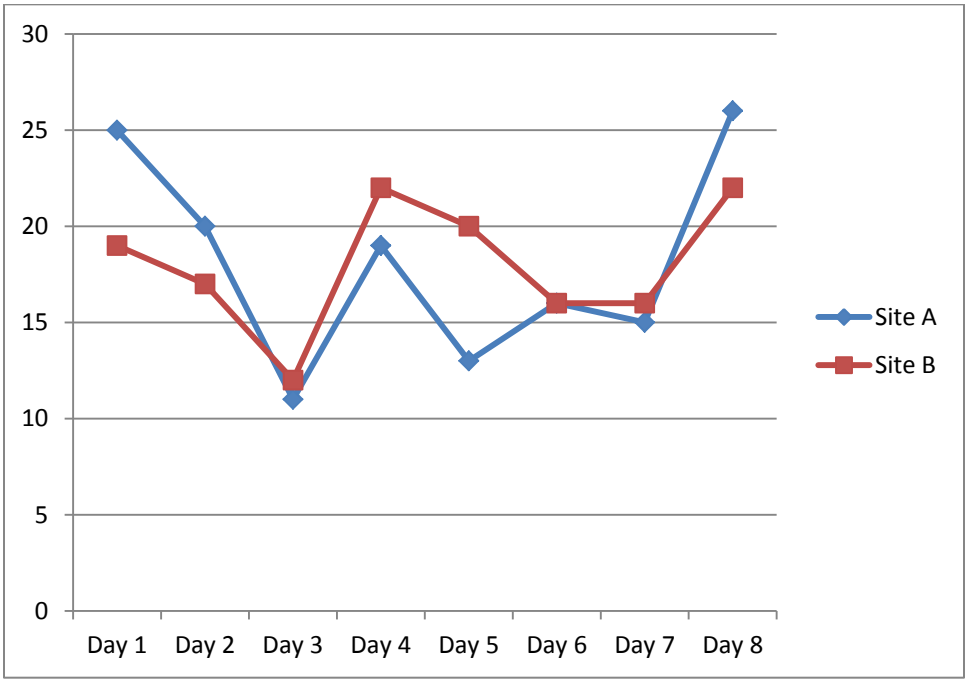

Table 6.1: Number of Patients Observed during each Observation Day

6.3 Findings

The decision to conduct this study in pediatric clinics as opposed to a hospital setting was decided because it would grant the researcher a better opportunity to observe

a greater number of patients to allow for more data collection. Observing in a pediatric clinic setting also allowed the researcher to better observe patient interaction with the built environment and the emotional status of the children. During the observation phase of this study, it was found that on average, children at Site A spent 51.2 minutes at the pediatric clinic with an average of 12.9 minutes of that time spent in the waiting area. At Site B, the data shows that patients spent an average of 57.5 minutes at the pediatric clinic with an average of 13.7 minutes of that time spent in the waiting areas. Although only a small percentage of the time children spent at the pediatric clinic was spent in the waiting areas, previous research on the inclusion of a connection to nature into the design of healthcare facilities shows that even a minimal amount of time with active or passive interaction with nature has substantial restorative effects on the emotional health and wellbeing of children in healthcare settings (Whitehouse et al 2001). Table 6.2 shows a comparison of the average amount of time children spent at the pediatric clinic at each site.

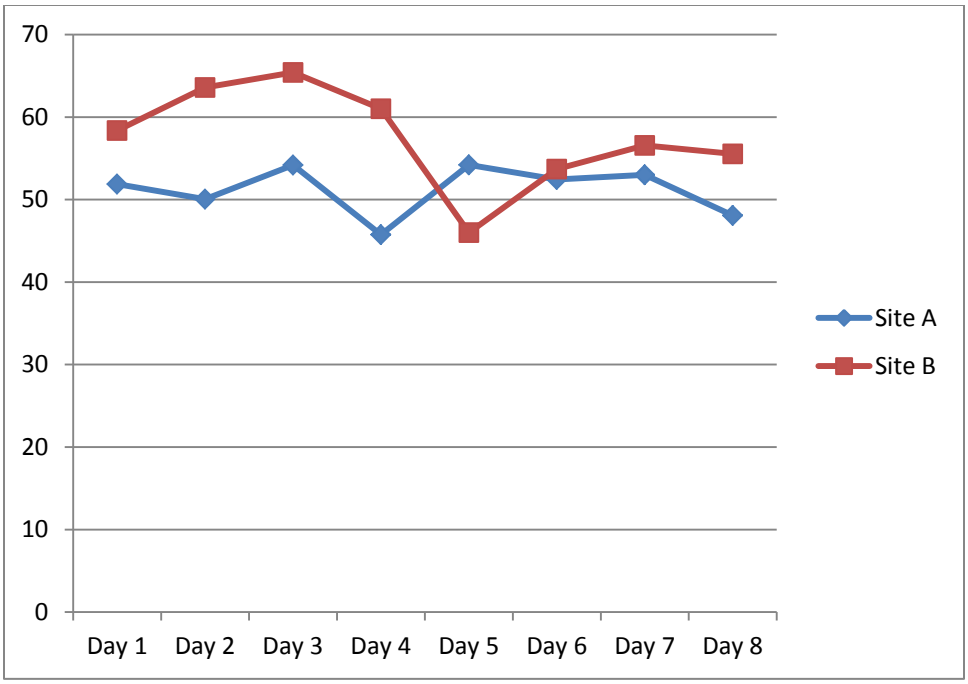

Table 6.2: Average Amount of Time Spent at Pediatric Clinic in Minutes

Upon entering the pediatric clinic, the researcher documented the perceived emotional state of each child as well as each child's initial action upon entering. The perceived emotional comfort level of each patient visiting the pediatric clinic was rated on a scale from one to five:

1. Appear Excited
2. Appear Clam
3. Appear Indifferent
4. Appear Concerned
5. Appear Highly Anxious

The perceived comfort level of each patient was made at the discretion of the researcher based on this preplanned rating system. The higher the score correlates with a higher level of perceived anxiety. Table 6.3 shows a graphic representation of the

average perceived emotional state of each observed child as they enter the facility. The average perceived emotional state of the children at Site A was 2.25 while the average perceived emotional state of the children at Site B was slightly higher at 2.59. It is important to note that the perceived emotional comfort level for children at each site included a range of scores from one to four with no child at either clinic appearing highly anxious. It is interesting to note that on day four of observation, it was raining and lightly storming all day, and on days five through eight of observation, the weather was overcast or lightly precipitating during the times of observation. A correlation was recorded between the weather and the perceived comfort level of children at Site A. During the observation days where the weather was overcast or storming, the researcher recorded a higher perceived comfort level while the perceived comfort level of children at Site B during these days when the weather was overcast or storming did not appear to be negatively affected. Furthermore, on days five through seven of observation at Site B when the weather was overcast or storming, the researcher documented a slight decrease in the averaged perceived comfort level of children when entering the facility. Overall, the average perceived comfort level of children upon entering the each pediatric clinic was slightly higher at Site B.

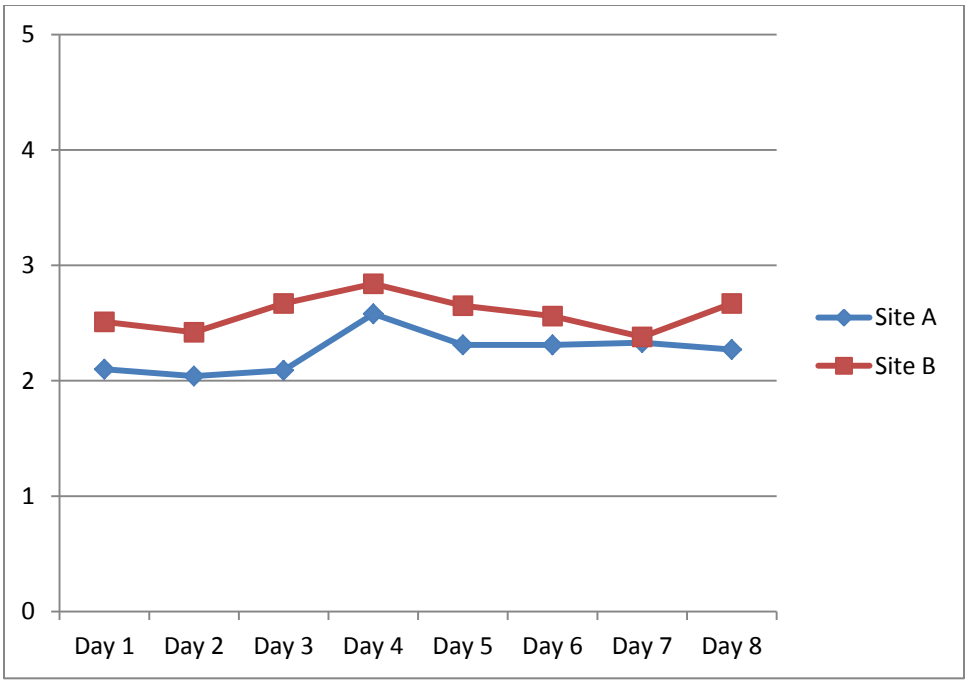

Table 6.3: Average Perceived Emotional State – Entering Facility

Along with documenting the perceived emotional state of the children upon entering the pediatric clinic, the researcher also noted each child's initial action upon entering. At Site A, the researcher noted that 76% of the children went straight to the reception counter either following or leading the adults accompanying them there. The other 24% of the children entered the facility and immediately went to the semi-confined play area or went to find a place to sit and watched television, played games on a cell phone or tablet, watched outside, interacted with others, etc.

At Site B, the researcher found that 97% of the children closely followed the adults accompanying them upon entering. The other 3% were noted as immediately finding a place to sit and watched television, played games on a cell phone or interacted with others' that had accompanied them to the pediatric clinic. This behavior and interaction with the built environment could be contributed to many variables including

the design of the built environment. With the current design of Site B lacking a connection to nature and views to the outside, children may have a difficult time with wayfinding throughout the facility. Studies have shown that children are better able to maneuver through the built environment when they can use nature and views to the outdoors as a point of reference (Durio 2006). Since this facility currently does not have the ability for patients to view outdoors, children may not be confident in their ability to successfully maneuver throughout the space. They rely heavily on the adults accompanying them to get to the pediatric clinic once they enter the building.

During the time spent in the waiting areas before going to see the medical professionals, the researcher noted the activities and locations of the children. Figure 6.4 shows the typical areas children spent their time at Site A and frequency of use of each area. The documented children's activities at Site A included play in the semi-confined play are, both individual and collaborative play, watching television, playing games on or using cell phones or tablets, interacting with the people who arrived at the pediatric clinic with the child, interacting with others, playing near and looking out windows, playing at the drinking fountain and wandering throughout the waiting area. Of the various activities children were involved in while they were waiting, the most common activities were sitting in the waiting area watching television and playing in the semi-confined play area. 66% of the children at this pediatric clinic sat in the waiting area and watched television, used cell phones or tablets, or interacted with the people that arrived at the pediatric clinic with them. 24% of children at this pediatric clinic spent time playing in the semi-confined play area and either played by themselves or interacted with the children near them and/or the adults that arrived at the clinic with them. The children

that played in this semi-confined play area appeared to be grade school age or younger. Of the remaining 10% of the observed children at this pediatric clinic, 4% spent the time in the waiting area wandering between the different areas and did not spend a significant amount of time in any one area while the other 6% did not spend a significant amount of time in the waiting area.

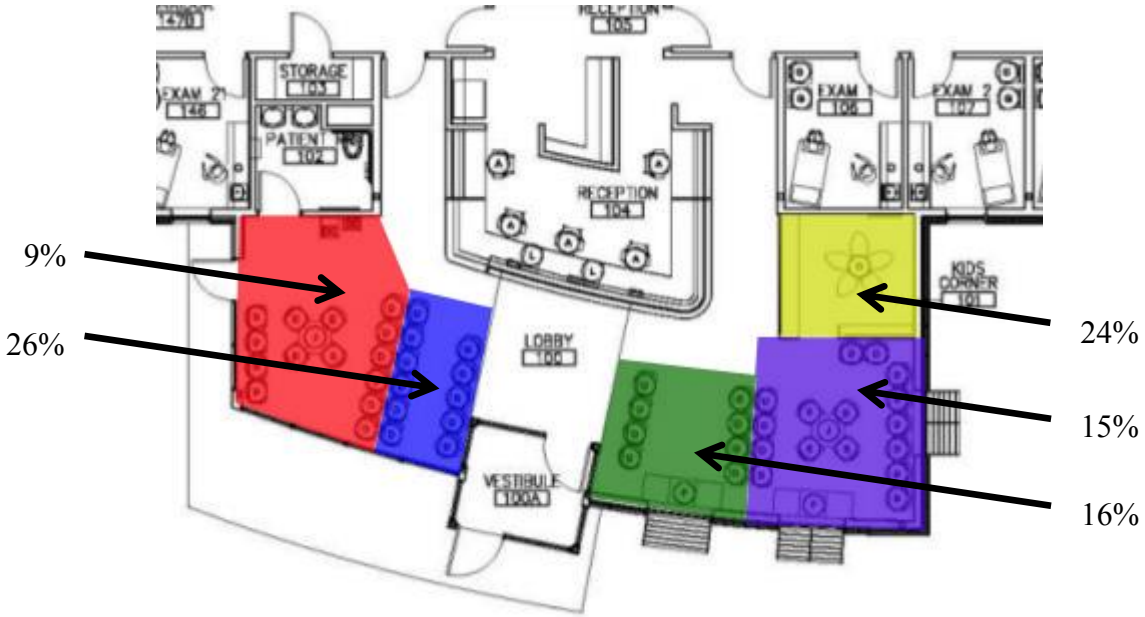

Figure 6.4: Site A – Frequency of Waiting Area Use

Similar to the documentation of the typical areas children spent their time at Site A and the frequency of use at each area, figure 6.5 shows the typical areas children spent their time at Site B and frequency of use of each area. The documented children's activities at Site B included watching television, playing games on or using cell phones or tablets, interacting with the people who arrived at the pediatric clinic with the child, playing with or reading the available children's books and magazines and wandering up and down the waiting areas. The most recorded activities among children in this

pediatric clinic were sitting in the waiting areas and watching television or using cell phones and interacting with the people who arrived with the children. 52% of the children at this pediatric clinic sat in the waiting area and watched television and/or used cell phones while 45% of children at this pediatric clinic interacted with the people who arrived with the child. Of the remaining 3% of patients observed at this site, 2% were recorded seeking out the available books and magazines or wandering up and down the waiting areas. Of the 2% of patients involved in these activities, they all appeared to be grade school age or younger. The final 1% of the observed children at this site did not spend a significant amount of time in the waiting areas.

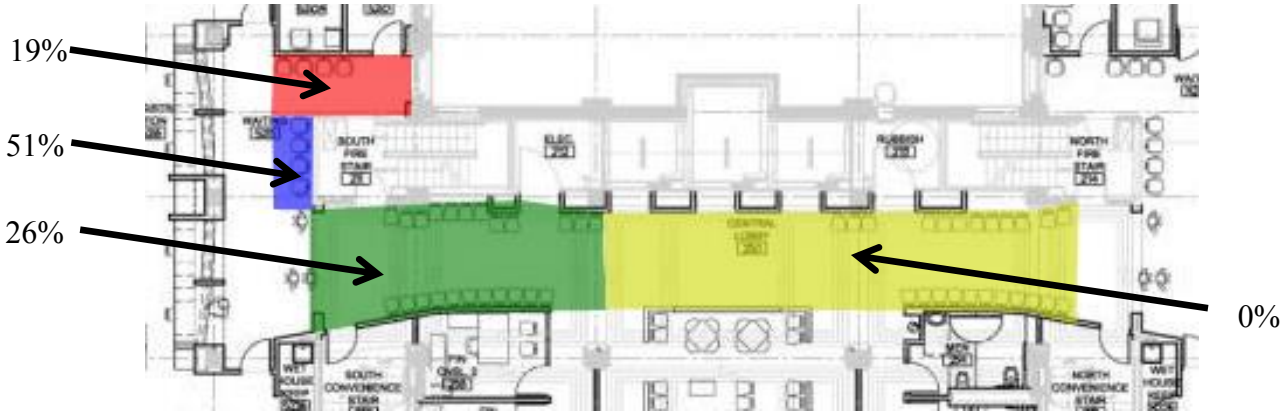

Figure 6.5: Site B – Frequency of Waiting Area Use

It was interesting to note that there was minimal interaction between children and people the children did not know. In some instances, if the child sought to interact with other children that did not arrive to the pediatric clinic with the child, they would be discouraged from interacting with each other. In contrast, adults at Site A openly encouraged their children to interact and play with other children. This difference could

in part be due to the layout of the two pediatric clinics. As noted earlier in the documentation and assessment section, Site A includes spaces for children to play in areas that are out of the main paths of circulation. The layout of Site B, however, does not currently have space apart of the main paths of circulation to play. Without appropriate areas for children to be able to play while out of the main paths of circulation, adults may discourage children from playing in the main paths of circulation in an attempt to keep the paths clear.

While some of the activities among the two pediatric clinics were similar, such as watching television and interacting with the people they arrived with, there was an increased level of activity occurring at Site A. The children at Site A were more involved in conversation and play creating greater amounts of noise. Although there appeared to be more noise creation at Site A, the measured decibel readings at Site A was generally lower than the measured decibel readings at Site B. Peak noise levels at Site A averaged at 75.75dB while the peak noise levels at Site B averaged at 82.25dB. The average decibel reading at Site A was 59.75dB and the average reading at Site B was 68.5dB. The low decibel reading at Site A averaged at 46.25dB while the low reading at Site B averaged out to 60.13dB. Table 6.6 shows the graphic representation of the peak, average and low decibel readings on each day of observation at Site A and Site B.

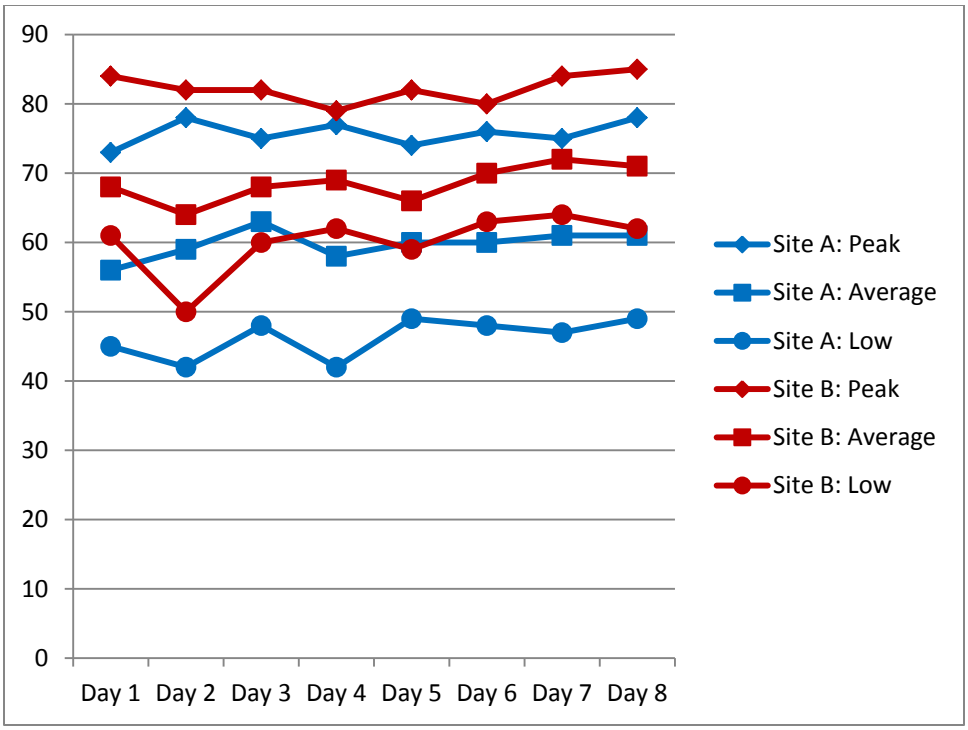

Table 6.6: Measured Decibel Reading

Once the visit with the medical professionals was complete, many patients at both locations immediately left the clinic, while only a small amount stopped by the front desk to set up another appointment or talk with those at the front desk. As the children were leaving the pediatric clinics, the researcher again noted the perceived emotional comfort level of each child on the same scale previously used. Similar to the perceived emotional state of patients upon entering the pediatric clinics, the scores noted as children were leaving ranged from a one to a four with no child falling into the category of appearing highly anxious. Approximately 90% of children at both facilities fell within the two to three score of the perceived emotional state. Table 6.7 shows the average perceived emotional state of children upon leaving the pediatric clinics. The average perceived emotional state of children upon leaving Site A was 2.07 while the average perceived

emotional state of children upon leaving Site B was 2.39. This perceived emotional comfort level could be associated with many variables such as the children being excited to leave the pediatric clinic, excited to go outside, etc. At both locations, younger patients were also rewarded with items such as stickers or a small piece of candy once their visit was over and they were leaving the pediatric clinic. This factor may have highly contributed to the perceived emotional state of the children as they were leaving because the researcher noted that most of the children who received these items were commenting about and displaying the item they just received.

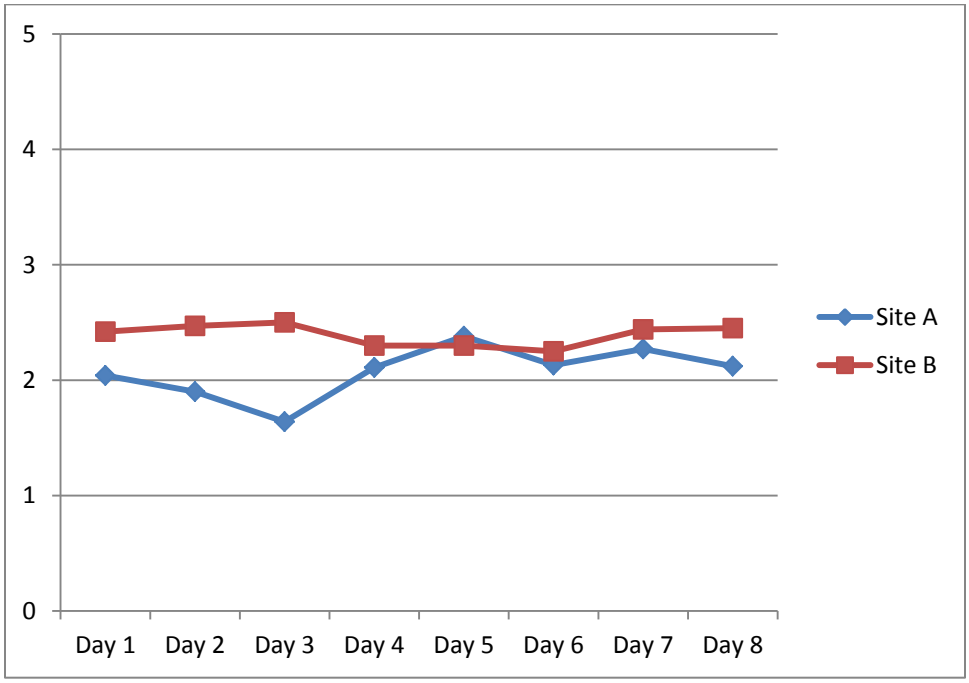

Table 6.7: Average Perceived Emotional State – Leaving Facility

Chapter VII: Conclusion

7.1 Overview

The intention of this study was to explore and better understand how the incorporation of specific aspects of green design affects the emotional health and wellbeing of patients in children's healthcare facilities. Using LEED for Healthcare as a standard of measure, this study focused specifically on the connection to nature and focus on the acoustic environment throughout the design of each facility. With the increased amount of research focusing on healthcare design in recent decades, this previous research has shown the gradual shift from designing for functional and sanitary spaces in favor of healing environments that are psychologically supportive. The ideology of creating healing environments within healthcare facilities stems from research supporting the idea that the built environment "can make a difference in how quickly the patient recovers from or adapted to specific acute and chronic conditions" (Dijkstra, 2006).

Using this framework as a basis for the study, the researcher identified specific aspects of the built environment and green design that would allow for positive distraction, elimination of environmental stressors and allow for a connection to nature. By researching these specific aspects of green design, the study was designed to determine if these specific aspects of green design affected the emotional health and wellbeing of patients in children's healthcare facilities and assisted in creating a psychologically supportive healing environment.

7.2 Restatement of Site Selections and Method

In order to study the effect the incorporation of aspects of green design has on the emotional health and wellbeing of patients in children's healthcare facilities, the researcher identified and selected two pediatric clinics in Omaha, Nebraska. For comparison purposes, the sites were chosen based on their inclusion of a connection to nature and the focus on the acoustic environment.

Site A was selected as a newly constructed pediatric clinic. The design specifically focused on the incorporation of nature and a connection to the exterior through the use of multiple, large windows placed at heights and locations that are accessible to patients of all ages. These large windows allow for natural daylight to penetrate throughout the space as well as provide patients with views to the natural elements surrounding the pediatric clinic. The design of Site A also focused on the acoustic environment. The design created an acoustically pleasing environment through the layout of the space as well as through the selection and use of sound absorbing and noise reducing materials.

Site B was selected as an adaptive reuse of an historic building that was lacking a connection to nature, including the availability of natural light throughout the space as well as views to the exterior. The acoustic environment in Site B was not emotionally supportive in the waiting areas because of its current layout as well as the fact that there were many original finishes still being used that promoted sound reverberation instead of reducing noise throughout the space.

Through the use of a qualitative mixed-method approach, this study was comprised of two phases. The preliminary studies of the selected sites were conducted to

identify the varying degrees to which each pediatric clinic incorporated a connection to nature and the acoustic environment. The preliminary study also allowed the researcher to become more familiar with the layout and design of each facility. This phase consisted of interviews with a point of contact and/or designer, site tours and documentation of each pediatric clinic.

The observational phase of this study concentrated on observing and documenting the patients' interaction with the built environment, the amount of time spent in various locations throughout the pediatric clinic, measuring the acoustic environment and observing the patients perceived state of emotional comfort as they enter and leave the clinic. The data collected from the two pediatric clinics were compared for similarities and differences. From there it was determined if a connection to nature and the acoustic environment influenced patient interaction with the built environment and perceived state of emotional comfort.

7.3 Conclusion

Overall, the data from this research supports the relationship between an environment that incorporates a connection to nature and acoustic environment and its influence on patient interaction with the built environment and perceived emotional health and wellbeing. While these findings suggest only a slight correlation between the built environment that incorporated a connection to nature and the acoustic environment with the perceived emotional comfort of children at these pediatric clinics, a stronger link emerged throughout the course of this study. A strong correlation appeared between the

inclusion of a connection to nature and the acoustic environment with increased patient interaction with the built environment as well as other social interactions.

This research shows that there was an increase in the amount of prolonged interaction between children and others at the pediatric clinic at the site that incorporated a connection to nature and had a more emotionally pleasing acoustic environment. Furthermore, interaction between children at Site A was encouraged while interaction between children that did not arrive at the pediatric clinic together was minimal and not specifically encouraged during the times of observation.

With the results of this study providing steady results throughout the research, the researcher concluded that the incorporation of a connection to nature and a focus on the acoustic environment in the design of pediatric healthcare facilities did provide a slight, but meaningful shift in the overall perceived emotional health and wellbeing of the children at the two pediatric clinics being studied.

The operating hypothesis stated that there were aspects of green design within the design of children's healthcare facilities that affected the emotional health and wellbeing of patients in children's healthcare facilities. While correlations between aspects of green design and the emotional health and wellbeing of patients in children's healthcare facilities were found, there were many extraneous variables outside the researchers' control that may have influenced these findings. Further research into this topic would be necessary to substantiate or disprove the working hypothesis and its subsets of this study.

Chapter VIII: Recommendations

Throughout the research process, the researcher recognized specific limitations in the current design of the study. The researcher acknowledged that these limitations within the current design of this study lead to the study's inability to fully validate the causal relationship linking the connection to nature and the acoustic environment with the emotional health and wellbeing of children in pediatric clinics. In response to these recognized limitations of the study, the researcher compiled recommendations to be incorporated into future research. Although the research compiled throughout this study did suggest a causal relationship between a connection to nature and the acoustic environment with the perceived emotional health and wellbeing of children in these two pediatric clinics, further research into this topic will be necessary to confirm or contest this relationship.

The first recommendation for future research is extending the time frame. The time frame allotted for this study was long enough document patterns that emerged during the research, but it was not long enough to identify a concrete link between the variables being studied. In order to identify a concrete link between the variables being studied, a substantial amount of time would be required to observe and document at multiple sites.

Along with increasing the time frame of future studies, the researcher would also recommend expanding the number of sites being studied. By assessing multiple pediatric clinics, future studies would be able to confirm or contest the patterns found in this study. Additionally, during the observation portion of this study, inaccurate or overlooked data could result if too few observers are present. Multiple observers or the addition of video

capability would be recommended to increase the validity and reliability of the data collected.

Finally, the researcher would recommend specifically focusing on one aspect of the design of the built environment and its link to the perceived emotional health and wellbeing of children in pediatric clinics. By focusing on one aspect of this research to examine the link between that specific aspect and the perceived emotional health and wellbeing of children in healthcare facilities would allow the researcher to develop a more detailed account and documentation of the study and its results. Overall, while this research did document a pattern that developed throughout the study between the connection to nature and acoustic environment with the perceived emotional health and wellbeing of children in pediatric clinics, this topic would benefit from further study.

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Appendix A

SS Credit 9.1: Connection to the Natural World—Places of Respite

1 Point

Intent

Provide outdoor places of respite on the healthcare campus to connect patients, staff and visitors to the health benefits of the natural environment.

Requirements

Provide patient and visitor accessible outdoor places of respite equal to 5% of the net usable program area[1] of the building or project.

Provide additional dedicated outdoor place(s) of respite for staff equal to 2% of the net usable program area of the building or project.

Qualifying areas must meet the following requirements:

- Accessible from within the building or located within 200 feet (60 meters) of a building entrance or access point.
- Located where no medical intervention or direct medical care is delivered.
- Open to fresh air, the sky and the natural elements, including seasonal weather.
- Provide options for shade or indirect sun at a minimum of one seating space per 200 square feet (19 square meters) of garden area with one wheelchair space per five seating spaces. Examples of qualifying shade structures include trellises and tree-shaded wheelchair accessible seating areas.
- Non-smoking areas in compliance with IEQ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control.

In addition, qualifying areas must comply with the following:

- Interior atria, greenhouses, solaria or conditioned spaces may be used to meet up to 30% of the required area, if 90% of each qualifying space's square footage achieves a direct line of sight to unobstructed views of nature. If views of nature are exterior to the space, calculate lines of sight between 30 inches and 90 inches (0.8 meters and 2.3 meters) above the finish floor.
- Horticulture therapy and other specific clinical or special-use gardens (i.e. a cancer healing garden) unavailable to all building occupants may be used to meet up to 50% of the required area.
- Universal-access natural trails with places to pause that are available to visitors, staff and/or patients may be used to meet up to 30% of the required area, provided trail access is available within 200 feet (60 meters) of a building entrance.
- Provide options for shade or indirect sun at a minimum of one seating space/200 square feet (19 square meters) of garden area with one wheelchair space per five seating spaces. Examples of qualifying shade structures include trellises and tree-shaded wheelchair accessible seating areas.
- Exterior places of respite shall comply with the 2010 FGI Guidelines for Design and Construction of Health Care Facilities (Section 1.2-6: Design Considerations and Requirements). Existing exterior places of respite on the hospital campus may be used to comply with this credit, provided that the location of the existing spaces meets the credit requirements.

1 For the purposes of this credit, "net usable program area" shall be defined as the sum of all interior areas in the project available to house the project's program. Areas housing building equipment, vertical circulation and structure shall be excluded.

Appendix B

SS Credit 9.2: Connection to the Natural World—Direct Exterior Access for Patients

1 Point

Intent

Provide patients and staff with the health benefits associated with direct access to the natural environment.

Requirements

To provide direct access to an exterior courtyard, terrace, garden or balcony with a minimum area of five square feet per patient for 75% of all inpatients AND 75% of qualifying outpatients with clinical Length of Stay (LOS) greater than four hours.

- Qualifying outpatients may include outpatient renal dialysis, infusion therapies, ambulatory surgery intake and stage 2 recovery. Patients with length of stay greater than four hours, whose treatment makes them unable to move, such as emergency, stage 1 surgical recovery, and critical care may be excluded. Places of respite outside the building envelope that meet the requirements of SS Credit 9.1: Connection to the Natural World—Places of Respite that are immediately adjacent to clinical areas or with direct access from inpatient units may be included in the calculation.
- Qualifying spaces must be designated as non-smoking and meet the requirements of IEQ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control.
- Qualifying spaces must meet the requirement for outdoor air quality enumerated in IEQ Credit 5: Indoor Chemical and Pollutant Source Control and be located more than 100 feet (30 meters) from building exhaust air locations, loading docks, building entrances and roadways subject to idling vehicles.

Appendix C

IEQ Credit 2: Acoustic Environment

1-2 Points

Intent

Provide building occupants with an indoor healing environment free of intrusive or disruptive levels of sound.

Requirements

Design the facility to meet or exceed the sound and vibration criteria outlined in the 2010 FGI Guidelines for Design and Construction of Health Care Facilities (2010 FGI Guidelines) and the reference document on which it is based, Sound and Vibration Design Guidelines for Health Care Facilities (2010 SV Guidelines).

OPTION 1 (1 Point)

Sound Isolation

Design sound isolation to achieve speech privacy, acoustic comfort and minimal annoyance from noise-producing sources. Consider sound levels at both the source and receiver locations, the background sound at the receiver locations and the occupant's acoustical privacy and acoustical comfort needs. Speech privacy is defined as "Techniques...to render speech unintelligible to casual listeners" by ANSI T1.535-2001, Telecom Glossary 2007.

Design the facility to meet the criteria outlined in the sections of the 2010 FGI Guidelines Table 1.2-3: Design Criteria for Minimum Sound Isolation Performance between Enclosed Rooms and Table 1.2-4 Speech Privacy for Enclosed Room and Open-Plan Spaces (2010 FGI Guidelines and 2010 SV Guidelines).

Calculate or measure sound isolation and speech privacy descriptors achieved for representative adjacencies as necessary to confirm compliance with criteria as identified in Sections 1.2-6.1.5 and 1.2-6.1.6 (including associated sections of the Appendix) of the 2010 FGI Guidelines and the referenced standard on which it is based: the SV Guidelines.

Room Noise

Consider background sound levels generated by all building mechanical-electrical-plumbing systems, air distribution systems and other facility noise sources under the purview of the project building design-construction team.

Design the facility to meet the 2010 FGI Guidelines' Table 1.2-2 Minimum-Maximum Design Criteria for Noise in representative interior rooms and spaces.

Calculate or measure sound levels in representative rooms and spaces of each type as necessary to confirm compliance with criteria in the above referenced table using a sound level meter that conforms to ANSI S1.4 for type 1 (precision) or type 2 (general purpose) sound measurement instrumentation. For spaces not listed in Table 1.2-2, refer to the ASHRAE 2007 Handbook, Chapter 47, Sound and Vibration Control, Table 42.

OPTION 2 (2 Points)
Achieve OPTION 1 AND

Acoustical Finishes

Specify materials, products systems installation details, and other design features to meet the 2010 FGI Guidelines Table 1.2-1 Design Room Sound Absorption Coefficients (including associated sections of the Appendix) and its reference to the 2010 SV Guidelines.

Calculate or measure the room average sound absorption coefficients for representative unoccupied rooms of each type in the building, as necessary, to confirm conformance with the requirements for this credit.

Site Exterior Noise

Minimize the impact of site exterior noise on building facility occupants produced by all exterior noise sources—road traffic, aircraft flyovers, railroads, on-site heliports, emergency power generators during maintenance testing, outdoor facility MEP and building services equipment. Also minimize impacts on the surrounding community produced by all facility MEP equipment and activities as required to meet the lower of the local applicable codes or Table 1.2-1 of the 2010 FGI Guidelines and the supporting Table 1.3-1 of the 2010 SV Guidelines.

Comply with the appropriate sections of the 2010 FGI Guidelines for each category:

- Heliports – A1.3-3.6.2.2
- Generators – 2.1-8.3.3.1
- Mechanical Equipment – 2.1-8.2.1.1
- Building Services – A2.2-5.3

Measure and analyze data to determine the Exterior Noise Classification (A, B, C, or D) of the facility site. See Table A1.2a: Categorization of Health Care Facility Sites by Exterior Ambient Sound in the 2010 FGI Guidelines and Table 1.3-1 in its reference standard, the 2010 SV Guidelines. Design the building envelope composite STC rating based on the 2010 FGI Guidelines for Categorization of Health Care Facility Sites by Exterior Ambient Sound and analyze contract documents to show conformance with requirements for this credit.

For Exterior Site Exposure Categories B, C or D, measure the sound isolation performance of representative elements of the exterior building envelope to determine the composite sound transmission class (STCC) rating for representative façade sections as necessary. Measurements shall generally conform to the current edition of ASTM E966 Standard Guide for Field Measurements of Airborne Sound Insulation of Building Facades and Façade Elements.

Appendix D

University of Nebraska Lincoln

INFORMED CONSENT FORM

THE IMPACT OF GREEN DESIGN ON THE EMOTIONAL HEALTH OF PATIENT'S IN CHILDREN'S HEALTHCARE FACILITIES

Masters candidate Kimberly Riege is conducting a research study to find out more information about the connection between the built environment of children's healthcare facilities and the emotional health and wellbeing of patients. This research is specifically focusing on two aspects of the built environment: the connection to nature and the acoustic environment. You are invited to participate in this research study. The following information is provided in order to help you to make an informed decision whether or not to participate. If you have any questions please do not hesitate to ask.

You are eligible to participate in this interview process of the research. If you agree to participate in the interview process pertaining to the design and function of the pediatric clinic, the following will happen:

1. The researcher will conduct an interview concerning the design and function of the built environment of the pediatric clinic.
2. The interview will last between 30 minutes and one hour.
3. The interview will occur during the site tour of each pediatric clinic and follow up questions may be asked to for further clarification.

The purpose of this study is to investigate how specific aspects of green design affect the emotional health and wellbeing of patient's in children's healthcare facilities. This study will help the researcher better understand the design and function of the built environment of your pediatric clinic to further investigate the behavior of patients in children's healthcare facilities. In addition, this research will benefit society by providing more information about the benefits of incorporating aspects of green design in the built environment of children's healthcare facilities.

To maintain confidentiality, your name and the name of your pediatric clinic will not be published in this thesis. Any information obtained will be kept digitally on the researcher's personal laptop that is only accessible by the researcher via a password. This information will be deleted once the research and thesis are completed.

Your participation in this interview session is voluntary and there is no penalty for non-participation. You are free to decide not to participate in this study. You can also withdraw at any time without harming your relationship with the researchers, the University of Nebraska-Lincoln, or the health clinic. There are no known risks in the participation of this research.

If you have any questions about the study, please contact me at (402) 968-5448 or kimberly.riege@huskers.unl.edu. You can also contact my thesis advisor, Dr. Betsy Gabb, at (402) 472-9245 or bgabb1@unl.edu. If you have any questions or concerns regarding this study and would like to talk with someone other than the researcher, you may contact the University of Nebraska – Lincoln Institutional Review Board (UNL IRB) at (402) 472-6965 or irb@unl.edu.

You have received a copy of this consent document. You agree to participate.

_____ _____

Signature of Participant Date

Appendix E

Initial Tour of Facility and Interview

Name & Title of Interviewee:

Site A
Site B

Date:

Background Information of Clinic

Do you know when this building was originally built?

Do you know what year this facility became a pediatric clinic?

Do you know what this building used to be before it was a pediatric clinic?

Approximately how many patient's are seen at this facility annually?

How many medical staff members currently work at this facility including doctors, nurses, etc?

Other Comments:

Tour of Site

In order to become better aquainted with your pediatric clinic, can you give me a tour of your facility?
Will it be alright if I photograph the various spaces as long as there are no people in the space?

What activities typically occur in the various areas:
Wating Room:

Reception Area:

Patient Rooms:

Offices:

Break Area:

Staff Areas:

Other:

How do you determine how patients move from space to space?

How long is a typical patient visit?

During that typical patient visit, how long is the patient interacting with a nurse and/or doctor?

Discussion of Daily Activites

In order to become better aquainted with your pediatric clinic, can you describe a typical daily routine beginning before the clinic opens? What is the first thing that happens in order to prepare for the day?

When does the clinic open and patient's begin to arrive?

What typically brings patient's to your facility, such as sick children, wellness checks, vaccines, etc?

Can you explain the typical routine of activites patient's go through when visiting the pediatric clinic?

Additional Comments:

Appendix F

Observation

Date of Observation: Site A X

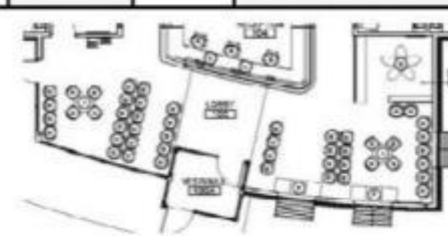
Time of Observation: Site B

The perceived emotional state of the patient's is at the discretion of the researcher based on their visible actions:

1- Excited; 2 - Calm; 3 - Neutral; 4 - Concerned; 5 - Highly Anxious

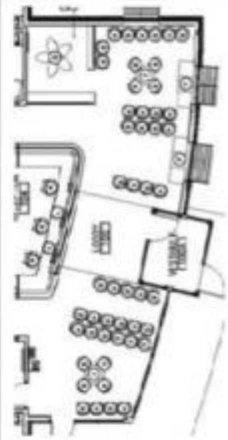
Subject Number:	Time: Entered	Perceived Emotional State: Entering	Location Chosen to Sit or Play	Patient Activities	Time: Went to Patient's Room	Time: Returned from Patient's Room	Time: Left Clinic	Perceived Emotional State: Leaving	Total Time
									Waiting Room: Patient Room:

Additional Comments:



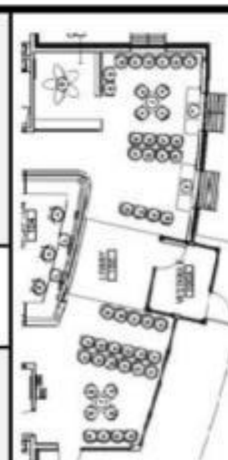
Subject Number:	Time: Entered	Perceived Emotional State: Entering	Location Chosen to Sit or Play	Patient Activities	Time: Went to Patient's Room	Time: Returned from Patient's Room	Time: Left Clinic	Perceived Emotional State: Leaving	Total Time
									Waiting Room: Patient Room:

Additional Comments:



Subject Number:	Time: Entered	Perceived Emotional State: Entering	Location Chosen to Sit or Play	Patient Activities	Time: Went to Patient's Room	Time: Returned from Patient's Room	Time: Left Clinic	Perceived Emotional State: Leaving	Total Time
									Waiting Room: Patient Room:

Additional Comments:



Appendix G

Observation

Date of Observation: Site A

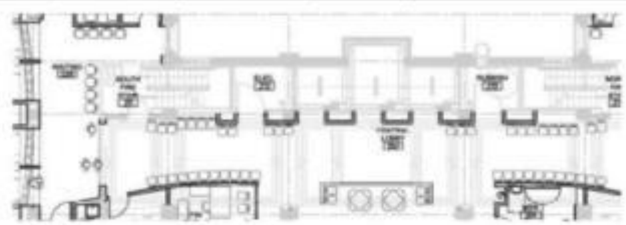
Time of Observation: Site B X

The perceived emotional state of the patient's is at the discretion of the researcher based on their visible actions:

1- Excited; 2 - Calm; 3 - Neutral; 4 - Concerned; 5 - Highly Anxious

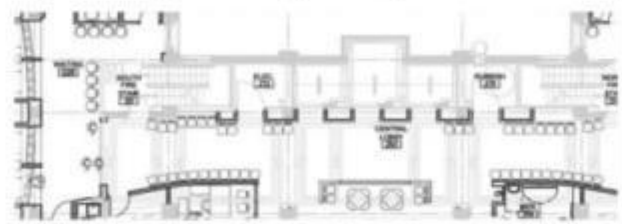
Subject Number:	Time: Entered	Perceived Emotional State: Entering	Location Chosen to Sit or Play	Patient Activities	Time: Went to Patient's Room	Time: Returned from Patient's Room	Time: Left Clinic	Perceived Emotional State: Leaving	Total Time
									Waiting Room: Patient Room:

Additional Comments:



Subject Number:	Time: Entered	Perceived Emotional State: Entering	Location Chosen to Sit or Play	Patient Activities	Time: Went to Patient's Room	Time: Returned from Patient's Room	Time: Left Clinic	Perceived Emotional State: Leaving	Total Time
									Waiting Room: Patient Room:

Additional Comments:



Subject Number:	Time: Entered	Perceived Emotional State: Entering	Location Chosen to Sit or Play	Patient Activities	Time: Went to Patient's Room	Time: Returned from Patient's Room	Time: Left Clinic	Perceived Emotional State: Leaving	Total Time
									Waiting Room: Patient Room:

Additional Comments: