USABILITY OF OUTDOOR SPACES IN CHILDREN'S HOSPITALS

A Dissertation

by

SAMIRA PASHA

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2011

Major Subject: Architecture

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Approved by:

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ABSTRACT

Usability of Outdoor Spaces in Children's Hospitals. (May 2011)

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Researchers have studied the positive effect of healing outdoor environments on hospitalized children, their family members and staff's health and mood. Consequently many modern hospitals dedicate portions of their space to healing outdoor environments. However, these amenities are underutilized due to various design barriers.

This research aimed to identify barriers to garden visitation and introduce design guidelines that encourage garden visitation in pediatric hospitals for all groups. Five Texas pediatric hospital gardens were selected to examine the impact of availability of shade, quality and availability of seats, and presence of the healing nature on user satisfaction and garden use. Behavioral observation, surveys, interviews, and site evaluations were conducted. Gardens were ranked based on design qualities, user satisfaction, and frequency and duration of garden visitation.

The primary conclusion of this study was that garden visitors' satisfaction with design is positively correlated with presence and quality of hypothesis variables. Duration and frequency of garden visitation also increased in gardens with better shading, seating options, and planting. Other factors identified as influential in increasing garden use included availability of amenities for children and playfulness of design layout. The research findings were instrumental in introducing new design

guidelines for future hospital garden design projects. In addition, they served to statistically support design guidelines suggested by previous researchers.

DEDICATION

To Behnaz

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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

1.1. Introduction

A large body of research demonstrates the importance of interaction with nature for human health and well-being. Children, in particular, are proven to benefit both physiologically and psychologically from engagement with nature and outdoor activities. Researchers have studied the positive effect of nature on hospitalized children's health and mood. Along with patients, restorative effects of nature spaces for family members of patients have been also studied. Outdoor spaces afford opportunities for playing, relaxing, and socialization as well as enjoying nature and offering a child-friendly environment. There is evidence to state that nature can contribute to health and wellbeing of the family as a whole.

This strong body of research, combined with the long history of healing gardens, which can be traced back to middle and ancient ages, has stimulated modern hospitals to dedicate portions of their space to healing gardens, courtyards, playgrounds, and outdoor spaces. However, the usability of such spaces is not guaranteed. Case studies and reports revealed that not all of the gardens or outdoor spaces in pediatric hospitals are being used to their fullest capacity. Pediatric patients may not be using outdoor hospital spaces. Additionally, families might spend several hours in a hospital without even making a single visit to the outdoor spaces available to them.

This dissertation follows the style of *Health Environments Research and Design*.

While the usability of the outdoor space is still uncertain, and the design factors encouraging their use are not fully studied, creation and maintenance of such spaces are being criticized for the economic pressure they put on hospitals. For example, Forman argued that financial resources are better spent on direct patient care than garden construction and maintenance (Forman, 1996). Sadler (2001), however, suggests that by creating "life enhancing healthcare environments," which improve health and well-being of patients, hospitals are more likely to survive in an environment of nursing shortage, demands for higher quality of care, and financial failure of hospitals. Research shows that outdoor spaces utilizing nature can reduce costs directly or indirectly, by reducing length of stay, fewer pain medication doses, and higher patient and staff satisfaction (Ulrich, 1999). Yet, if outdoor spaces fail to attract visitors, their return on investment (ROI) remains uncertain.

Cooper Marcus and Barnes (1995) suggested factors such as visibility, accessibility, familiarity, quietness and comfort should be considered to help the garden reach its full potential of usability. Aside from physical attributes of the space, Whitehouse et al. (2001) introduced organizational factors such as staff education, informative brochures and posters, and assigning volunteers to bring patients and families to visit the garden, and to increase use and accessibility of outdoor spaces in children's hospitals. There are also health factors such as infections and injuries associated with garden use, which may influence hospital managers and staff to limit use of the gardens, especially for some groups of patients.

Lessons can be learned from the success or failure of garden spaces in hospitals. With a focus on the design features of pediatric hospital outdoor spaces, this research aims to investigate the main factors discouraging garden and outdoor space visitation for patients and their families.

Chapter I presents a review of the literature on healing gardens and on research methods applicable to this study. Chapter II introduces research hypothesis, selected sites, design and data collection methods and confers research significance. Chapter III and IV include data analysis methods and results that are further discussed in Chapter V. Conclusion, research limitations and future directions are discussed in Chapter VI.

1.2. History, Theory, and Research on Healing Nature

1.2.1. History of Healing Gardens

Ideas of connections between health and garden can be traced back to the middle Ages, the Roman Empire, and the Persian Empire (Prest, 1988).

The Greeks created healing temples called *asclepieions* for the god Asclepius (god of medicine and healing). The temples were built in pastoral settings with mineral springs, bathing pools, gymnasiums, and healing gardens where people would go to worship, lodge, recreate, and heal. In the middle ages, hospitals were associated with monasteries and their garden cloisters were used as places of healing. Figure 1.1 demonstrates an asylum garden painted by Vincent Van Gogh in 1889.

Figure 1.1.The Asylum Garden at Arles Painted by Vincent Van Gogh

In the 19th century, biologists Louis Pasteur and Claude Bernard developed the germ theory of disease, which altered the focus from patient comfort to disease treatment

(Lindheim & Syme, 1983). Later, the industrial revolution made the high-rise building possible and increased the distance between patients and outdoor spaces. Eventually, the importance of access to nature in outdoor settings was more or less overlooked during 20th century. High-rise hospitals built in the International Style with institutional indoor spaces, lacked terraces and balconies, and their outdoor spaces were dedicated to parking spaces. Such environments have been reported to be stressful for patients, visitors, and staff (Ulrich, 1992; Malkin, 1992; Horsburgh, 1995).

While hospital gardens were not as common a decade ago (Shepley et al, 1998), the creation of usable outdoor space in hospitals is being discussed among patients, staff and designers (Cooper Marcus, 2005), and today most hospitals include some outdoor space in their master plans.

1.2.2. Theories of Restorative Nature

Biophilia: According to the theory of Biophilia, humans have a biological need to affiliate with nature (Wilson, 1993). The long history of intimate involvement of people with nature is a reason for people and especially young children to prefer natural settings to man-made built environments (Barrow, 1995).

Attention Restoration Theory: This theory is based on two different types of human attention: spontaneous attention, with a practically unlimited capacity, and directed concentration, with a limited capacity which tires out in a relatively short time (James, 1982). According to attention restoration theory, nature attracts spontaneous

attention, which doesn't tire out. This theory has been tested several times with positive results (Hartig, Mang & Evans, 1991; Hartig & Evans, 1993).

Although there is strong evidence showing the affiliation between humans and nature, a relaxing and enjoyable experience for a human is not guaranteed in every type of natural setting.

Supportive Garden Design: According to Ulrich's Theory of Supportive Garden Design (Ulrich, 1999), gardens help to reduce stress to the extent that they provide opportunities for physical movement and exercise, maintain a sense of control and privacy, and facilitate social support and access to nature, and other positive distractions.

Appleton's Prospect and Refuge Theory (1975): Appleton establishes his theory based on human and animal's preference to have the ability to observe and the opportunity to hide, which is especially important for survival. The place which offers an opportunity to observe the environment around is described as providing prospect and a place which offers an opportunity to hide allows for refuge.

Environmental Preference from Kaplan and Kaplan (1989): Steve and Rachel Kaplan believe that space plays a central role in human perception of a landscape. In their definition, space can be viewed in a three-dimensional way, as well as an immediate, two-dimensional way. The third dimension which is the time spent to discover or explore a natural scene or space, along with a balanced complexity, creates a desirable scene for humans, while an overly simple scene can be boring and not desirable.

1.2.3. Nature and Health

Exposure to sunlight in the morning is effective against insomnia, premenstrual syndrome, and seasonal affective disorder (SAD). SAD, first proposed by Rosenthal in 1984, is a form of depression triggered by the brain's response to decreased daylight exposure. The melatonin precursor, serotonin, also affected by exposure to daylight, results in more positive moods and calm yet focused mental outlook.

Furthermore, exposure to natural scenes contributes to physical and psychological health by reducing stress (Ulrich, 1992). Although a distinction is often made between physiological and psychological stress symptoms, medical evidence has proven that stress can reduce resistance to illness (Parsons, 1991).

The positive effect of natural views has been tested in different settings. For example in prisons with views of nature, prisoners were less often sick (Moore, 1982) and were less stressed (West 1985).

1.2.4. Research on Healing Gardens in Hospitals

Physical or visual access to nature can have positive influences on health outcomes (Hartig et al., 1991, 1993, 1996; Ulrich, 1981, 1984, 1992). Kaplan and Kaplan (1989) found that complexity and unfamiliarity of the hospital environment may cause mental fatigue and cognitive chaos. They suggested that access to a natural setting with little complexity would have a relaxing effect because of familiarity and lower information load. In 1984, Ulrich found that nature views from patient rooms aided their recovery from gall bladder surgery.

Outdoor healing spaces also provide opportunities for social interactions. Research indicates that people with higher levels of social support are usually less stressed and have better health than those who are more isolated, and that stronger social support improves recovery and increases survival rates for a variety of medical conditions (Ulrich, 1999). Research in urban settings indicates that residents of urban areas with more vegetation have stronger social ties (Taylor et al., 1998).

Research has supported incorporation of outdoor spaces enriched by natural elements in hospitals. Among several effects of the outdoor gardens in hospitals, researchers have pointed out a variety of benefits. Achieving perspectives about life and death (Marcus & Barnes, 1999), stress reduction and fewer health-related complaints among patients (Ulrich, 1984), staff and patient satisfaction with hospital experience (Cooper-Marcus & Barnes, 1995; Paine & Francis, 1990), and facilitation of the healing process (Cooper-Marcus, 1995; Olds, 1989) are the major findings in this area. Garden users have pointed out control retrieval and stress reduction as main reasons for garden use (Cooper Marcus & Barnes, 1995).

1.2.5. Benefits of Access to Nature for Children

Nature and green views have a positive effect on cognitive functioning and self-discipline for normal children and on symptoms of children with Attention Deficit Disorder and Attention Deficit/Hyperactivity Disorder (Wells, 2000). Nature also has a beneficial effect on developmental behaviors in children and interactions between

children and adults (Taylor et al 1998). It can reduce children's stress with providing an opportunity for social interactions (Wells & Evans, 2003).

Research has shown a positive relationship between a child's health and access to nature. Grahn et al. (1997) found in a kindergarten located in natural setting, children had fewer absences due to sickness compared to children from a kindergarten located in urban setting. In Scandinavia, fewer incidents of absence due to sicknesses is lobserved among children who attend kindergartens with outdoor spaces (Fjortoft, 2001).

Nature outdoor spaces also provide great environments for children outdoor play. Play is integrated with a child's life (Gariepy & Howe, 2003; Haiat, Bar-Mor, & Scochat, 2003) and freedom to play allows children to gain control, explore their abilities and maintain optimal levels of alertness (Olds, 1989). Having freedom to move helps them to feel relaxed, calm and comfortable (Korpela, 2002) and maintains their psychological well-being (Rubin et al., 1998).

Numerous studies have linked the lack of unstructured outdoor play with obesity, poor physical fitness, heart and circulation problems, and even allergies in children. Research also shows that outdoor activity reduces the occurrence of myopia (Rose & Morgan, 2008). In addition, playing in nature promotes children's social interaction and growth, attentiveness, and motor ability (Fjortoft, 2001; Grahn et al, 1997). In residential setting children play longer in spaces with vegetation. Natural surroundings also contribute to more creative games compared to spaces with little or no vegetation (Taylor et al., 1998).

The need for play even exists in hospitalized children (Bjork and colleagues, 2006). Gariepy and Howe (2003) found a positive correlation between happiness and social play in children with leukemia. Play can also be effective in reducing pain and anxiety in children experiencing medical treatment (Uman et al., 2006).

1.2.6. Access to Nature in Children's Hospitals

Access to nature and outdoor space is especially essential for hospitalized children (Horsburgh, 1995; Strain & Grossman, 1975) and to their parents and family members (Carpman & Grant, 1993).

In pediatric hospitals, outdoor spaces with elements of nature can provide a restorative environment to "get away" from medical environment and improve children's mood (Sherman et al., 2005; Whitehouse et al., 2001). For example, physicians at Children's hospital and Health Center in San Diego reported that interaction with the garden had a positive effect on children recovery and attitude (Sutro, 1995). Said and colleagues (2005) found that almost all parents and staff in their study believed that hospitalized children preferred the garden to the ward. In this study, nurses expressed that experiencing the garden can help children socialize with peers and parents, act more independently in the ward, and be more cooperative taking medicine and show obedience.

1.2.7. Groups of Garden Users in Children's Hospitals

Hospitalized Children: According to Bastin (2000) hospitalized children need to adjust psychologically to the twofold impact of their condition: the image of the sick body and the separation from life routine. Research shows that disease symptoms, severity, and the level of weakness it can cause, are often reinforced by psychosocial factors (Fielding & Duff, 1999; Zimmermann, 1995). Hospitalization causes feelings of stress in toddlers and young children (Lau, 2002), which can result in diluted cognitive performance, feelings of helplessness, restlessness, and high blood pressure (Lau, 2002) followed by excessive fears, anxiety, increased dependence on parents and low esteem (Lau, 2002).

Lack of control experienced by patients results in higher stress levels, which, in turn, negatively affects immune system functioning and other physiological measures (Ulrich, 1999). Perceived stress is associated with negative child health outcomes as well, such as physical pain and emotional distress (Varni & Katz, 1997; Kiecolt-Glaser et al., 1998). Fears are one of the sources of stress in hospitalized children. Zimmerman (1995) found that loss of control, the unknown outcomes, unfamiliar setting and procedures, aches and pain, missing school, body image, separation from family and friends, and death are the major sources of pre-surgery fear among children. Bossert (1994) identified the sources of fears of hospitalized children as distressing procedures, illness symptoms, medical treatments, limited movement, and separation from significant others. Enforcing ward routines can cause feelings of irritation and weakness in children (Coyne, 2006).

For infants, environmental instability and unexpected medical procedures may cause anxiety and difficulties in forming attachments to caregivers (Mayes, 2003). Repeated painful procedures and lack of social stimulation in neonates affects pain sensitivity, brain volume, neuroendocrine functioning, behavior, and cognition (Bhutta & Anand, 2002).

Research shows that children with a chronic illness are weak in developing social relations with peer (Banner et al. 1996, Blackford, 1999, Meier et al. 2000). Meier et al. (2000) compared children with chronic diseases with healthy children and found that the chronically ill children tend to behave less aggressively and more submissively, and generally have less self-confident. Children with the experience of hospitalization either fail to use their social skills or have never learned them (Meier, et al., 2000).

Serious psychiatric consequences of medical illness in children are posttraumatic stress disorder (PTSD) (Stuber & Shemesh, 2006) and in the case of severe illness, depression, anxiety and low self esteem, or poorer social functioning in areas such as employment and adult social skills in their future life (Gibson & Soanes, 2001; Lau, 2002).

Parents of Hospitalized Children: Bjork et al. (2006) studied needs of hospitalized children with cancer and found five common themes of need: to have the parent close by, to play and feel joy, to participate in care, good relationships with the staff, and satisfaction. Runeson et al. (2002) pointed out the importance of having parents nearby especially in threatening situations. Parents play an important role in repealing the negative aspects of hospitalization (Cleary et al., 1986, Runeson et al.

2002, Woodgate & Kristjanson, 1996). Particularly, research shows that hospitalized children's play can be encouraged by the secure base parents provide to them (Bowlby, 1988).

However, the parental support may also be a source of anxiety for ill children. Parents of hospitalized children may become overwhelmed (Kieckhefer et al., 2000; Schulz et al., 1998) and feel captive of their new situation and role (Palmer, 1993). Stressed family members can have negative effects on hospitalized children. Banner et al. (1996) found that children of exhausted parents might have trouble coping adequately with their condition, and have feelings of responsibility and guilt because of their parent's stress. Stewart and Mishel (2000) suggest that parents' perceptions of uncertainty affect the child's illness experience.

Considering the fact that parental stress can be both harmful to them and their hospitalized child, caring for parents emotional condition has the greatest importance. While researching the experience of mothers of hospitalized children, Callery (1997) found that involvement in their child's care put mothers themselves in need of care. In the same research it was revealed that parents are hesitant to seek support and help for their own needs, being afraid of distracting staff from their child. Another study showed that most parents have unexpressed needs for communication and are passive in seeking help and emotional support (Lam et al., 2004).

Parents try to participate in care for their sick child; however their lack of information and the undefined roles makes them experience feelings of anxiety and loneliness (Blower & Morgan 2000; Coyne, 1995). Fortunately, nurses are mostly aware

of parents' needs and consider the parental care as part of their work; however they have uncertainties about the nature and extent of this portion of their job (Callery, 1997).

Well Siblings of Hospitalized Children: According to Systems Theory, changes in one family member affect the whole family (Wright & Leahey, 2000). A child's experience of severe illness and hospitalization can negatively affect all the family members, including siblings (Banner et al., 1996). Research shows having a terminal sibling in a hospital can even be more stressful than being in such setting (Spinetta, 1981, Stein et al, 1989). Siblings of hospitalized children might not get a chance to share their feelings regarding their ill siblings and can feel left out (Havermans & Elser, 1994; Murray, 2002).

Children who are not allowed to visit or receive information about a hospitalized family member may experience psychological and emotional distress. Having the right to be with the hospitalized family member is important to children (Clarke & Harrison, 2001). Children's visitation of the hospitalized family member will reduce their feelings and fears of helplessness, guilt, separation, and loneliness (Clarke & Harrison, 2001). Moreover, visiting hospitalized family members helps reduce the child's confusion about the illness and the hospital environment, and nullify misconceptions about permanent departure of the person (Clarke $ Harrison, 2001).

Staff: Research shows that among nursing staff in healthcare settings lack of exercise can result in obesity and numerous negative health conditions, such as work-related back injury (Goldman et al. 2000, Health and Safety Executive 2006). On the other hand, according to Jakicic et al., (1995), accumulating physical activity throughout

the day can help sustain physical health. In addition to physical benefits (Hartig & Cooper Marcus, 2006, Naderi, 2008, Ulrich, 1999).

1.2.8. Barriers to Garden Visitation in Children's Hospitals

Although there is strong evidence that outdoor restorative spaces positively impact health and mood of patients, families, and staff, research shows these spaces are not being used to their fullest capacity (Whitehouse et al., 2001; Cooper Marcus, 2005).

Whitehouse and colleagues (2001) found four factors as major barriers to the use of healing gardens in hospitals:

1) Knowledge of existence of the garden: 54% of family members in their study found about the garden accidentally by passing by it or seeing it through a window. One-third of the families had never been to the garden.

2) Accessibility of the garden: 13% of the families had difficulties finding wheelchairs to take their child to the garden. Also, distance was found to be a prohibiting factor. Some staff members requested IV electrical outlets (for patients who needed intensive care).

3) Beliefs about the garden: There was confusion about the purpose of the garden. Families didn't know if they were allowed to go there, or take their kids there.

4) Underlying philosophy toward treatment: Nurses mentioned there was insufficient staff to take patients there or it was too time consuming to explain about the garden to families.

In general, influential factors identified by previous research include:

Visibility: Having views to outdoor spaces from patient rooms, waiting rooms, staff areas, and corridors, can increase the chance of knowing about existence of the garden, as well as stress reduction effect because of providing views (Ulrich, 1999) and helping with wayfinding (Cooper Marcus, 2005). Visibility from indoor areas can also make staff supervision and assistance to garden visitors possible (Davis, 2002). Cooper Marcus and Barnes (1995) reported that, with views to the outdoor play spaces, parents felt comfortable staying with their sick child in the patient's room while keeping an eye on their other children playing outside.

The outdoor spaces located at the building entrance or visible from the main foyer have the chance to be noticed by more people without the use of signage (Cooper Marcus, 2005).

Accessibility: Reneman et al. (1999) conducted research on open spaces in residential areas. They found that people prefer to visit small parks and green spaces close to their home rather than large nature areas farther away. Residents also preferred small nature areas accessible via attractive green routes over large parks and nature areas accessible via an unappealing route. Although this study is conducted in a different setting, it clearly elaborates the importance of accessibility over the design and physical attributes of the open outdoor spaces. Considering patients' impairment and family members and staff's limited time, accessibility in hospitals finds greater importance.

Cooper Marcus (2005) observed that in many hospitals, doors to outdoor spaces were kept locked either because staff couldn't monitor use or to cut maintenance costs.

Staff understanding of the therapeutic value of access to outdoors also plays a crucial role in solving some part of the accessibility barriers (Cooper Marcus, 2005). Physical impairments of the patients should also be taken into account when considering accessibility issues. Entrances and pathways in outdoor spaces to the garden need to be designed compatible with wheelchairs or gurneys (Davis, 2002).

Privacy: Sherman et al. (2005) found most of patient room with a view to the garden had closed curtains due to privacy issues. Higher usage of the garden was correlated with a higher number of closed curtains. However, indoor patient rooms are not the only spaces which require privacy. It is also reported that too many windows looking at a small courtyard, can cause the feelings of being in a fishbowl for people in the courtyard (Ulrich, 1999; Cooper Marcus, 2005). In design of the garden itself, Cooper Marcus (2005) draws attention in providing private corners for discussion among family members, family members and staff, or for just being alone.

Health Issues: *Fusarium* is a large genus of fungi widely distributed in soil. Most of their species are harmless as members of the soil microbial community. However, some fusarium species produce toxins, which can negatively affect human and animal health. Specially, in humans whose immune systems are weakened,for example because of chemotherapy, fusarial infections may penetrate the entire body and bloodstream. Raad et al. (2002) found that outdoor Fusarium levels can be more than indoor levels, especially during the rainy summer season. Inadequate water treatment for pools and fountains may also be the source of gastroenteritis outbreaks (Hoebe et al,

2004). Also facility managers are concerned about adverse health effects of pesticides used in the gardens.

Although research (Lewis, 2004) on parents of healthy children indicates that they typically interpret children's playing injuries as a means of learning and growth, this can't be generalized to ill children with weakened immune systems. As a result, many hospital administrators might decide to remove play equipment or limit garden use to prevent injuries and infections.

1.3. Research Methods

1.3.1. Review of the Research Methods

In 1994, Cooper Marcus and Barnes conducted the first systematic post-occupancy evaluation of hospital gardens in the U.S. with environmental evaluation, behavior mapping, and user-interviews (Cooper Marcus & Barnes, 1995). Varni et al. (2004) conducted separate focus groups with parents and staff to help generate items of garden visitation questionnaires. In 2008, Toone utilized questionnaires to estimate parental stress levels before and after garden visitation. In another case, parents and nurses completed questionnaires to provide information about children's preferences regarding garden or ward (Said et al., 2005).

Whitehouse et al. (2001) carried out environmental evaluation by visual analysis of the hospital gardens. In addition they incorporated data from behavior observation, surveys and interviews with patients, families and staff. Trace tracking techniques were used by Sherman et al. (2005) on their study on a children hospital garden. They noted

number of closed curtains of patient room windows looking into a garden and found a positive correlation between number of visitors of the garden and number of closed curtains. Haq and Zimring (2003) conducted wayfinding research in three hospitals using Space Syntax analysis. They found that when exploring an unfamiliar setting, people tend to go to spaces with higher connectivity.

To obtain qualitative data on children's perceptions of hospitalization, traditionally parents or staff act as proxies for children. However, recently researchers are emphasizing the importance of recording the perspectives of children directly (Carter, 2002; Cohen & Emanuel, 1998; Coyne, 1998; Oldfield & Fowler, 2004). Adults speaking for children may not accurately reflect the perspective of the child and can lead the research to invalid results. As a result, to obtain more accurate and reliable data, discussing issues directly with children is recommended (Maguire, 2005). However, some investigators suggest that children may be forgetful about their experiences, have difficulties with conceptualizing their experiences and become affected by suggestions of others (Hart, 1992). They might also be affected by the Hawthorne Effect meaning they may change their behavior or opinion consciously, or subconsciously in order to please the experimenter.

The research methods of the proposed study are established based on the methods used in prior studies and by consulting with researchers in this field.

1.3.2. Multi Method Research Design

Multi-method research design is common practice to carry out environment-behavior field studies that are multivariate in nature. The selection criteria for research methods in this study include their strengths, weaknesses, and theoretical relevance. By using different methods and sources of data, strengths of each method compensates for limitations of the other and enables obtaining a more holistic explanation of the phenomenon.

In this research, variables comprise design characteristic of the gardens, garden location within the hospital layout, groups of users and activities in the gardens. The triangulation approach in this research consisted of qualitative and quantitative methods of data collection such as interviews, site evaluations, behavior observation, and survey. Triangulation will increase the confidence in the interpretation of research findings (Sommer & Sommer, 1997) and generalizability of research finding to similar phenomenon (Flick, 1992).

Interviews and focus groups are qualitative research methods that help to understand a phenomenon in a given context through understanding of people's judgments, and feelings and views (Sommer & Sommer, 1997). With quantitative methods, a phenomenon is broken into independent and dependant variables that have measurable relationships. Quantitative methods are objective means providing a generalizable explanation for the phenomenon (Lincoln and Guba, 1985).Quantitative methods used for this study included a survey, behavior observations, and an audit form to score garden qualities.

Although to researchers, both qualitative and quantitative data are similarly valuable, quantitative data is usually more useful when it comes to competitive decision making situations. Also, statistical analysis of quantitative data can reveal new factors and principles which might not be easily distinguished in qualitative data. Still, according to Campbell (1974), quantitative data needs to be augmented by qualitative knowledge, so that it would produce meaningful data.

1.3.3. Site Visits and Environment Evaluation

Site visits and evaluations are the key component of field studies. Zimring (1994) distinguishes site visits in three major categories: specific visits (focused on particular issues), departmental visits (focused on operation and design of departments), and general visits (focused on concepts relevant to the institution as a whole).

Visiting healthcare organizations will provide an opportunity to experience what costumers perceive during their stay at the facility as well as understanding the facility from viewpoint of administrators. The qualitative and quantitative data gained during a site visit is a valuable source to enrich future decision making. According to Zimring (1994) one of the major pitfalls of site visits is altering the tour to a marketing session where an idea or solution is being advertised. A second problem is that many visits occur early in the research process and visitors rush to close the research options too early. Lastly, due to the busy schedule of the staff familiar with daily operations, visitors sometimes are unsuccessful in scheduling an appointment with them. Instead they might meet someone from public relations office who is not much familiar with actual

problems (Zimring, 1994). Zimring (1994) also suggests developing interdisciplinary communication skills to correspond more effectively during the visit.

Environmental evaluations can take place during site visits. Environment audit tools are relatively simple evaluative framework for assessing whether an environment incorporates necessary design elements and qualities. These tools, developed based on previous research or design and safety guidelines, are targeted at specific environment. For example Cooper Marcus developed the Alzheimer's Garden Audit Tool (AGAT) and Children Hospitals Garden Audit Tool. The later has been utilized in this research.

1.3.4. Space Syntax

Space syntax, in concordance with environment-behavior research, is based on the notion that spatial layout shapes patterns of human behaviour. Thus, it generates graphs representing relationships between components of space (Turner, 2004). The theory was conceived and developed in the late 1970s to early 1980s, and is defined as "a set of techniques for the representation, quantification and interpretation of spatial configuration in buildings and settlements" (Hillier, Hanson, & Graham, 1987).

In 1979, Benedikt created maps based on visual characteristics of a building that showed how people navigated the building. He theorised that these maps would correspond to movement patterns within the space. Hillier and Hanson (1984) generated their own version of maps by breaking the space into its components, and drawing a diagram demonstrating those components and their relationships. In 1985, Hillier

introduced the concept of depth by creating a graph showing spaces, which needed to be passed through in order to get from one space to a space of interest.

Haq and Zimring (2003) conducted wayfinding research in three hospitals. They found that when exploring an unfamiliar setting, people tend to go to spaces with higher connectivity. By connectivity they take into account the relationship of one space to other immediate spaces. A higher level of public connectivity suggests more opportunities for exploration because of being connected to a high number of immediate spaces. Haq and Zimring noted that once people gain some familiarity with the setting, they tend to use spaces with higher integration. Integration conveys the same concept as connectivity, but verified globally, meaning it puts the whole built project into consideration, not only immediate spaces. Integration and connectivity are two concepts of Space Syntax, which suggest how well the spaces are bond together. Eventually, they suggest that a strong correlation between connectivity and integration will result in a more comprehensible spatial experience. Earlier, Hillier, et al. (1987) noted that in an urban environment layout integration was a predictor of movement.

Space Syntax analysis has been used in various urban and architectural studies, as well as in healthcare settings. For example Alalouch and Aspinall (2007) used Space Syntax analysis on six ward designs to explore the relationship between space configuration and perceptions of privacy. They found that at the ward level, designs with low integration and more control are perceived to offer more privacy. In addition to the visibility graph and depth map analysis, they incorporated questionnaires to assess subjective judgments of participants. Depthmap software can be used for space syntax

analyses. This software was primarily developed for visibility analysis of architectural and urban spaces. For example Hölscher and Brösamle (2006) used the software for wayfinding analyses within the buildings.

Although a number of inconsistencies have been reported in Space Syntax (Ratti, 2004), its application has been generally successful in architectural and urban researches (Hillier, 1999). The application of Space Syntax in conjunction with other data collection techniques would increase reliability of analysis and results. Observation (Osmond, 2007; Penn, Desyllas, & Vaughan, 1999) and survey (Alalouch & Aspinall, 2007; Penn, Desyllas & Vaughan, 1999) are other frequently used techniques.

In the proposed research this software, as a supplementary tool, can help to rank spaces based on their connectivity, integration and visibility, to find out whether such factors can affect usability of the outdoor spaces.

1.3.5. Interviews

Interviews are conducted in order to answer questions that could not be easily answered by any other study method. Qualitative data provided by interviews should be coded, and categorized to draw patterns that explain the phenomenon under investigation (Guba & Lincoln, 1994; Stake, 1998). Once the data of each case is analyzed individually, a variable oriented strategy will be utilized to identify themes that different cases shared or did not share (Huberman & Miles, 1994).

Individual and group focused interviews, are usually used when the researcher has already completed a situational analysis to identify “elements, patterns and processes

of the situation" (Ziesel, 2006). The participants should be chosen among the individuals who have been involved in the situation under investigation. Using this methodology, the researcher actually familiarizes herself with their definition of the situation and the terminology they use. According to Zeisel (2006) the pros of group focused interviews (known as focused group) over individual focused interviews are identifying different interpretations of a situation and verifying general beliefs or thought about it in a shorter period of time. However, Merton et al. (1956) pointed out the problem of "leader effect," which may rise in some focus groups, meaning a few people taking over the interview and rule out others from participating. Zeisel (2006) suggests that by appeals for equal time and paying attention to body language of participants an interviewer can invite all group members to participate. In case there are too many different ideas about a single issue, the interviewer can come to a conclusion by asking for votes.

Interviews in his research can cast light on the original intent and philosophical goals of both the designer and the hospital administrators in design and operation of outdoor spaces in children's hospitals.

1.3.6. Behavior Mapping

Zeisel (2006) introduces behavior observation as a helpful method to understand a setting and its users very soon by getting into that environment and feeling it. Behavior observations are instrumental to capture information about human behavior that other research methods such as interviews or surveys may miss. For example Zeisel (2006) advises that research participants may normally hinder some information in the

questionnaires or hesitate to report some other because they think it is not important, or they have forgotten the details.

Behavior observation provides a better understanding of activities in a particular context where a standardized behavioral map will be used to record occurring behaviors during an observation session (Sommer & Sommer, 1997). To demonstrate the association of different categories of subjects, activities and spaces, this information can be recorded by documenting people's locations in space. This technique is widely used for behavioral research in architecture, environmental psychology, and urban design (Sommer & Sommer, 1997).

One of the specific advantages of behavior observations is enabling the investigator to observe the sequence of behaviors, and the causes and effects (Zeisel, 2006). The observer will soon be able to distinguish the recurring behaviors and draw patterns of behavior regarding situations or environmental conditions. Because of dynamic nature of behavior observations, the observer is able to test any detected pattern by predicting subjects' behavior or paying more attention to the circumstances related to the pattern. The tests and predictions need to be recorded and reviewed later with a clear mind, so that they would be free from biases (Zeisel, 2006).

Lack of standardized procedure in collecting and interpreting data is one of the deficiencies of behavior observations (Zeisel, 2006). During an observation session, personal feelings of the observer can be a great source of insights or biases at the same time. This will especially negatively affect the data when details are not being recorded or observer overlooks subjects' differences (Zeisel, 2006). Observer should pay specific

attention to the location she chooses to record data, since obstructive observation can influence the ongoing behaviors. Observer might consider unobtrusive positioning, or changing locations to watch results (Zeisel, 2006).

1.3.7. Survey

Surveys are a suitable method to obtain participants opinions about a specific topic, already identified by previous qualitative or quantitative methods. Therefore opinions about multiple or complex issues are not sought in the surveys (Sommer & Sommer, 1997).

According to Zeisel (2006), questionnaires enable researchers to obtain large amounts of data in a short time and at little cost. Repeating validated questionnaires can help making comparisons between different groups of users, in different locations or times. One of the advantages of questionnaires is enabling the researcher to learn how people think, feel and experience. Such information cannot be gained by behavior observations since behavior observations do not reveal subjects' intentions.

According to Zeisel (2006), in order to develop a questionnaire first the structure of situation under investigation needs to be formed either by observations, archival data analysis, focus interviews, or by referring to theoretical work already completed. After obtaining useful information to generate items of a questionnaire, it can be created in open-ended or close ended structures. When the first draft of the items is prepared, the researcher can ensure the precision of the items by checking the items one by one and comparing them with available guidelines regarding writing questionnaires (Zeisel,

2006). At this stage the investigator would be able to test the questionnaire through different stages which include: Review by experts, cognitive interview and/or conducting a pilot study. (Dillman et al., 2009).

Cognitive interviewing is designed to evaluate "cognitive and motivational qualities" of each item and ensure they will be comprehended as intended, and can be answered accurately by respondents (Dillman et al., 2009). To accomplish the test, a retrospective interview or observing the respondent behavior while answering the questions will be conducted. The respondent will be asked to read questions and vocalize what she perceives (Dillman et al., 2009). An ideal questionnaire will be interpreted similarly by respondents, and answered willingly and accurately by them (Dillman et al., 2009).

According to Babbie (1998), the ultimate way of pre-testing a research tool is by testing it in the manner it will be incorporated in real research. During the field test, the questionnaires should be sent to sample respondents. Controlled sampling is not favored at this stage, so that the investigator can receive a wider range of responses or feedbacks (Babbie, 1998).

If there are several versions of a questionnaire available, each of them should be sent to a different group of respondents to realize which of them was better understood or responded (Babbie, 1998). In some cases, field testing can be utilized to form survey items (i.e. asking respondents to answer to an open ended question to help generate answers for the same question in a close ended format).

By analyzing results of the field testing, the investigator will have an estimate of the answers' rank, their distribution across proposed categories, or their usefulness in case of open ended questions (Dillman, 2009). To obtain high-quality survey responses Dillman et al. (2009) proposes that perceived rewards for responding by respondents be increased.

1.4. Summary

Positive effect of healing nature on human health and wellbeing is supported by research, history of healing gardens, and theories of restorative nature. In healthcare environments, nature outdoor spaces can benefit patients, family members and staff by providing positive distraction, opportunities for physical activity and social interaction that can lead to stress reduction.

The benefits of outdoor spaces for hospitalized children can be studied from both psychological and physiological benefits of nature for health and wellbeing, and opportunities for play and socializing that outdoor spaces in natural settings offer to children.

This research focuses on usability of outdoor spaces in healthcare settings for pediatric patients, their family members, visitors and staff. Barriers to garden visitation investigated in available literature and methodologies incorporated in similar studies were studied to create the base for the research.

CHAPTER II

RESEARCH DESIGN AND METHODOLOGY

2.1. Research Hypothesis

Based on the results of a post occupancy evaluation in the healing gardens of a pediatric hospital, Whitehouse et al (2001) suggested design guidelines to encourage garden visitation in pediatric hospitals. These guidelines included incorporating more greenery and seating options. Cooper Marcus (2005) has extensively discussed the importance of presence of shade (especially in warmer climates), seats and nature in healing gardens and outdoor spaces of healthcare facilities. Research in urban outdoor spaces suggests than presence of shade (especially in hot climates), seats, and more greenery will encourage use (Cooper Marcus & Francis, 1998). Although all these factors have also been identified in previous research on pediatric hospitals, no quantitative data has been collected and analyzed to ensure their effectiveness.

Research also suggests that besides the design characteristics of the outdoor spaces, their location within the hospital impacts visitation. As suggested by Whitehouse et al. (2001), one reason gardens might be underutilized is that few people walk by and find out about them. The proposed research mainly focuses on outdoor spaces adjacent to high traffic zones of the hospitals, to be able to compare effectiveness of design features of the outdoor spaces on usability.

The hypothesis of this research is that presence of seats and shade coupled with a nature-dominant design will encourage use of outdoor spaces located in high traffic zones of the children's hospitals in Texas.

2.2. Site Selection Criteria

The outdoor spaces in the study hospitals were selected based on similarity of five potentially confounding variables, and differences in the three design variables of interest (shade, seating, nature dominance). Garden differences in terms of connectivity to adjacent high traffic zones of the hospitals will also be put into consideration. As a result, it can be insured that the variability of emerging data from various sites are not from the impact of control factors.

2.2.1. Control Factors

The major barriers to use identified in previous research are: lack of knowledge about existence of the gardens, locked doors, inappropriate pavements and paths for wheelchair and walkers. These factors were controlled for in this study. In this regard, only the gardens, which are visible and accessible from high traffic zones of the hospital, were selected, so that people were more likely to know about the gardens and have access to them. Also the outdoor spaces which had locked doors (such as Texas Children's Hospital playground) or inappropriate pavement were eliminated from the study. Additionally, only children's general acute care hospitals in Houston, Dallas, Austin and San Antonio were visited to control for climate and setting (see Table2.1).

Table 2.1
Control Factors

CONTROL FACTORS- SIMILAR ACROSS ALL GARDENS		
Factor	**Description**	**Background**
Setting	Type of Hospital (long term care - general acute care- children's hospital)	
Climate	All hospitals are located in same geographical area with similar climate, with data collection taking place in similar weather conditions.	People are less likely to use the gardens in adverse environmental conditions.
Physical Access to the Outdoor Spaces	Easier access policies (unlocked doors)	Cooper Marcus (2005) observed that in many hospitals, doors to outdoor spaces were kept locked.
Wheelchair and Walker Accessible Outdoor Spaces	Paths and pavements are accessible for wheelchairs and walkers	Entrances and pathways in outdoor spaces need to be designed compatible with wheelchairs or gurneys (Davis, 2002).
Location	Outdoor spaces are visible and accessible from high traffic zones of the hospital	Views to outdoor spaces increase knowledge about existence of the garden, help with stress reduction effect (Ulrich, 1999) and wayfinding (Marcus, 2005).

2.2.2. Design Features

To test the impact of selected design features (good seats, shade and greenery), two groups of sites were selected to be compared in terms of their usability. Group 1 consisted of outdoor spaces with relatively poor seating and shading along with a hardscape-dominant design. The outdoor spaces in group 2 have better seating and shading conditions in addition to a nature-dominant design (see Table 2.2). A third group of hospital gardens were selected that their design features will fell in a range in between those of the two main groups.

Table 2.2
Design Factors/Research Variables

Design Factors	**(group 1)**	**(group 2)**
Shade	Lack of shade	Presence of Shade
Seats	Poor seating	Good seating
Nature vs. Hardscape	Low Nature	High nature

2.2.3. Site Visits

A list of children's hospitals located in Houston, Dallas, San Antonio and Austin was created. The marketing director for some hospitals provided informative material used in the fundraising process. Several healthcare firms were contacted to obtain information about their recent projects in mentioned cities. Eventually five children's hospitals that had healing outdoor spaces selected to be visited in cities of San Antonio, Plano, Fort Worth, Austin and Houston.

Table 2.3
Selected Hospitals (Data provided by American Hospital Association. 2009)

	Texas Children's Hospital	Dell Children's Medical Center	Legacy Children's Medical Center
Location	Houston, TX	Austin, TX	Plano, TX
Number of beds	458	174	72
Admissions	22,080	8,138	not available
Outpatient Visits	1.21 million	88,022	not available
Inpatient Surgery	8,859	2,580	not available
ER Visits	82,025	56,432	not available

The site visits were completed based on guidelines provided by Zimring (1994) and considering research control factors. Six gardens at four children's hospital met the garden selection criterion. From the four final hospitals, three approved to cooperate with the study. Eventually five gardens located in three hospitals were included in the study (Table 2.3). All gardens were accessible and visible from a high traffic zone of the hospital, had unlocked doors (during daytime), and were wheelchair accessible.

2.2.4. Site Information

Tables 2.4 to 2.9 provide detailed information about the selected gardens. LHG is an outdoor garden accessible from the hospital's dining area and available to staff, patients, and visitors. The garden is located on the north side of the building and therefore fairly shaded during most hours of the day. Movable chairs and dining tables are available in the garden. Colorful flowers, a water stream, and views to surrounding grass beds outside the garden premises create a calming atmosphere for garden visitors (Table 2.4).

LLG is located in the same hospital and accessible from the hospital main lobby. The garden's shade and seating options are similar to LHG. However, compared to LHG, the garden's design has fewer design amenities. No walking paths, water stream or sculptures are available in the garden. The garden views to the outside nature environment are interrupted by a parking lot.

TCH is a rooftop garden with diverse and rich planting and comfortable and various seating options. Colorful sculptures, wind chimes, and a water fountain, which

attracts birds, create an attractive atmosphere for the visitors. The garden is nicely shaded due to the presence of surrounding buildings and shading elements. The surrounding buildings however, create a fish-bowl effect, which can negatively affect garden visitor's experience (Table 2.6). TCH is accessible from the family lodging area and is close to the NICU.

DLP and DOG, are located in the same hospital (Tables 2.7 and 2.8). DLP is accessible from the surgery waiting area, which daily hosts around 10 to 15 family members who wait in the area for an average of 3 hours. The garden is a small courtyard garden lacking outside views and a variety of design amenities. No seating options are available and the garden is poorly shaded especially during the morning and noon when the waiting area has visitors. DOG, is an outdoor garden that is visible from family rooms and PICU, and incorporates pools, sculptures, colorful hardscape, various plants, and amenities for children. The garden offers no specific seating options other than hard edges and is poorly shaded.

Table 2.4
LHG Garden Design Characteristics

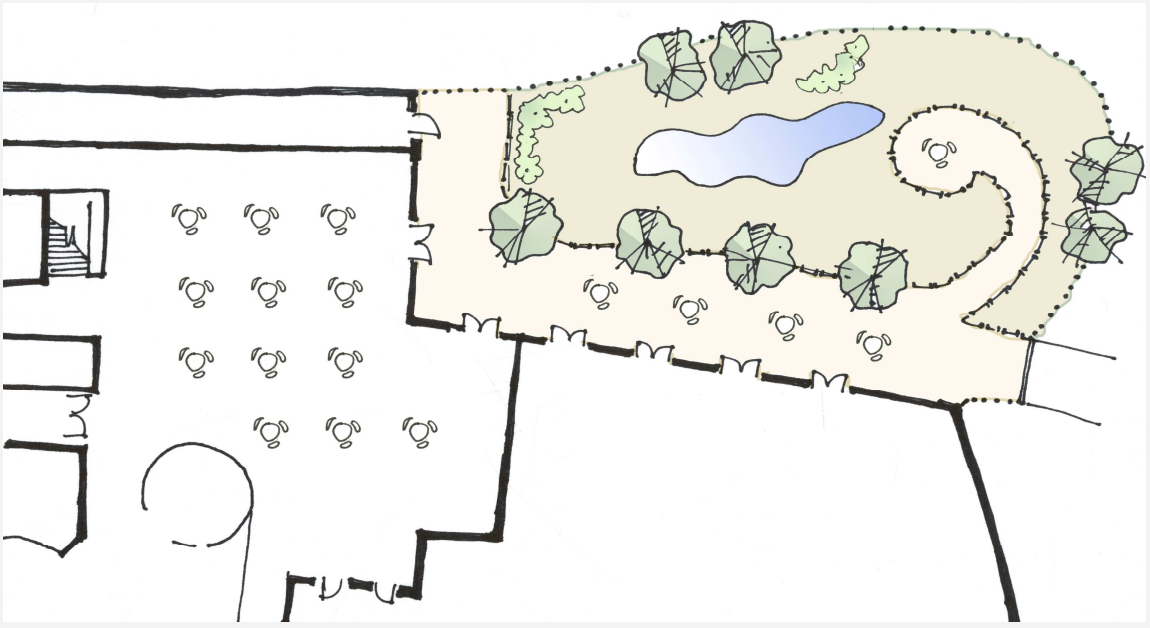
Design Factors	Type: Open Outdoor Space
Control Factors: Visible and Accessible from high traffic area Unlocked doors Wheelchairs Accessible **Design Considerations:** Good shade Relatively good seats Nature dominant **Location:** Accessible from public dining area and staff spaces, parking area	
	

Table 2.5
LLG Garden Design Characteristics

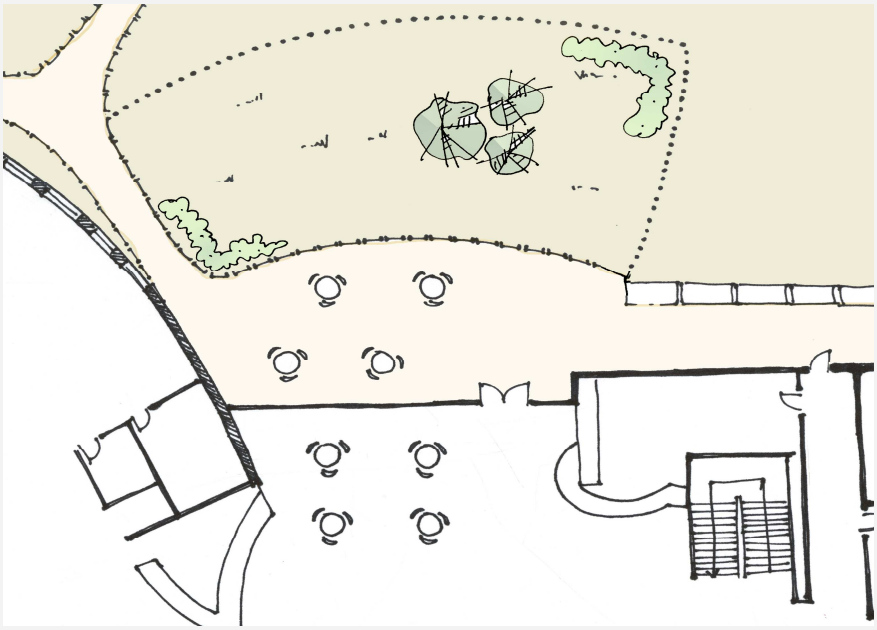
Design Factors	Type: Open Outdoor Space
Control Factors: Visible and Accessible from high traffic area Unlocked doors Wheelchairs Accessible **Design Considerations:** Limited Shade Not much good Seats Low nature **Location:** Accessible from main lobby	
	

Table 2.6
TCH Garden Design Characteristics

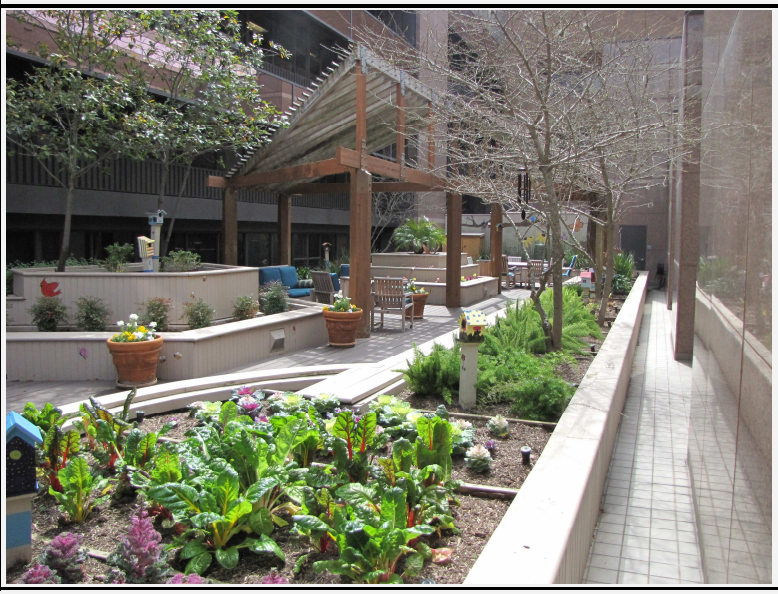
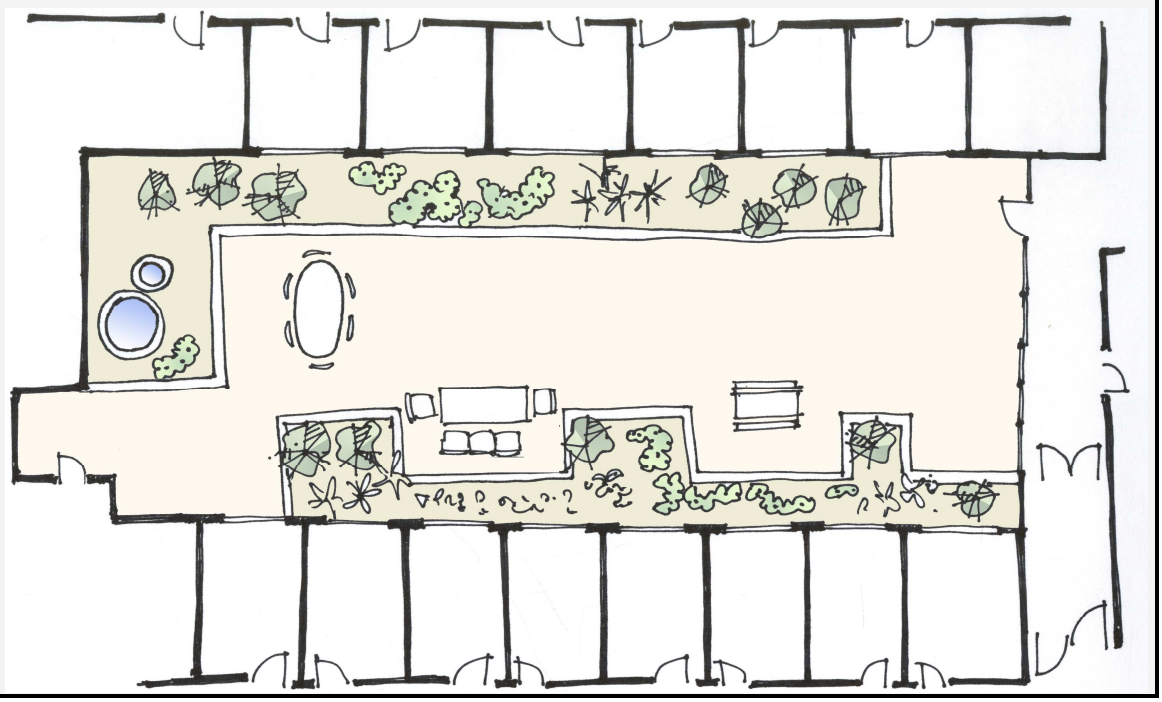
Design Factors	Type: Rooftop Garden
Control Factors: Visible and Accessible from high traffic area Unlocked doors Wheelchairs Accessible **Design Considerations:** Good Shade Good Seats Nature Dominant **Location:** Accessible from parent's lodging area	
	

Table 2.7
DLP Garden Design Characteristics

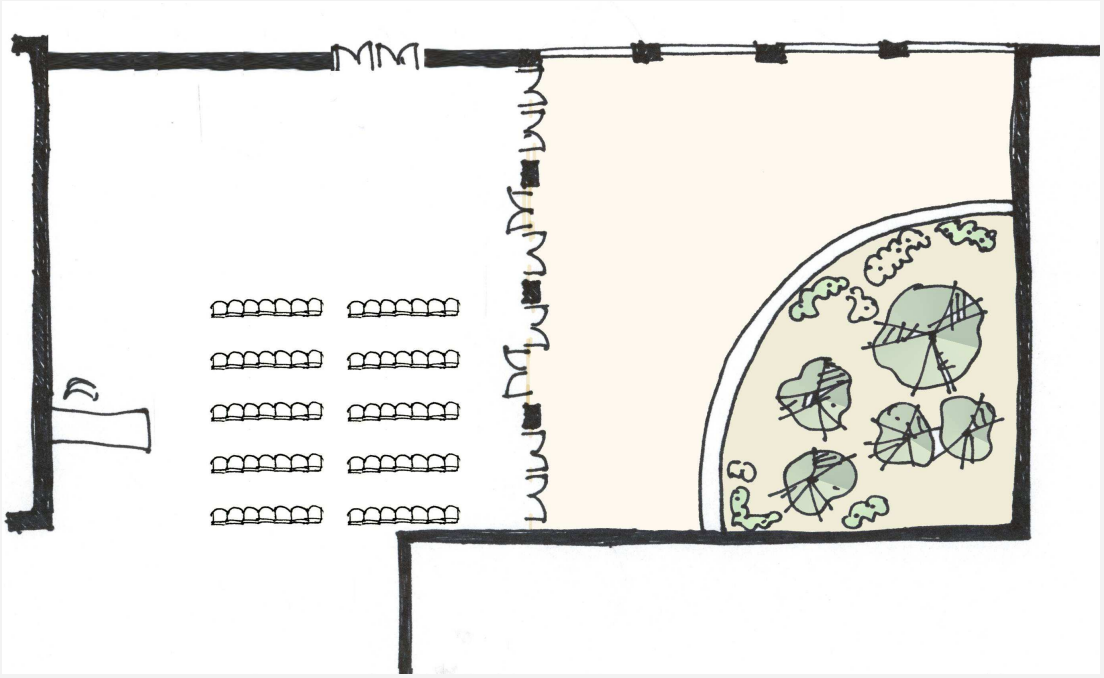
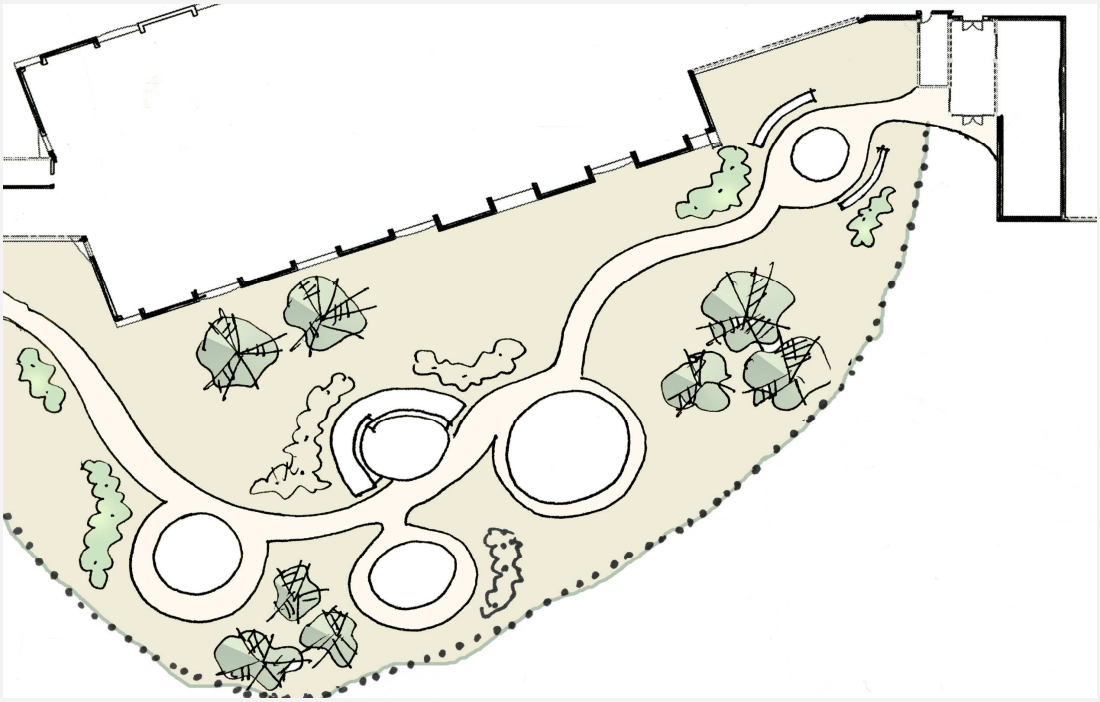
Design Factors	Type: Courtyard Garden
Control Factors: Visible and Accessible from high traffic area Unlocked doors Wheelchairs Accessible **Design Considerations:** Poor shade No Seats Low Nature **Location:** Accessible from surgical services waiting area	
	

Table 2.8
DOG Garden Design Characteristics

Design Factors	Type: Open Outdoor Space
Control Factors: Visible and Accessible from high traffic area Unlocked doors Wheelchairs Accessible **Design Considerations:** Limited shade Limited Seats Nature Dominant **Location:** Adjacent to patient rooms	
	

2.2.5. Evaluation of Selected Outdoor Spaces

Design features including shade, planting and seats were evaluated to rank Gardens. Variable were evaluated using available tools including environmental evaluation tools and software. Location was one of the control factors of the study and all gardens were located close to high traffic zones of the hospitals. However, among those outdoor spaces adjacent to high traffic indoor spaces, a wide range can be identified in terms of function, visibility and connectivity to the outdoor spaces and other adjacent spaces. As a result, location of the gardens were also scored and compared. The summary of research variables and evaluating tools are presented in Table 2.9.

Table 2.9
Evaluation Tools for Design Features

Design Feature	**Evaluation Tool**
Shade	Shade Maps
Seats	Children Hospitals Garden Audit Tool
Planting	Children Hospitals Garden Audit Tool
Location	Children Hospitals Garden Audit Tool, Depthmap

For each garden, shade maps at 2-hour intervals from 9 a.m. to 6 p.m. were obtained to calculate percentage of shaded versus sunny area (Table 2.10) The garden shade scores for each time interval were calculated using the percentage of garden's area that was shaded during that specific time interval. The average of these values for each garden represented the garden's final shade score (Table 2.11). This method does not put shade quality, location, and footprints into account, however, provides quantitative values

representing each garden's level of success in providing shade for visitors who don't wish to stay in sunny areas for long periods of time.

Table 2.10
Garden Shade Maps

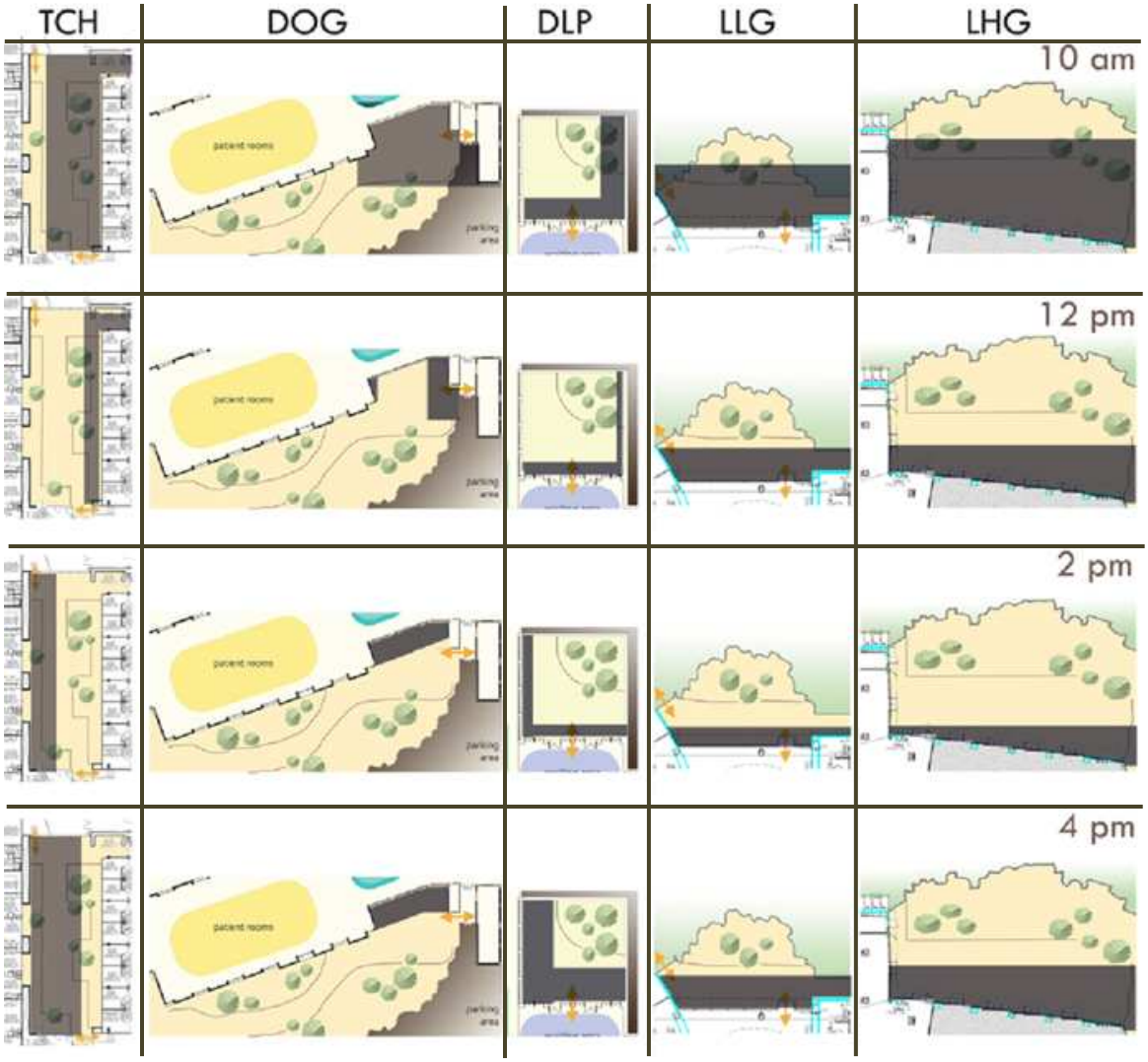


Table 2.11
Garden Shade Scores

	DLP	LLG	DOG	LHG	TCH
10 am	40%	100%	30%	100%	80%
12 pm	10%	50%	20%	70%	50%
2 pm	10%	60%	10%	70%	40%
4 pm	30%	90%	20%	100%	100%
6 pm	60%	100%	30%	100%	100%
Average	30%	80%	22%	88%	74%

Seating options and planting were evaluated using Children Hospital Garden Audit Tool developed by Cooper Marcus and Barnes in 2007. The tool also provided items to evaluate gardens in terms of location, design details, maintenance, garden atmosphere, and amenities for children. Gardens locations were evaluated using Depthmap, the Space Syntax software and the audit tool. Space Syntax is based on spatial configuration and physical layouts. Studying plans of various gardens and surrounding indoor spaces with Depthmap, only helped to have a grasp of levels of each garden's connectivity to surrounding indoor spaces. To obtain quantitative scores for location and boundaries of each garden, the Children's Hospital Garden Audit Tool was instrumental. Interestingly, both tools sorted gardens similarly. Finally the scores produced by the audit tool were incorporated in final chart.

Considering scores for design features, one gardens was selected for group 1 (poor seats, shade and landscape dominant) and one gardens for group 2 (good seats, shade and

nature dominant). Three gardens have been selected for a third group, which have design characteristic of either of the main groups or stand in the middle (see Table 2.12).

Table 2.12
Groups of Selected Outdoor Spaces

	Group 1 (Poor)	**Fillers (Mixed, Average)**			**Group 2 (Good)**
	DLP	LLG	DOG	LHG	TCH
Location	.73	.78	.76	.78	.67
Planting	.37	.37	.46	.43	.77
Seating	.25	.35	.45	.44	.52
Shade	.30	.80	.22	.88	.74

2.3. Research Methods

Applied research aims to respond to an existing problem and incorporates hypothetical predictions and testing research outcome to accept or reject the hypothesis (Graziano & Raulin, 1997). In case of applied field research, the researcher is unable to eliminate confounding variables completely to control the setting and this may eventually interfere with validity of the study (Campbell, 1974). As a result the use of multiple research methods (triangulation) are encouraged to provide greater confidence in the research findings (Leedy, 1993).

With triangulation, the researcher inspects reliability and validity of the research findings by testing one source of information against another one. To understand context and patterns of use in each site of this study, both qualitative and quantitative methods were incorporated.

Behavioral observations in garden spaces and adjacent public indoor spaces, surveys of family members and staff, and site tours with designer or administrative representatives of the hospitals were the methods used to understand the context and collect necessary data from different resources (See Table 2.13).

Table 2.13
Data Collection Methods and Sources of Data

Method	**Sources of Data**	**Data**
Site Tours	Hospital and Designer Representative	Hospital policies, Design Intentions
Surveys	Staff, Parents, Adult/Non-Patient Visitors	Demographics, Visitation Habits Barriers to Visit Satisfaction with Environment
Observations	Garden Visitors	Demographics, Visitation Patterns

2.3.1. Interviews and Site Tours

With reference to the literature and ideas from site visits and evaluations, a number of items were developed during site tours to form interview questions for designers and key staff of the hospitals. The questions involved intended user groups, garden usability, encouraged and discouraged activities, and design recommendations (see Appendix 4).

Site tours were performed during March and April 2009 involving visiting the facilities, evaluating the gardens, and discussing research related issues with participants.

For each case, the schedule was adjusted to fit number and specialty of participants. A Delphi approach was employed to discuss design and incorporation issues with a child-life specialist, project manager, director of acute care services, and designer representatives of Legacy Children's Medical Center in an approximately 75 minute session in the hospital. Project manager and a volunteer worker at Texas Children's Hospital shared their experiences and knowledge regarding incorporation of hospital's playground and healing gardens during a 25-minute walking tour in the hospital. Gardens at Dell Children's Hospital were discussed with the landscape designer and a child-life specialist.

Field notes were taken and discussions were transcribed and analyzed based on qualitative research methods which involved coding data to draw patterns or categories (Guba & Lincoln, 1994; Stake, 1998). A variable oriented strategy was utilized to identify themes that different cases shared or did not share (Huberman & Miles, 1994).

Lincoln and Guba (1985) offer credibility as the equivalent of internal validity and transferability as the equivalent of external validity for interview data. Informant error and researcher error can both interfere with validity of interview data. In the case of this study, the informants' information was in concordance with available literature and previous research, and served to validate the data. Member checks and reflexivity as suggested by Gilchrist and Williams (1999) were used during interviews to prohibit misunderstandings. Furthermore, triangulation with behavior observations and surveys, as another method to nullify bias (Lincoln & Guba, 1985), was incorporated to ensure validity of interview data.

2.3.2. Behavior Observations

During Spring 2010 approximately 30 hours of observations were completed at each facility during regular daytime hours and both on weekdays and weekends. Observation sessions were scattered throughout the day in order to record an accurate summary of daily activity, and to determine when most visitations occur. The spring period was chosen because the weather is generally pleasant and comfortable in the garden, with temperatures ranging from 70-85 degrees. The observations took place both inside the garden and in adjacent indoor spaces with physical and visual access to the garden.

The observational scheme was designed for behavior tracking technique and enabled recording activities, preferences for seats and shade, duration of stay and subjects (Figure 2.1). Time and weather conditions were recorded as independent variables at the beginning of each observational session. In addition, a plan of the garden was used to mark locations where various behaviors took place.

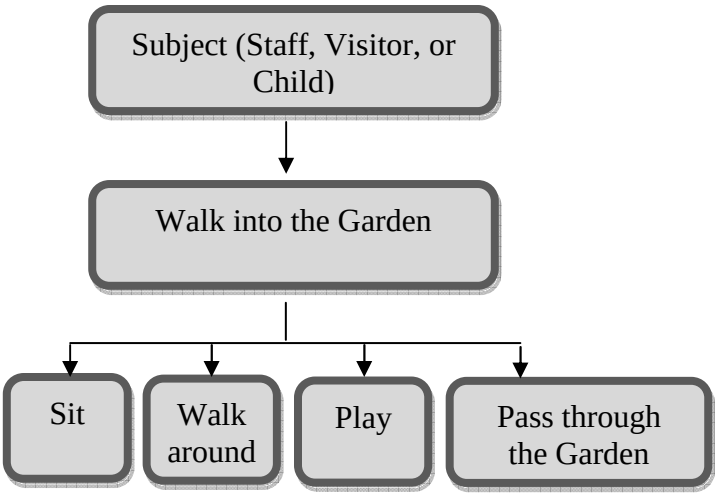


Figure 2.1. Observational Scheme

Noldus observational software was utilized to create the observational scheme. The completed scheme was downloaded to a PDA to be taken to the site and record behaviors. To ensure accuracy and compatibility of the behavioral program generated for Noldus, a pilot study was completed in College of Architecture Cafeteria with access to an outdoor space. The recording competence and emerging data was examined, the program was revised and tested again until it was ready to use for data collection.

Instrumentation is a threat to validity of observational data collection. In this research, the observer could become bored or overly familiar with the measurement. To avoid observer fatigue, she took 15-minute breaks after each 45 minutes (approximately) of observation. In addition, the first 15-minute block of each observation session was dropped off the study.

Upon completion of observational sessions on each site, the data on the PDA was downloaded to the computer immediately and revised. This helped the observer to repair

any missing data or correct recording mistakes, while she still remembered incidents in the garden. This was especially possible due to limited number of garden users each day. The Noldus equipment has already been used to observe children's behavior in educational settings (Brand, 2003) along as well as healthcare settings (Konofal et al., 2001) and also to record parent-child interaction patterns (Granic et al., 2007, Hollenstein & Lewis, 2006) and children's play (Sánchez-Martín et al., 2000).

According to Hartmann (1982), subjects might alter their behaviors when they feel they are being monitored. He suggested different methods such as unobtrusive measures without evoking participant awareness (which may raise ethical issues), reducing the degree of obtrusiveness by reducing conspicuousness of the observers, or prolonged observation sessions for adaption to observers presence. The last two techniques were used in this study.

2.3.3. Surveys

The survey method was designed to evaluate different constructs associated with garden visitation and use. The categories and items were derived from Sherman et al (2005) garden visitation questionnaire, interviews with staff and designers and available literature on healing gardens, mainly the work by Cooper-Marcus and Barnes (1995).

Accordingly, the main constructs addressed in the survey include: demographic data, knowledge about existence of the garden, barriers to garden visitation, and garden visitation habits including frequency, duration and activities. Respondents were also asked to rank garden features of the available garden and an ideal garden on a 5-point

scale. This enabled the researcher to compare quality of design perceived by users with quality of same design assessed by Children Hospital Garden Audit Tool (Figure 2.2).

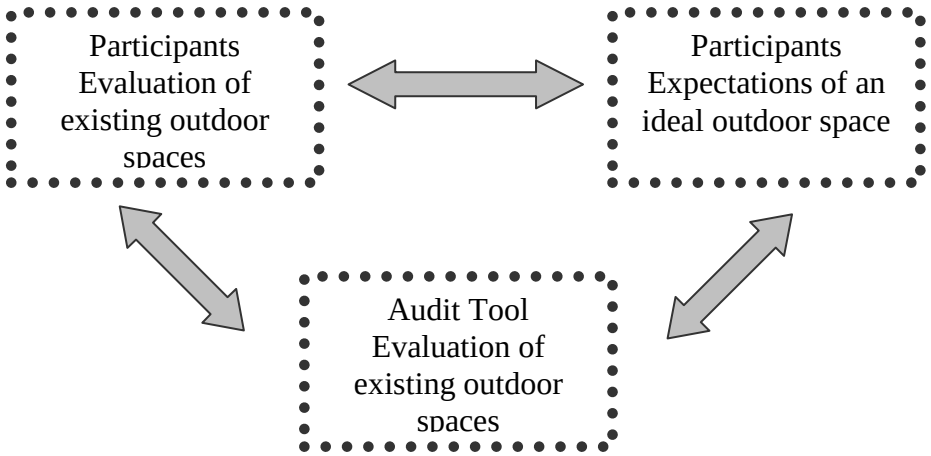


Figure 2.2. Research Sites Ranking Criteria

The survey tackled concerns of a wide range of people, the ones who never visited the gardens and the people who visited the garden on a regular basis. As a result, it was suitable to be answered by both groups of people to obtain their viewpoints. The surveys were customized differently for staff and visitors. A Spanish version of visitor's survey was prepared for family members and visitors, who were more fluent in Spanish.

Open-ended questions are an important part of a questionnaire giving diverse and invaluable information. However, open-ended questions were kept to a minimum to keep the survey shorter and encourage more visitors and staff to participate.

For each garden, the survey was customized to bear the name of the hospital and image of the garden under investigation. The customized image was particularly helpful in situations where hospitals had more than one garden.

To ensure that the surveys will be comprehended by participants as intended, cognitive interviewing was utilized. To accomplish the test, a non-architecture major under graduate student who had no prior knowledge about the research hypothesis and objectives, was asked to go through the survey questions and tell the researcher what he comprehended. After accomplishing this test, the draft was sent to the on-site principal investigator in Texas Children's Hospital for final revisions.

Eventually a pilot study was conducted with eight staff at Legacy Children's to examine the ease of understanding and answering to the survey. This led to few additions to section concerning barriers to garden visitation. On-site researchers suggested "not being allowed to visit the garden" and "high traffic in the garden" to be added to staff's questionnaire as one of the barriers to use. In addition, during the pilot study, it was observed that that 3 out of 8 people added the item of weather as one of the barriers to use, so this item was added to the second edition of the survey. In the ranking sections for the design features, 2 out of 8 people had ranked 5 out of 5 all the way down for all design factors. It is suggested that offering contradicting options (positive options and negative options) avoids such responses because it makes respondents to pick answers more carefully. However, eventually all items were kept in positive words, since contracting items can be confusing and may lead to wrong answers. It was understood that a roughly correct response is more desired than a possibly wrong answer. Items

included Availability of seats, shade, plants and flowers, water features, child friendly design and walking paths.

Although it was ideal to employ similar methods of survey distributions in all four hospitals, this was not possible due to different hospital administrative preferences and IRB policies.

In two of the sites the on-site researcher (the child-life specialist cooperating with the research) was in charge of distributing the survey among staff and visitors in the garden, and visitors and staff who she knew through the child-life program and did not use the garden. On other two sites (Dell and TCH) surveys were located at the entrance of the garden, the family room nearby the garden and the family housing lobby adjacent to the garden. A note that said "Garden Study, Please Take One" was place beside the surveys. Boxes were placed where respondents were asked to drop completed surveys.

Different methods of distribution could have led to sampling error, which is one of the four critical sources of survey error including miscalculations in coverage, sampling, measurement, and non-response (Dillman et al., 2009). Sampling error is also associated with the non-probabilistic sampling process. In this study for each garden, number of visitors, number of people able to access the garden, number of hospital inpatient and outpatient visitors and staff and percentage of them with similar distance to the garden were different. This made calculating ratios for disproportionate sampling complicated. Consequently, similar numbers of surveys (20 staff and 20 parents and visitors) were collected from garden users and non-users for each case.

Coverage error takes place when a large number of populations are not included in the sample. In this study, the target population for the survey was aimed at staff, and visitors (garden users and non-users). Measurement error can be caused by inaccurate or imprecise questionnaires. Measurement error also occurs when respondents' answers are incorrectly recorded. To ensure the survey questions could be understood and answered appropriately, it was reviewed by experts and on-site researchers and pilot-tested in Legacy Children's Medical Center.

The non-response error occurs when a high percentage of projected sample doesn't answer the surveys. Survey of this study was relatively short and easy to answer, with few open-ended questions and appealing presentation to obtain desired number of completed surveys.

2.4. Research Validity

To reduce the probability of drawing erroneous conclusions, the validity of the research tools should be ensured. Shadish et al. (2002) define validity as "the approximate truth of an interference," that will be determined by the extent relevant evidence, including past findings and theories, supports it. Validity typology has been expanded by Shadish and colleagues (2002) (See Table 2.14).

Table 2.14
Validity Types and Threats. Applicable to this Study from Shadish, et al. (2002).

	Definition	Question	Threats
Statistical Conclusion Validity	Appropriate use of statistics to test the relationship between presumed independent and dependant variables.	How strongly does garden visitation co-vary with quality of seats, shade or planting?	Low statistical power, Unreliability of measures, Heterogeneity of units or respondents
External Validity	Is the relationship between independent and dependant variable genaralizable to other persons, settings and times?	Can the findings of this study be generalized to other healthcare settings, especially other pediatric hospitals?	Inadequate explication of constructs, construct confounding, reactive self-report change,
Construct Validity	Do the measured operations truly represent the study constructs?	Do items under investigation truly represent garden visitation patterns influenced by garden design characteristics?	Interaction of casual relationship with units, outcomes, or setting; Context-dependant mediation
Internal Validity	Does the existing co-variation result from a causal relationship?	Are the differences in garden visitation patterns because of differences in seating options, shading, healing nature, and accessibility of the garden or other factors such as hospital policy, weather etc.?	Selection Bias

To ensure statistical conclusion validity in this study, a large sample size consisting of 6 gardens, with a total of 120 hrs of observations and 240 surveys was used. In addition, selected settings had large variability in terms of independent variables, and non redundant covariates were minimized by setting control factors.

Generally, confounding variables can be a possible threat to validity. Though factors such as weather, setting, type of respondents and accessibility of the gardens have been controlled for the research, differences may still exists in terms of size of the hospitals, culture of each organization, and types of patients. To reduce the impact of such disparity in the final outcomes, each hospital was studied as a case study, to enable considering unique characteristics of each site.

The threats to construct validity include inadequate explication of constructs; construct confounding, and reactive self-report change. Since, in this research, the garden visitation was carefully defined, and the constructs derived from previous research were validated by interviews and the measures were piloted, explication of constructs and construct confounding threats where ruled out. To ensure that reactive self report by respondents does not impact the outcomes, surveys were designed discreetly so that respondents wouldn't guess the actual research hypothesis or objectives to manipulate answers based on them.

To increase external validity of the study, questionnaires were prepared for various groups of participants: visitors and staff, garden users and non users, and English or Spanish speaking people. Studying four pediatric hospitals in Texas, contributes the generalizability of the research to all pediatric hospitals in the area. Meanwhile, the

research findings were in concordance with those of previous research, majorly conducted in California. This will greatly contribute to validity of research findings in both states.

2.5. Research Significance

A thorough search of the literature revealed that most articles on outdoor spaces in hospitals are published in landscape architecture journals and gardening magazines, as Sherman noted in 2005. This demonstrates a lack of concern by architects regarding this important element of design. Although the final layout of the outdoor spaces is designed by landscape architects, architects make crucial decisions such as placement, type, size and accessibility. Conducting research from an architectural perspective reveals aspects of the design focused on the relationship between the building and the outdoor spaces, which can influence accessibility of outdoor spaces.

Administrative rules and regulations play a significant role in usability of gardens and outdoor spaces in hospitals. Hospital administrators are the people who make the key decisions over design, construction, maintenance, and use of such spaces, yet their viewpoints have been overlooked by previous researchers. This research explores hospital owner's perspectives by seeking hospital directorial staff view points.

One of the major issues in garden visitation is the threat of contracting an infection or being injured, which, in case of particular diseases, can be extremely harmful. Despite a strong body of research on importance of active play for children, fear from injuries in hospital outdoor spaces has led many hospital owners to eliminate play

features from hospital gardens. This study investigated the relationship between presence of play features on usability and popularity of the garden spaces.

This study is among the few studies that have quantitatively measured garden visitation habits in pediatric hospitals. Moreover, no other study has assessed design features of gardens to find their impact on garden visitation.

2.6. Research with Human Subjects

According to part 46 of Code of Federal Regulations-title 45, any research about human subjects must receive Institutional Review Board (IRB) approval. Since this research was collaboration between Texas A&M University and four children's hospitals, it needed IRB approval from university and all hospitals involved.

An IRB application was filed after completing the CITI training course and finalizing interview questionnaire, surveys, observation checklist and consent forms to Texas A&M University IRB office. Since patients, children or senior citizens have been excluded from the research population, and the research procedure contained minimal risk, it was identified as exempt from review.

Hospital IRB processing was then initiated with identifying on-site principal investigators (PI) for each hospital. The PIs were child-life specialist from two sites and medical doctors in two other. Each site, despite minor differences in procedures and forms, correspondingly required three main steps to be taken before allowing data collection. Hospital administrative approvals needed to be obtained first. The steering committee reviewed research proposal and research documents to ensure research

procedure and implementation have no interference with hospital functioning. In the next step, IRB offices reviewed research protocol and documents and after a few stipulations, identified it as exempt from review. Finally an organizational affiliation contract was signed between each hospital and Texas A&M University through their Research Services offices.

2.7. Summary

The hypothesis of this research is that presence of seats and shade coupled with a nature-dominant design will encourage use of outdoor spaces located in high traffic zones of the children's hospitals in Texas. To assess the impact of hypothesis variables on levels of garden use, five hospital gardens were selected for this study. Control factors included weather conditions, accessibility, location and setting. Behavior observations and surveys were used to collect garden use data. Surveys were also instrumental in obtaining the garden users' satisfaction with design. Design variable were scored and ranked using available modified children hospital garden audit tool and shade maps.

CHAPTER III

DATA ANALYSIS: SURVEY DATA AND DESIGN CHARACTERISTICS

3.1. Research Hypothesis and Data Analysis Methods

The hypothesis of this research is that presence of seats and shade coupled with a nature-dominant design will encourage use of outdoor spaces located in high traffic zones of the children's hospitals in Texas. The research design includes a high number of hypothesis variables (4 variables including shade, location, nature and seating) compared to the number of samples (5 garden). Moreover, gardens had a combination of good and poor design qualities. Hence, testing impact of variables separately was neither feasible nor resulting in accurate findings.

To rank gardens based on design characteristics, a weighted score was calculated for each garden based on their scores on design variables. Gardens where also ranked based on their usability. Usability of the gardens was calculated using observational data and survey data considering groups of users, duration of stay and diverse activities. Usability of the gardens was compared against the weighted score to test whether gardens with a higher score and lower rank have higher levels of usability.

Gardens were also ranked based on levels of user satisfaction as reported in surveys. This ranking was compared against rankings based on design qualities as measured by the audit tool and usability of the gardens.

In addition to the main hypothesis of the study, survey data was used to 1) calculate the correlation between demographics and garden visitation habits, and 2)

determine design preferences. Observational data were used to examine the relationship between groups of users and garden visitation duration and activities.

3.2. Garden Ranks Based on Design Attributes

To score garden attributes, a modified version of Children Hospital Garden Audit Tool (CHGAT) developed by Cooper Marcus and Barnes (2007) was used. Location and accessibility, layout and pathways, planting, seating, amenities for children design details, maintenance, and garden atmosphere were evaluated using modified CHGAT. To assess levels of shade at each garden, shade maps obtained in two-hour intervals during day hours were used. The final shade score represents the average percentage of sunny area during a sunny day at each garden (Table 3.1). Two factors, maintenance and garden atmosphere, were excluded from further analysis since they were evaluated equivalently for all gardens. The remaining seven variables were used for further analysis.

Table 3.1
Scores for Design Attributes of the Gardens

	TCH	DOG	LLG	LHG	DLP
Location and Accessibility*	0.67	0.76	0.78	0.78	0.73
Layout and Pathways+	0.67	0.73	0.47	0.59	0.55
Planting+	0.89	0.82	0.43	0.7	0.52
Seating+	0.52	0.4	0.35	0.44	0.25
Amenities for Children+	0.45	0.61	0.32	0.43	0.37
Design Details+	.40	.40	.38	.42	.38
Maintenance+	1.00	1.00	1.00	1.00	1.00
Garden Atmosphere+	1.00	1.00	1.00	1.00	1.00
Shade^	0.74	0.22	0.8	.88	0.3

*modified Audit tool +Audit tool ^ Shade Maps

To rank gardens, an overall score for each garden is needed. To generate a comparable overall score, a weighted mean of the variable scores for each garden is needed. Principal Component Analysis (PCA) was used to estimate the weight of each variable. This method is helpful in describing the variance-covariance relationship between many variables for data reduction and interpretation purposes. Analysis of principal component helps to detect relationships not already suspected (Johnson & Wichern, 2009). The first component represents as much of the variability in the data as possible and includes variables responsible for that variability. Each succeeding component accounts for as

much of the remaining variability as possible, and includes variable influential in corresponding variability.

Table 3.2
Principal Component Analysis of Garden Design Characteristic Scores

	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.849	54.988	54.988	3.177	**45.380**	45.380
2	1.841	26.294	81.282	2.236	**31.938**	77.318
3	1.130	16.140	97.422	1.407	**20.104**	97.422
4	.180	2.578	100.000			
5	2.810E-16	4.014E-15	100.000			
6	-3.145E-17	-4.493E-16	100.000			
7	-2.638E-16	-3.769E-15	100.000			

The PCA helped to identify the design characteristics that varied largely across the selected gardens. The method clustered design characteristics in three main components (Table 3.2), calculating each component's weight in the total variance. Table 3.3 represents design characteristics clustered in the principal component and the succeeding components. According to Table 3.3 variables layout and pathways, amenities for children and planting have the highest coefficient in the principal component, and therefore compose the principal component. It can be concluded that the gardens mostly varied in terms of these design characteristics. The principal component here explains 45.3% of the total variance (Table 3.2). Variables associated with the succeeding component explain 31.9% of the total variance, and include shade, seating

and design details. Location is the only representative variable in component three (Table 3.3) explaining just 20.1% of total variance of all feature scores (Table 3.2).

Table 3.3
Principal Component Analysis of Garden Design Characteristics Clustered in the Principal Component

	Component		
	1	2	3
Location	-.130	-.017	**.982**
Layout	**.950**	.140	-.278
Planting	**.781**	.448	-.434
Seating	.333	**.842**	-.363
amenities for children	**.990**	.044	.027
Shade	-.569	**.819**	.021
design details	.482	**.795**	.212

Rotated Component Matrix
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 5 iterations.

To calculate the weighted score, the percentage of variance explained by each component (Table 3.2) was used as a coefficient for the variables of that component, where:

0.45 (layout score + planting score+ amenities score) + .32 (seating score+ shade score+ design detail score)+.2 (location score) = garden's weighted score

The resulting scores were used to rank gardens based on their design qualities. The garden scores and corresponding ranks based on scores of the seven variables including location and accessibility, layout and pathways, planting, seating, amenities for children, and design details are presented in Table 3.4.

Table 3.4
Garden Scores and Ranks Based on Design Characteristics

Garden	Score	Rank
TCH	1.65	1
DOG	1.57	2
LHG	1.32	3
LLG	1.19	4
DLP	1.15	5

The same steps were repeated to rank gardens based on research hypothesis variables including shade, seats, planting, and location. These variables composed a subcategory of four variables out of previous seven variables. In the new ranking system, DOG and LHG switched places, but the other gardens stayed in the same order (Table 3.5).

Table 3.5
Garden Scores and Ranks Based on Scores of Hypothesis Variables

Garden	Score	Rank
TCH	1.00	1
DOG	.77	3
LHG	.91	2
LLG	.74	4
DLP	.59	5

3.3. Analysis of Survey Data

3.3.1. Population

Descriptive statistics were used to analyze research population demographics. Staff and visitors surveys were analyzed separately. Data was also analyzed separately for each garden to understand data from the populations independently and detect any potential differences among gardens staff or visitor populations.

Figures 3.1 and 3.2 demonstrate the percentage of male and female respondents in both staff and visitor surveys. Seventy-five percent of respondents to visitor surveys and ninety percent of respondents to staff surveys were female. No male staff survey was obtained at TCH.

Figures 3.3 and 3.4 demonstrate the ethnic distribution of the respondents. Respondents were mostly white (50% of visitors and 65% of staff). Figures 3.5 and 3.6 show the percentages for respondents' roles. Ninety percent of respondents to visitor surveys were parents/guardians of a hospitalized child. Less than 10% of the respondents were either family members or patient visitors (Figure 3.5). Fifty percent of respondents to staff surveys were medical staff, and 35% were non-medical staff (Figure 3.6). Figure 3.7 demonstrates visitors' number of hospital visitations (days) at each hospital, with highest average of visits belonging to LHG (28) and lowest belonging to DOG (13). Figure 3.8, represents staff years of work at each of the hospital buildings. TCH, being the oldest hospital building, had the highest average (6 years), and Legacy, being the most recently built hospital had the lowest average of employment years (1.5 years and 1.8 years for LLG and LHG).

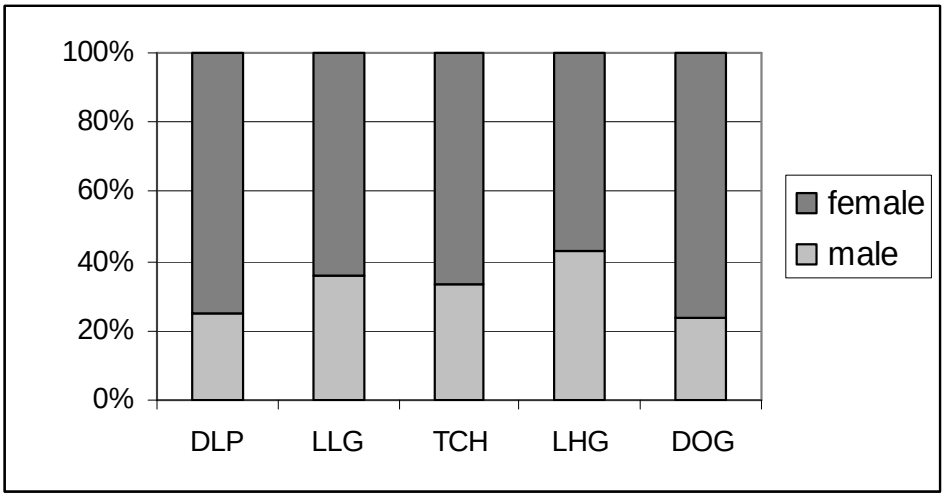


Figure 3.1. Visitor Gender Distribution

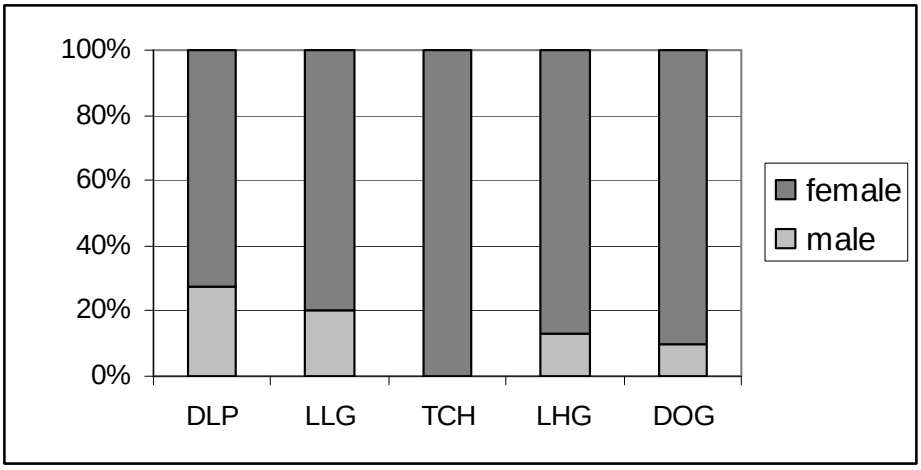


Figure 3.2. Staff Gender Distribution

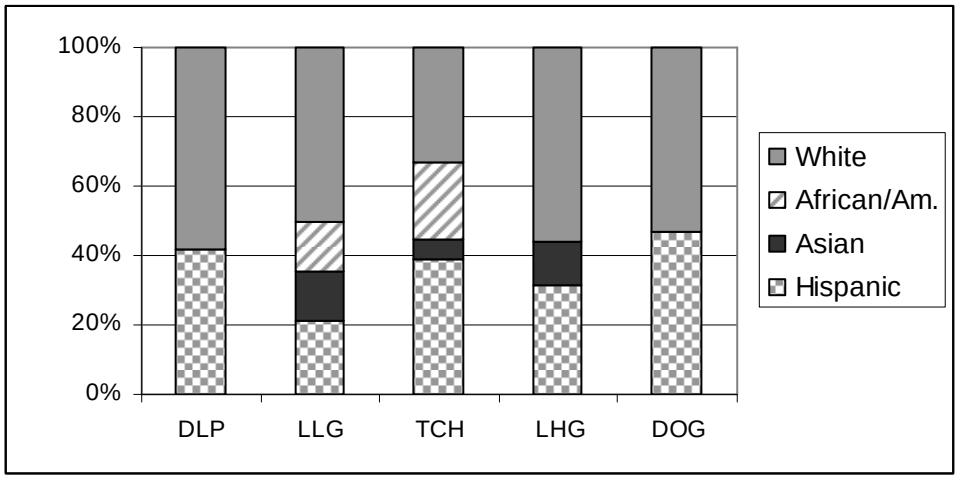


Figure 3.3. Visitor Ethnicity Distribution

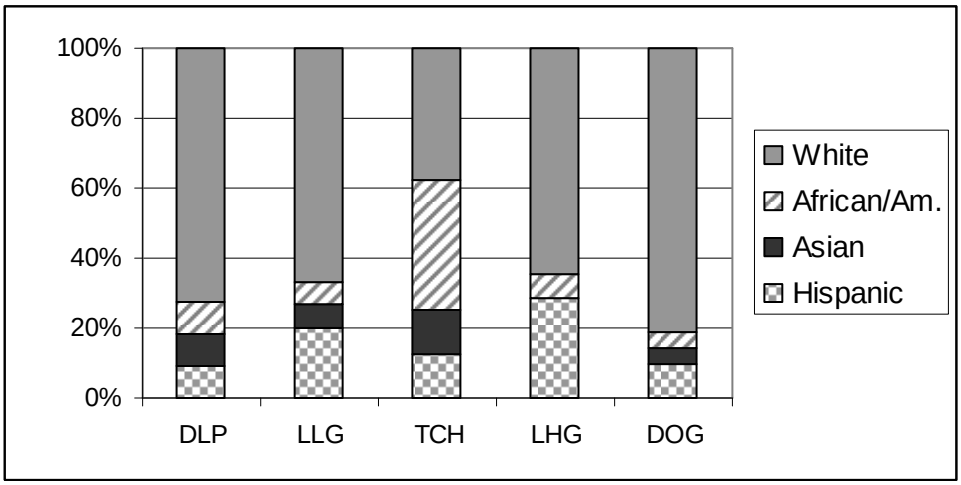


Figure 3.4. Staff Ethnicity Distribution

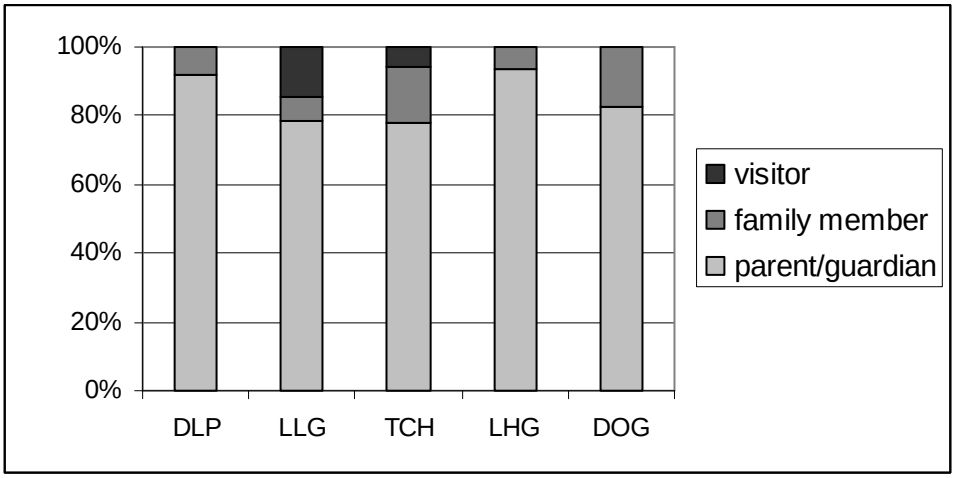


Figure 3.5. Visitor Role

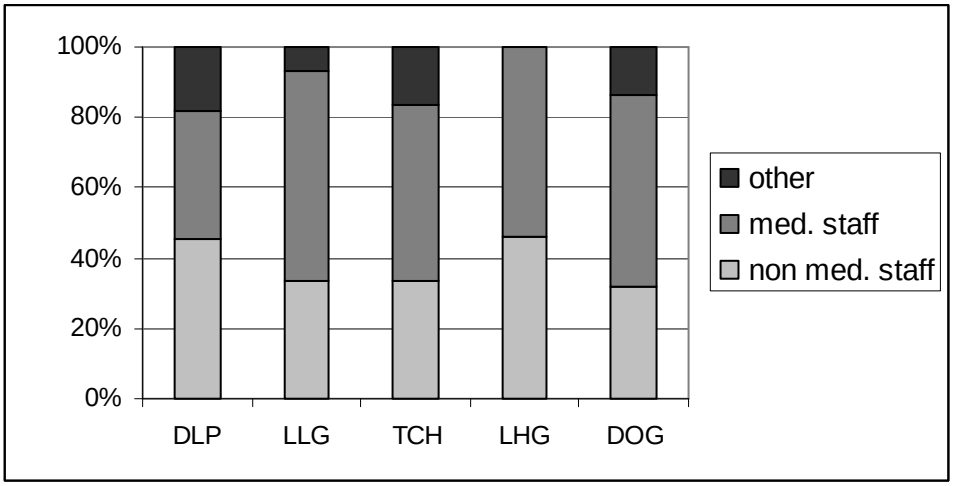


Figure 3.6. Staff Role

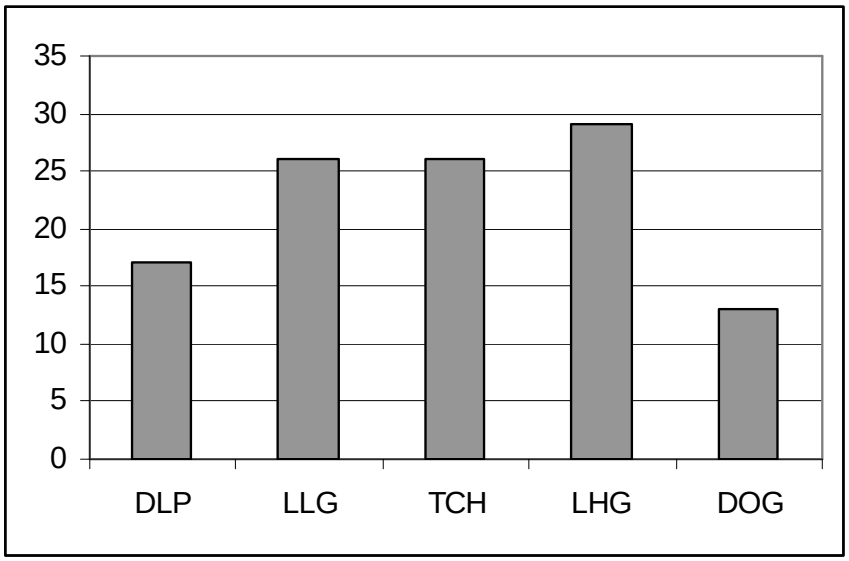


Figure 3.7. Visitor Average Number of Hospital Visits (days)

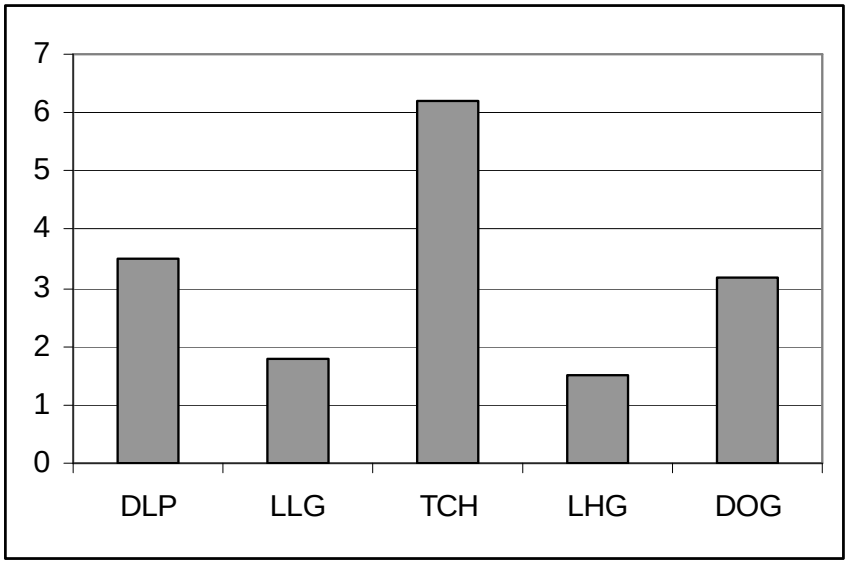


Figure 3.8. Staff Average Years of Work

3.3.2. Garden Use

Descriptive statistics and charts were used to visualize garden visitation habits as reported in staff and visitor surveys. Garden visitation habits include activities in the garden, frequency and duration of visitation, barriers to garden use, and knowledge about existence of the garden.

Figures 3.9 and 3.10 demonstrate sources of knowledge about the gardens. As shown in Figure 3.9, more than 60% of the respondents said that they did not know about existence of DLP, whereas all visitor respondents to DOG surveys said that they knew about the existence of the garden. Views to the garden, either from office/patient room (22%) or from corridors while walking by (42%), provide the main sources of knowledge about this garden. Around 30% of respondents to LHG and TCH surveys said that they learned about the garden through other people talking about them. In 90% of the cases they mentioned that the people telling them about the garden were staff.

As shown in Figure 3.10, staff knew about existence of all gardens except DLP, where around 25% of staff respondents said that they didn't know about this garden. DOG was the only garden that a percentage of respondents (both staff and visitors) said that they had read about it before visiting the garden.

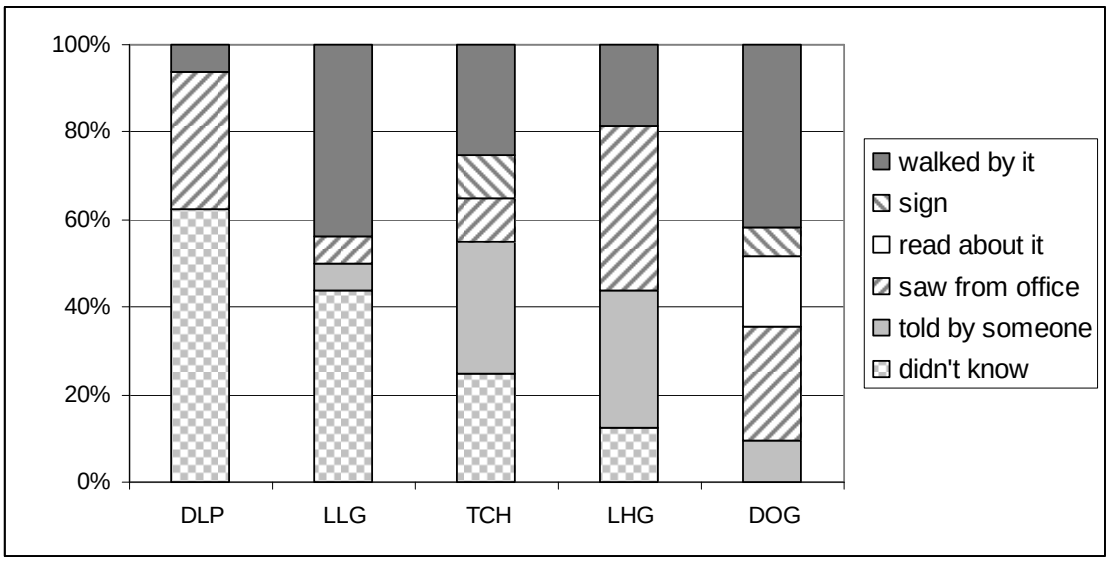


Figure 3.9. Visitor Sources of Knowledge about the Garden

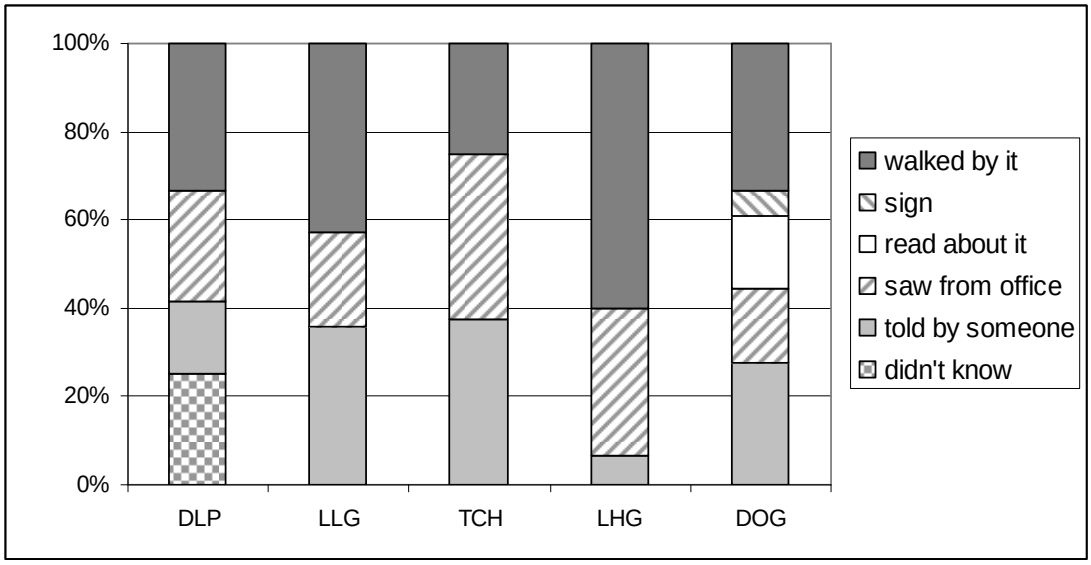


Figure 3.10. Staff Sources of Knowledge about the Garden

Figures 3.11 and 3.12 represent the various activities mentioned by staff and visitors that visited the gardens. As demonstrated in Figure 3.11, LHG and TCH had the highest diversity of activities (7 different types of activities) and DOG had the highest number of activity items (23 items) mentioned by visitors. More than 50% of activity items mentioned in DOG named by visitors are walking around and letting children play. DLP with only two types of activities mentioned, had the fewest activities mentioned by visitors in the garden.

Figure 3.12, representing staff activities in the gardens, demonstrated that DOG, is not only the garden with highest diversity of staff activities (8), but also the garden with highest number of activity items (23). DLP, again, has the lowest scores in activity items mentioned by staff.

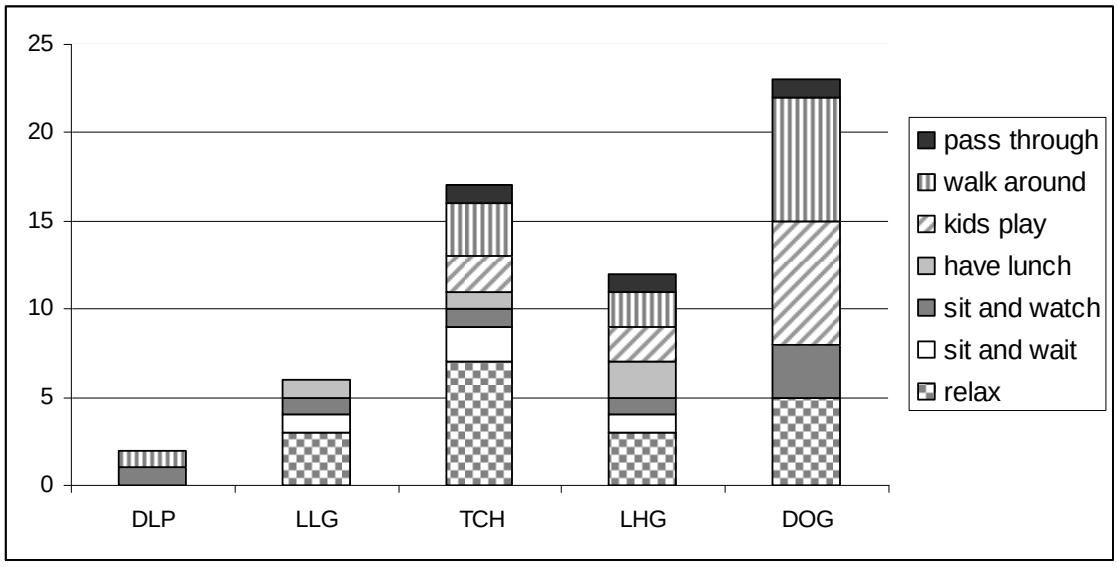


Figure 3.11. Visitor Activity in the Garden

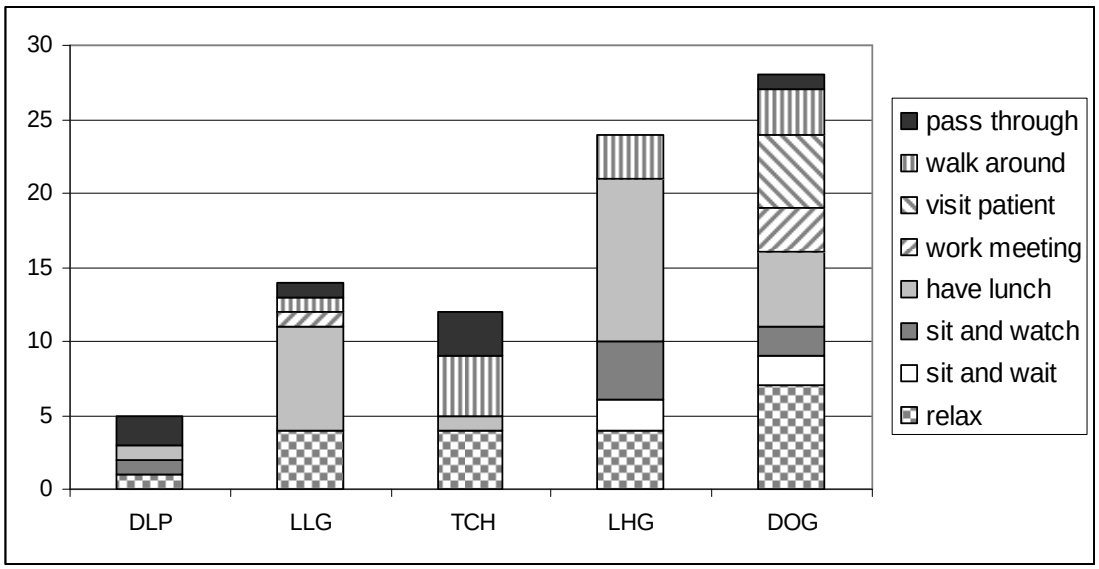


Figure 3.12. Staff Activity in the Garden

Figures 3.13 and 3.14 demonstrate barriers to garden visitation reported by staff and visitors. Visitors mentioned a higher variety of barriers to visiting LLG, followed by LHG. The least number of visitors complained about barriers in DOG. In contrast, staff complained the most about this garden. A similar contrast was observed in case of TCH, with the least barriers mentioned by staff, and a relatively high number of barriers mentioned by visitors. In both cases the categories causing drastic differences are personal circumstances such as child's condition or being busy. On average, staff complained about seats and shade more than visitors.

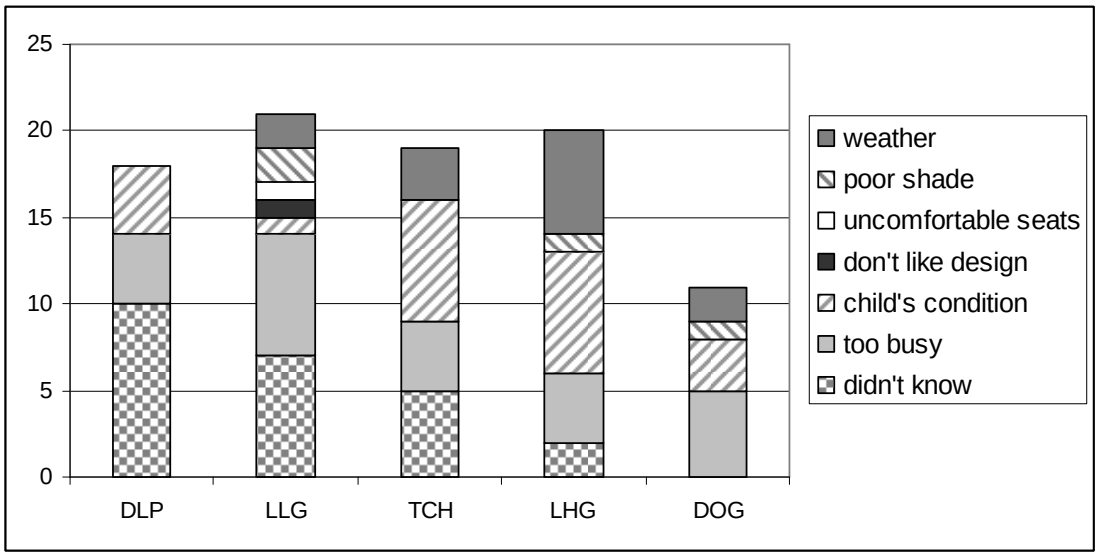


Figure 3.13. Barriers to Garden Visitation Reported by Visitors

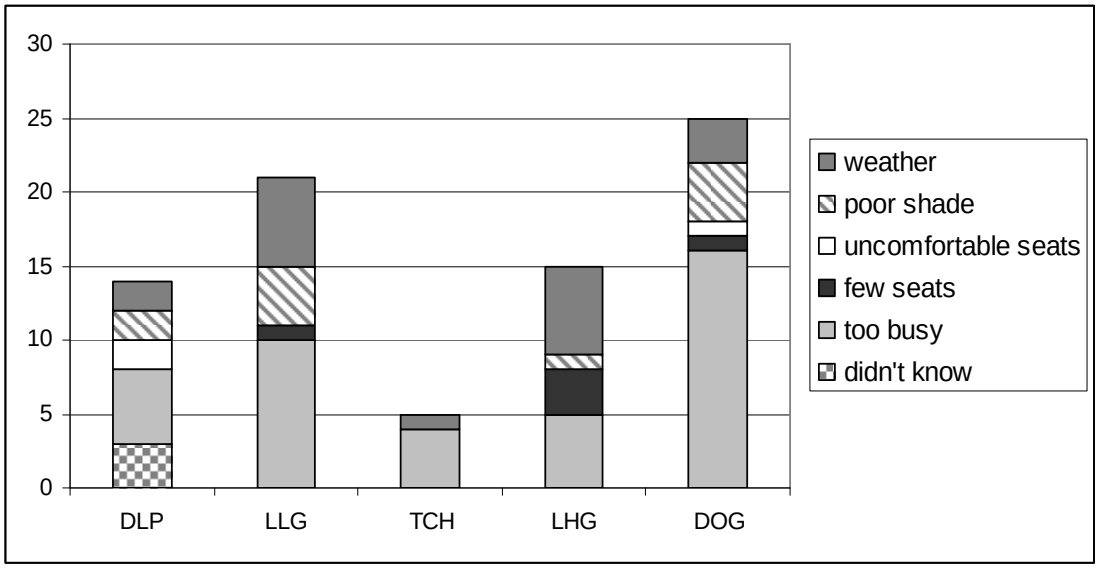


Figure 3.14. Barriers to Garden Visitation Reported by Staff

Figures 3.15 and 3.16 display frequency of garden visitation for all groups. On average, DOG is visited most frequently, and DLP is visited least frequently by both staff and visitors. The same pattern is observed in Figures 3.17 and 3.18, demonstrating durations of stay. Here, again, both staff and visitors stayed the longest in DOG and the shortest in DLP.

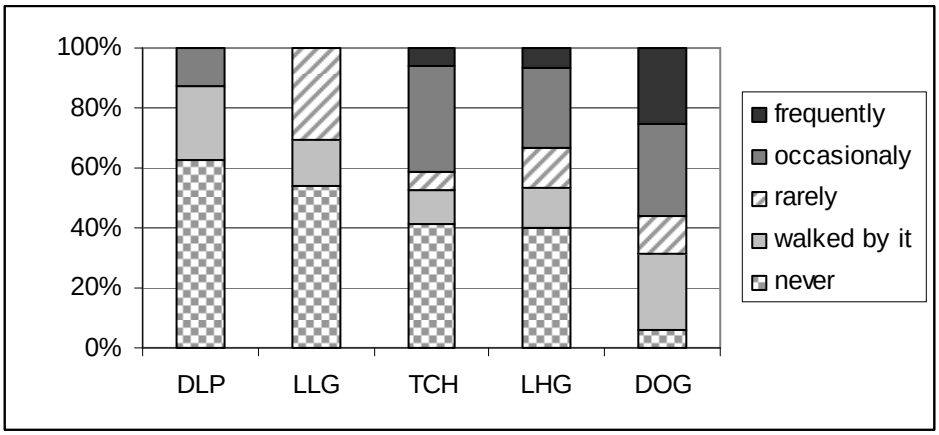


Figure 3.15. Visitor Frequency of Garden Visitation

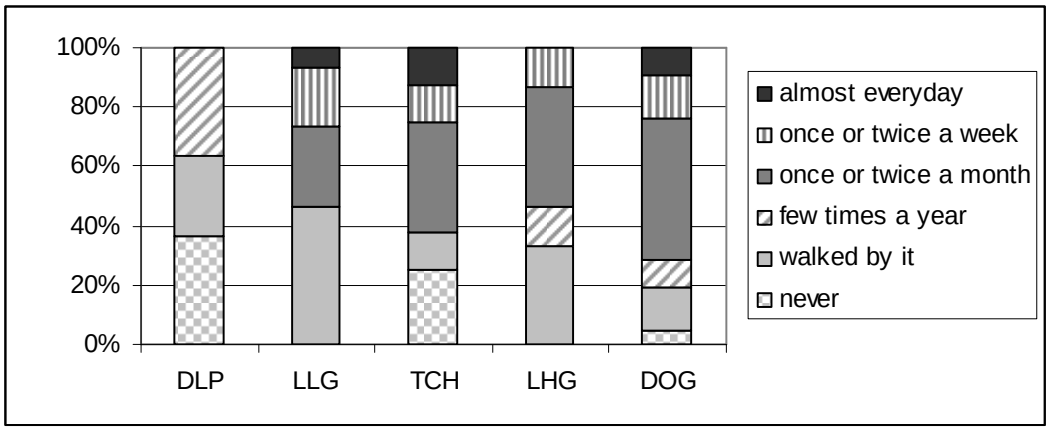


Figure 3.16. Staff Frequency of Garden Visitation

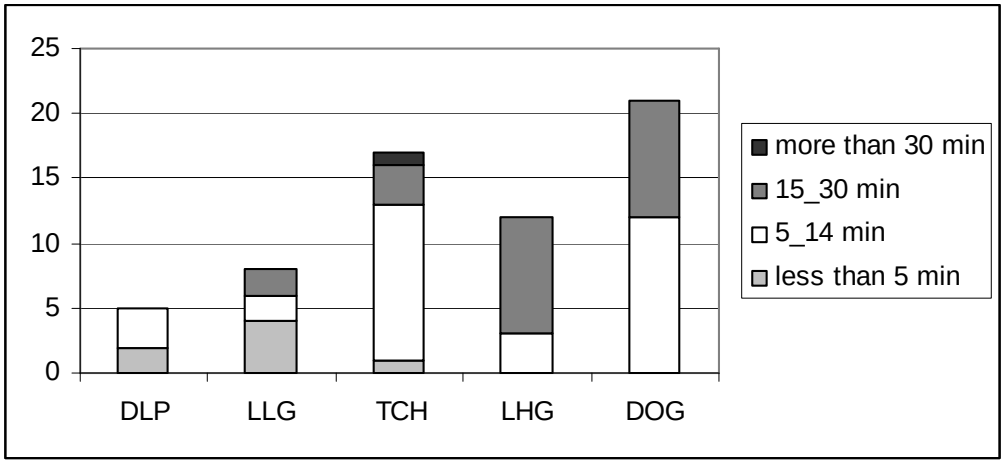


Figure 3.17. Visitor Duration of Stay in the Garden

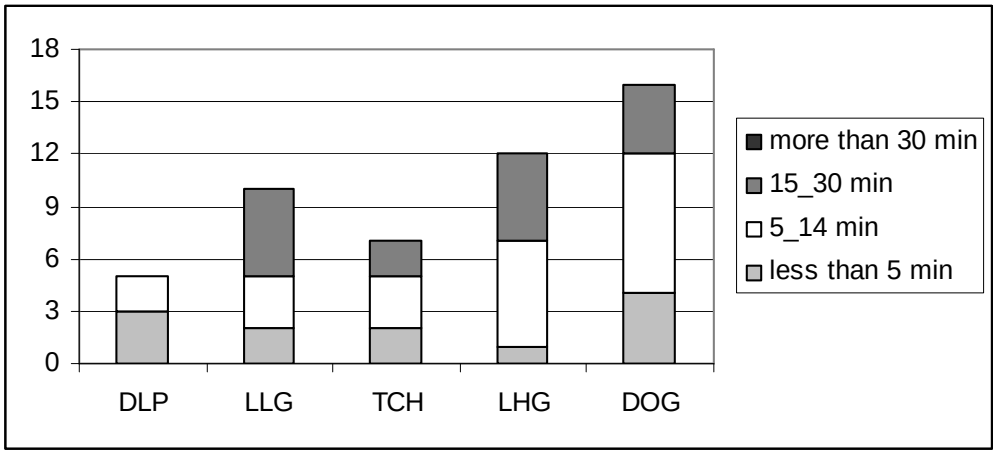


Figure 3.18. Staff Duration of Stay in the Garden

3.3.3. Association between Variables

Significance of the Association: Variables investigated in the surveys included age, gender, ethnicity, role, number of hospital visits (years of employment for staff), source of knowledge about the garden, frequency and duration of use, activities, and barriers to use.

For all gardens contingency tables were created (cross tabulations in SPSS) and Pearson's Chi Square test was performed to examine the significance of association between each two variables. Cross tabulation is a combination of two (or more) frequency tables. Each cell in the resulting table represents the occurrence of the combination of specific values of cross tabulated variables. This method can be used to test the relationship between categorical (nominal) variables or variables with a relatively small number of different meaningful values (Hildebrand, 1986).

In cases that the frequencies in cross tabulations are below 5 it is recommended to either collapse variable groups to reach minimum frequencies of 5, or carry out Fisher's Exact Test which calculates significance of the deviation from a null hypothesis without relying on approximations. Collapsed variable groups were used in this research where needed.

Data was first analyzed separately for each garden. Once a significant relationship was observed between two variables in a garden, the name of that garden was placed in the cell associated with corresponding variables. In the next step, the data collected in all five gardens were cumulated and analyzed. Once a significant correlation was observed between two variables in the cumulative data, the word "All" was placed

in the table. The procedure was completed separately for visitors (Table 3.6) and staff (Table 3.7).

Table 3.6
Association of Variables in Visitor Survey

	visits	duration	frequency	knowledge	barriers	activities
visits						
duration	TCH* Al**					
frequency	-	TCH* DLP* DOG* LHG* All*				
knowledge	LHG**	-	DLP* LLG* All*			
barriers	LLG*	TCH*	All*	-		
activities	DLP* LLG*	DLP* DOG* LHG* All*	TCH* DLP* DOG* LHG** LLG* All*	-	LHG** LLG* All**	

H0: row and column variables are independent
H1: row and column variables are associated
*: variables are associated (with Alpha=0.05)
**: Variable are associated (with Alpha=0.1, p value between 0.05 and 0.1)
- : variables are not associated

Table 3.6 shows that in all or most of the gardens, visitor reported activities had a significant relationship to their duration of stay and frequency of garden visitation. A significant association was observed between visitor duration of stay and frequency of garden visitation in all gardens except LLG. In some cases, such as association between age and role, or ethnicity and barriers, no significant relationship was observed at the level of each single garden. However, analysis of the gardens cumulative data demonstrated a significant association for these variables. Table 3.7 demonstrates association of variables in staff surveys. The variables identified as associated in both tables, were derived for further analysis.

Table 3.7
Association of Variables in Staff Survey

	years	duration	frequency	knowledge	barriers	activities
years						
duration	-					
frequency	-	DOG* DLP** All*				
knowledge	DOG* All**	All*	DLP** All*			
barriers	DLP* All**	All*	All*	DLP** All**		
activities	-	DLP** LLG* LHG* All*	TCH**, LLG** All*	-	DLP* All**	

H0: row and column variables are independent
H1: row and column variables are associated
*: variables are associated (with Alpha=0.05)
**: Variable are associated (with Alpha=0.1; p value between .1 and .05)
- : variables are not associated

Cells Contributing to Significance of the Associations: Standardized residuals were used to determine what categories (cells) were major contributors to the significance of the relationship of associated variables. The residual is the difference between the observed frequency and the expected frequency. The standardized residuals in this research were compared to a critical value of (+/- 1.96), which corresponds to an alpha of 0.05. For each two variables that are significantly associated, there can be 0, 1, 2, or more cells with statistically significant standardized residuals. Positive values indicate over-represented cells, while negative values indicate under-represented cells. Values over 1.96, or under -1.96, indicate the cell was a major influence on a significant chi-square test statistic.

Tables 3.8 and 3.9 represent cells responsible for significance of the relationship between variables indicated in Tables 3.6 and 3.7. According to Table 3.8, people who had visited the hospital more than 50 times, stay in the garden significantly longer than other groups. According to Table 3.7, staff who were not satisfied with quality of seats, stayed in the gardens less than other groups. Also staff who complained of lack of shade spent less time in the garden.

Table 3.8
Variable Pairs Significantly Associated in Visitor Survey

Variables	Garden	Responsible Cells	Std. Residual
Hospital Visits/Duration	TCH	More than 50 time/15- 30 min	2.7
		More than 50 times/more than 30 min	2.7
Barriers/Duration	TCH	Busy/less than 5 min	4.0
Frequency/Duration	TCH	Frequently/15-30 min	4.0
	DOG	0 min/walked by	2.6
	LHG	5-14 min/rarely	2.4
	DLP	Occasionally/5-14 min	2.9
	All	5-14 min/occasionally	3.7
		15-30 min/frequently	4.2
		Walked by/no visit	2.2
Frequency/Activity	TCH	Rarely/kids play	2.7
	LLG	Rarely/relax	1.9
	DOG	Occasionally/kids play	2.0
		No activity/Walked by	2.2
		Sit and wait/rarely	2.2
		Walk around/frequently	2.2
	DLP	Sit and wait/occasionally	2.0
		Walk around/occasionally	2.0
	All	Never/no activity	2.8
		Have lunch/rarely	2.8
		Pass through/rarely	2.6
		Kids play/Occasionally	2.9
		Walk around/frequently	4.1
Hospital visits/barriers	LLG	More than 50 times/Poor Shade	3.5
Hospital Visits/ Activities	LLG	More than 50 times/have lunch	3.0
	DLP	Walk around/30-50 times	3.2
Frequency/Knowledge	LLG	Walk by/views	2.3
	DLP	Didn’t know/never visited	1.7
	All	Didn’t know/never visited	4.3
		Rarely/walked by	2.5
Barriers/ Activities	LLG	Poor shade/have lunch	3.5
		Don’t like design/relax	2.3
Duration/Activities	LHG	5-14 min/walk around	3.6
	DOG	0 min/no activity	2.4
	DLP	Sit and wait/5-14 minutes	2.0

Table 3.9
Variable Pairs Significantly Associated in Staff Survey

Variables	Garden	Responsible Cells	Std. Residual
Activities/Frequency	All	walked by/ no activity	3.4
		Have lunch/weekly	2.0
Activities/Duration	LHG	No activities/0 min	3.1
	LLG	5-14 minutes/relax	1.8
	All	No activity/0 min	4.6
		pass through/less than 5 min	2.1
		have lunch/15 to 30 min	2.8
Role/ Duration	DOG	Other/ less than 5 min	2.6
	All	Other/ Less than 5	2.7
Knowledge/Years	DOG	Other/ More than 6 years	2.6
		Views/3 to 6 years	2.2
		Told by some one/ less than a year	2.7
Duration/Frequency	DOG	0 min/never visited	2.2
		0 min/ walked by	2.7
	All	Never/0 min	2.5
		walked by/0 min	3.7
		monthly/5-14 min	2.2
		weekly/15-30	2.9
		daily/15-30	2.8
Role/Activities	DLP	Other/pass through	2.7
	All	Other/pass through	3.5
Barrier/years	DLP	one year/ Uncomfortable Seats	3.0
Frequency/Knowledge	All	Never visited/didn’t know	5.4
		Weekly/read about it	2.6
Duration/Knowledge	All	Didn’t know/0 min	2.7
		Other/5-14 min	2.1
Duration/Barriers	All	Uncomfortable seats/less than 5 minutes	2.8
		No barrier/15-30 min	2.7
Frequency/Barriers	All	Other barriers/no visit	3.2
		No barrier/daily	3.9
Barrier/Activity	DLP	Weather/have lunch	3.0
	All	Weather/have lunch	2.0
		uncomfortable seats/pass through	3.1
		Uncomfortable seats/sit and watch	3.9

3.3.4. Differences across the Gardens: Population and Visitation Habits

To test whether the population and gardens visitation habits vary across the five gardens, crosstabs were generated consisting of survey variables and name of the gardens. Chi Square tests revealed significance of differences among gardens in terms of each variable assuming alpha=0.05. The test was performed separately for staff and visitors (Table 3.10 and 3.11). According to Table 3.10, no significant difference was observed among gardens' in terms of staff age, gender, ethnicity, role, duration and frequency of garden visitation. However, gardens varied significantly in terms of staff years of work, activities in the gardens and barriers to garden visitation. Gardens also varied significantly in terms of knowledge about existence of the garden assuming alpha=0.1.

Table 3.11, demonstrates the variables that differed significantly across the gardens in visitor surveys. No significant difference was observed in terms of visitor gender, ethnicity, role and reported barriers to garden visitation. At the alpha=0.05 level, visitors varied significantly in terms of age, number of hospital visits, duration of stay in the garden, knowledge about existence of the garden, and activities in the garden. At the alpha=0.1 levels, gardens varied in terms of visitor frequency of garden visitation.

Table 3.10
Visitor Survey Population and Garden Use Differences

	Age	gender	ethnicity	role	visits	duration	frequency	knowledge	barriers	activities
Significance	*	-	-	-	*	*	**	*	-	*

H0: row and column variables are independent
H1: row and column variables are associated
* : variables are associated (with Alpha=0.05)
** : variable are associated (with Alpha=0.1; p value between .1 and .05)
- : variables are not associated

Table 3.11
Staff Survey Population and Garden Use Differences

	Age	gender	ethnicity	role	years	duration	frequency	knowledge	barriers	activities
Significance	-	-	-	-	*	-	-	**	-	*

H0: row and column variables are independent
H1: row and column variables are associated
* : variables are associated (with Alpha=0.05)
** : variable are associated (with Alpha=0.1; p value between .1 and .05)
- : variables are not associated

To find the specific gardens that caused the significant difference (Table 3.10 and 3.11), post hoc analysis for the chi-square test of independence was performed. To do so, the value for each standardized residual (the difference between the observed frequency and the expected frequency) was compared against the critical z-value for α=0.05 level.

The critical z-value for a two tailed test at α=0.05 is +/-1.96. In some cases, no cell had an absolute value more than the critical value (1.96). Hence, the highest absolute value was picked. Results are presented in Table 3.12 for staff surveys and Table 3.13 for visitor surveys.

According to Table 3.12, TCH had significantly more visitors in the age group 22 to 26, which is the youngest age group indicated in the survey. People in TCH also reported that they visited the hospital significantly more than other hospitals (30 to 50 times).Among all gardens more visitors said that they visit DOG frequently and visit LLG for the shortest amount of time (less than 5 min). People took their children to play significantly more in the DOG and relaxed significantly more in the TCH.

Table 3.12
Significant Population and Garden Visitation Differences across the Gardens in Visitor Survey

Variable	Garden	Item	Std residual
Age	TCH	22-26 y/o	2.9
Number of Hospital visits	TCH	30 to 50 times	2.7
Duration	LLG	less than 5 min	1.9
Frequency	DOG	frequently	2.3
Knowledge	TCH	saw sign	2.2
Activities	DOG	kids play	2.9
	TCH	relax	2.6

According to Table 3.13, staff at TCH had worked significantly more years at the hospital as compared to other hospitals. Considering the fact that the other two hospitals are recently built, staff at the other two hospitals have an average of 1.5 years (Legacy) and 3.5 years (Dell) of employment. Significant differences in terms of knowledge about

existence of the garden were detected in DLP, where staff didn't know about the garden, and DOG, were staff had read about the garden. Staff complained significantly more about number of seats and weather at LHG. Their reports also showed that they have lunch significantly more in LHG, and significantly less in DOG than other gardens. In DOG staff held more patient visits compared to other gardens.

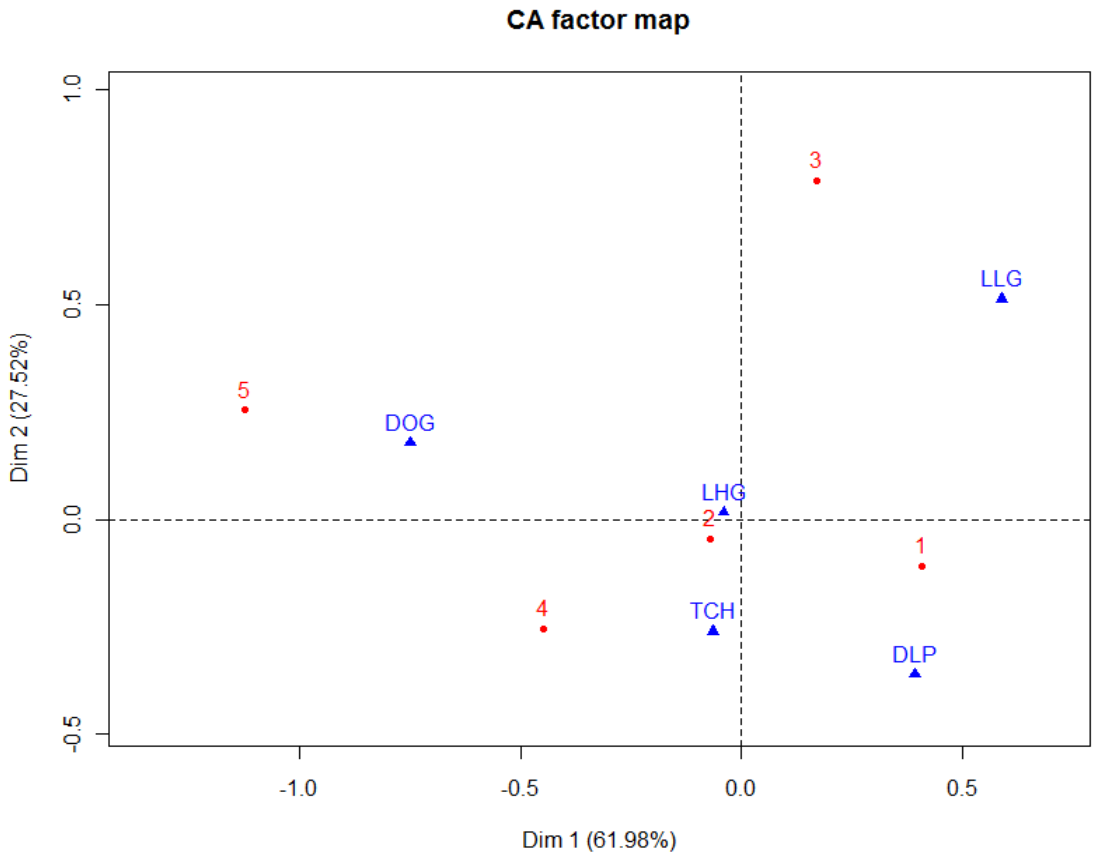
Table 3.13
Significant Population and Garden Visitation Differences across the Gardens in Staff Survey

Variable	Garden	Item	Std residual
years	TCH	4-10 years	2.1
knowledge	DLP	Didn't know	3.0
	DOG	Read about it	2.2
Barriers	LHG	Few seats	2.3
		Weather	2.4
	DLP	Other reasons	2.5
Activities	LHG	have lunch	3.1
	DOG	have lunch	-2.1
		visit with patients	2.9
	DLP	pass through	2.2
	TCH	relax	2.8
		Walk around	3.2

3.3.5. Garden Usability

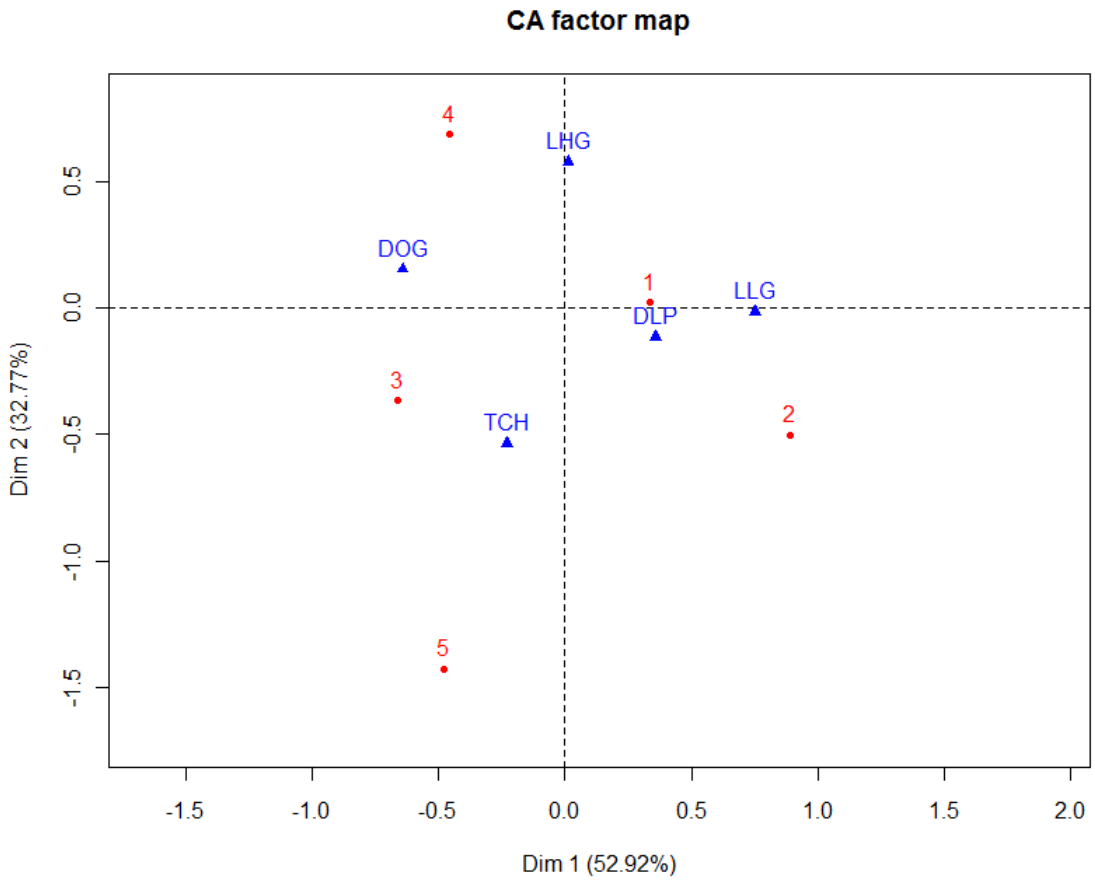
To visualize how each garden is utilized in terms of frequency and duration of use, correspondence analysis was used. This method is a graphical procedure that demonstrates associations in table of frequencies or counts (Johnson & Whichern, 2009). Correspondence analysis was carried out using FactomineR, a package for statistical software named R.

Figures 3.19 and 3.20 demonstrate visitor frequency and duration of garden visitation. The closer the name of a garden appears to a specific category of duration or frequency, the more that garden is associated with the specific category. For example, according to Figure 3.19, people walked by LHG more than any other garden. According to Figure 3.20, among all gardens, more people said that never visited DLP. Figure 3.21 and 3.22, demonstrate frequency and duration of stay in staff surveys.



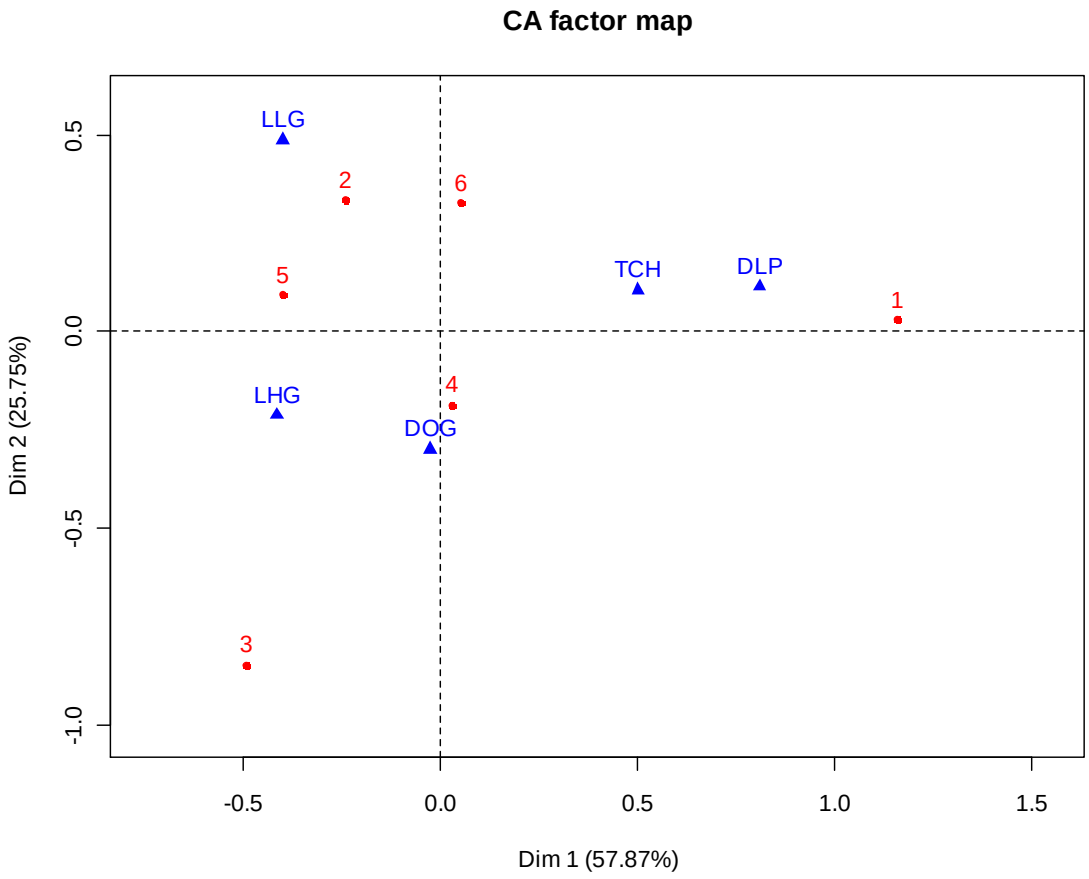
1=never, 2=walked by, 3=rarely, 4=occasionally, 5=frequently

Figure 3.19. Correspondence Analysis- Association of Gardens with Visitor Frequency of Garden Visitation



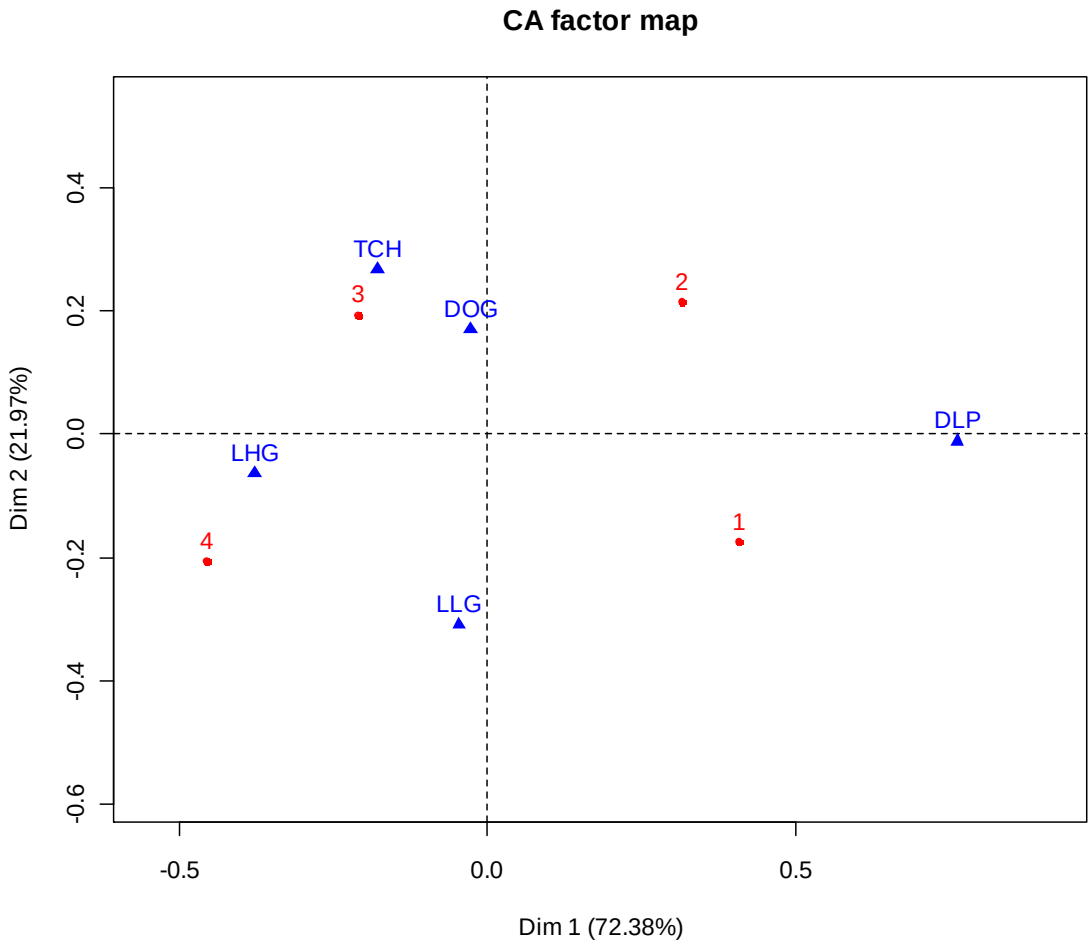
1=never, 2=less than 5min, 3=5 to 14 min, 4=15 to 30 min, 5=more than 30 min

Figure 3.20. Correspondence Analysis - Association of Gardens with Visitor Duration of Garden Visitation



1=never, 2=walked by, 3=a couple times a year, 4=once or twice a month, 5=once or twice a week, 6=every day

Figure 3.21. Correspondence Analysis- Association of Gardens with Staff Frequency of Garden Visitation



1=never, 2=less than 5min, 3=5 to 14 min, 4=15 to 30 min, 5=more than 30 min

Figure 3.22. Correspondence Analysis-Association of Gardens with Staff Duration of Garden Visitation

3.3.6. Garden Ranks Based on Frequency and Duration of Visitation

The final scores for usability of gardens for staff and visitors were calculated using respondents answers to frequency and duration of visitation items. Frequency-Duration contingency tables were created separately for staff and visitors surveys (Tables 3.14 and 3.15). Cross tabs for staff were edited so that they only included durations of stay for more than 5 minutes, and frequencies of visitation for once or twice a month, week or day. This data was instrumental in calculating the probability of staff visiting the garden at least once or twice a month, and for more than 5 minutes. The crosstabs for visitors where edited so that they only represented duration categories of visitation for more than 5 minutes and frequency categories of “occasionally” and “frequently.” This data was instrumental in calculating probability for visitors visiting the garden at least occasionally for five minutes. To calculate the probability, the cumulative frequencies for each garden were divided by number of respondents to surveys at each garden.

Table 3.14
Duration * Frequency * Hospital Cross-Tabulation of Visitor Survey

			FREQUENCY	
			Occasionally	Frequently
LLG	DURATION	5 to 14 min	0	0
		15 to 30 min	0	0
LHG		5 to 14 min	0	0
		15 to 30 min	3	1
DOG		5 to 14 min	4	1
		15 to 30 min	1	3
DLP		5 to 14 min	2	0
		15 to 30 min	0	0
TCH		5 to 14 min	5	0
		15 to 30 min	0	1
		Over 30 min	1	0

Table 3.15
Duration * Frequency * Hospital Cross-Tabulation of Staff Survey

			FREQUENCY		
			monthly	weekly	daily
LLG	DURATION	5 to 14 min	2	1	0
		15 to 30 min	1	2	1
LHG		5 to 14 min	4	1	0
		15 to 30 min	2	1	0
DOG		5 to 14 min	5	2	0
		15 to 30 min	1	1	1
DLP		5 to 14 min	2	0	0
		15 to 30 min	0	0	0
TCH		5 to 14 min	7	0	0
		15 to 30 min	0	3	3

The gardens were ranked once based on calculated probabilities for staff visiting the garden at least once or twice a month and staying more than 5 minutes. They were also ranked based on calculated values indicating probability for visitors for visiting the garden at least for five minutes and occasionally. The results are presented in Table 3.16.

Table 3.16
Garden Rankings Based on Staff and Visitor Duration and Frequency of Stay

Garden	staff visitation	visitors visitation
TCH	1	2
DOG	2	1
LHG	3	3
LLG	4	5
DLP	5	4

3.3.7. Satisfaction with Design

Descriptive statistics were used to compare visitor and staff scorings garden attributes. They were asked to rate how much specific design attributes encourage garden visitation in an ideal garden on a five point scale. They were also asked to rate same attributes in the garden they visited. The results are presented in Figures 3.23 to 3.32.

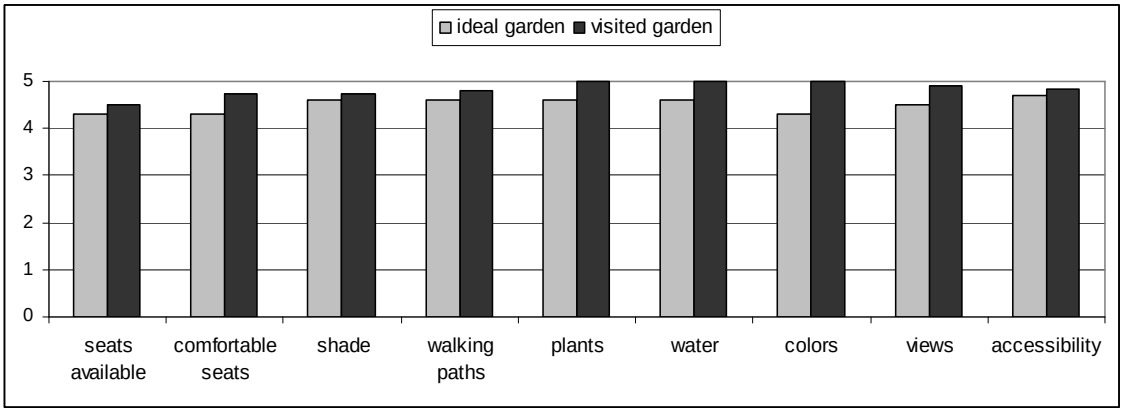


Figure 3.23. TCH Garden Visitor Satisfaction with Design

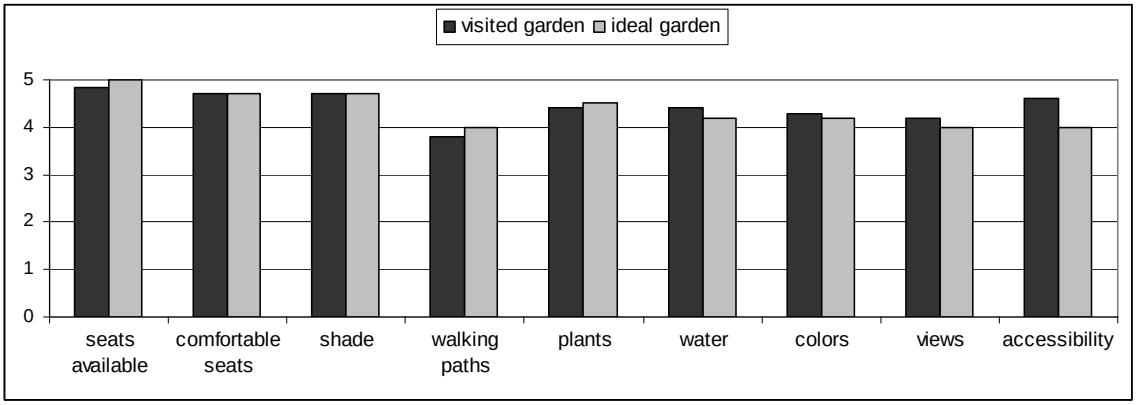


Figure 3.24. TCH Garden Staff Satisfaction with Design

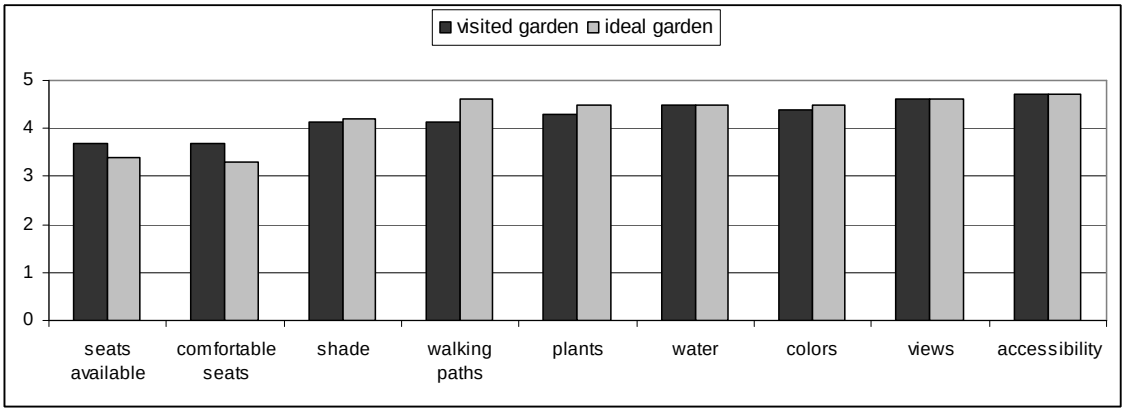


Figure 3.25. DOG Garden Visitor Satisfaction with Design

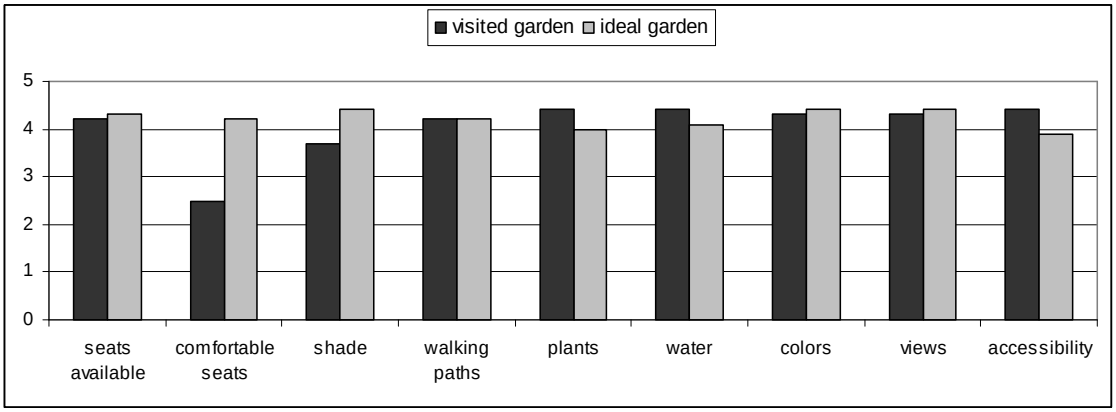


Figure 3.26. DOG Garden Staff Satisfaction with Design

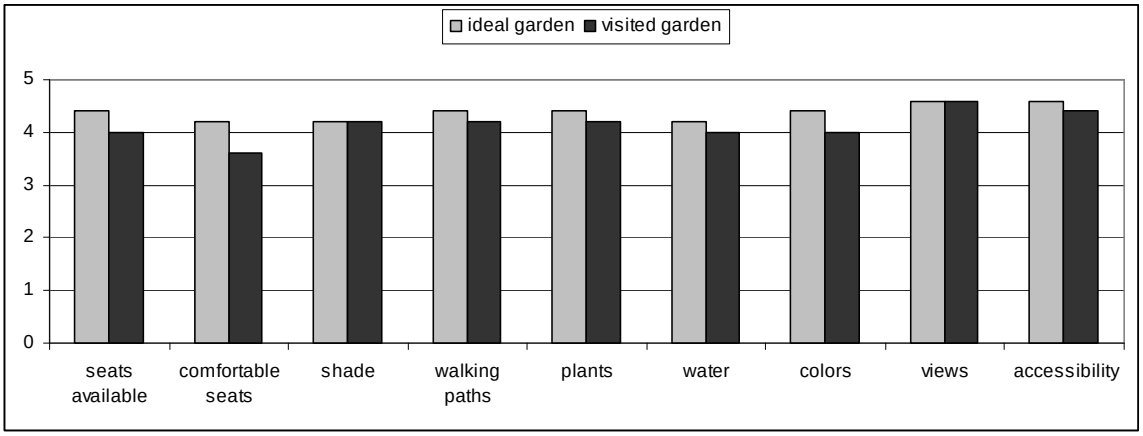


Figure 3.27. DLP Garden Visitor Satisfaction with Design

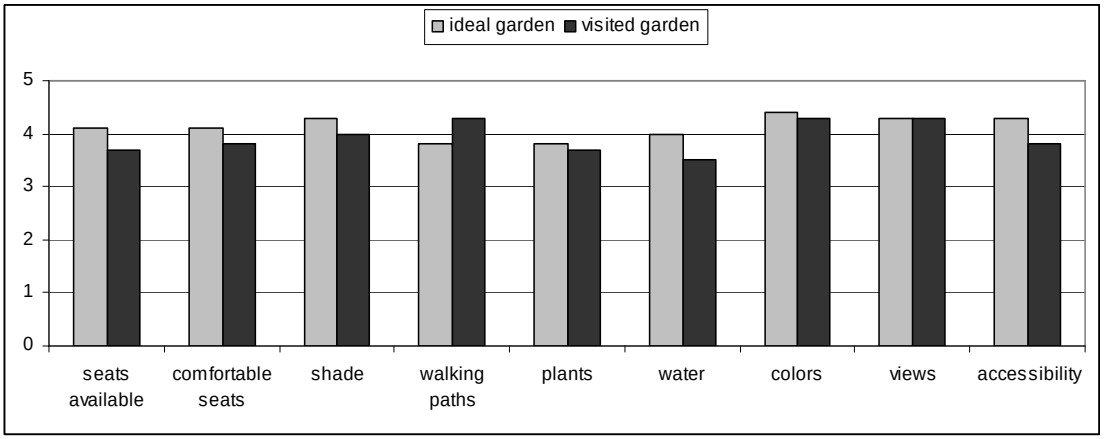


Figure 3.28. DLP Garden Staff Satisfaction with Design

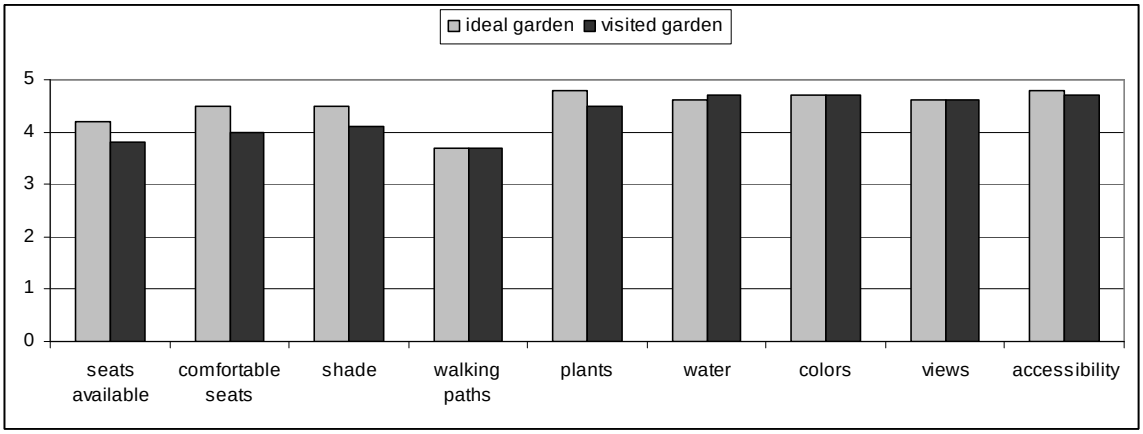


Figure 3.29. LHG Garden Visitor Satisfaction with Design

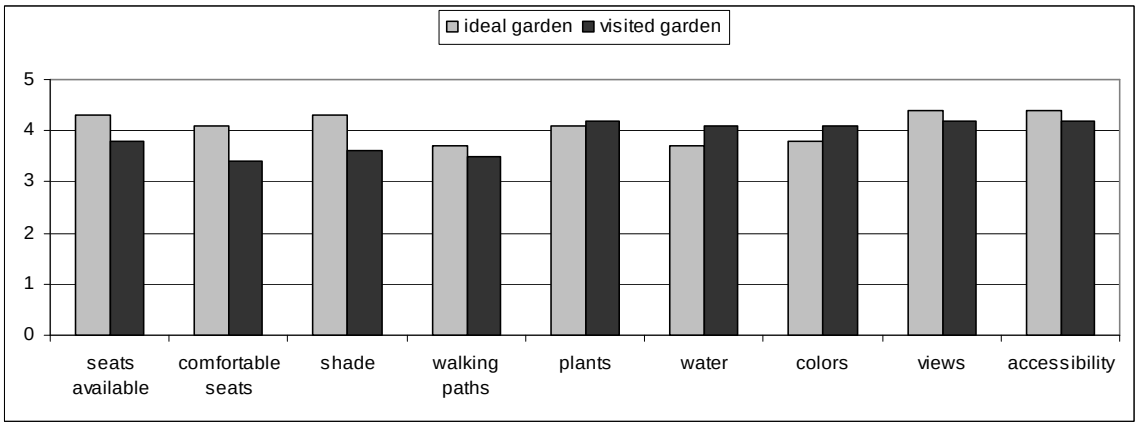


Figure 3.30. LHG Garden Staff Satisfaction with Design

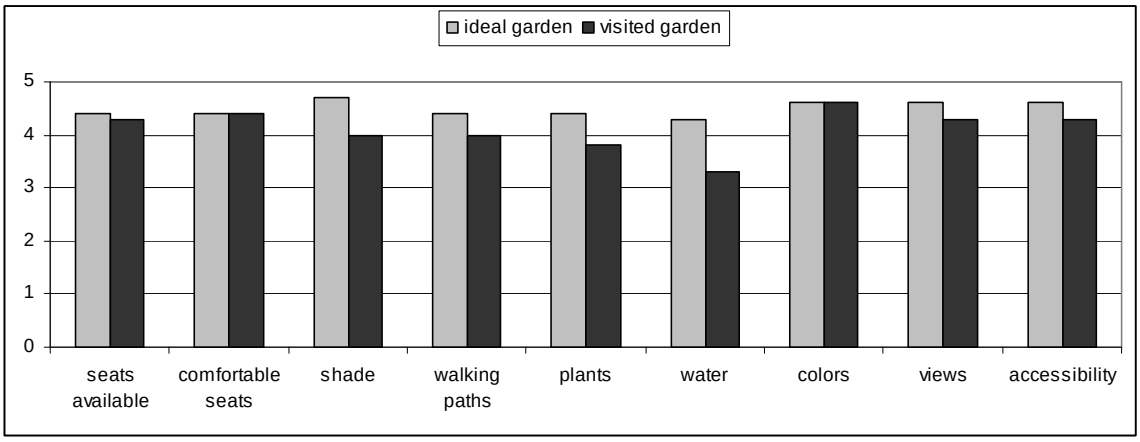


Figure 3.31. LLG Garden Visitor Satisfaction with Design

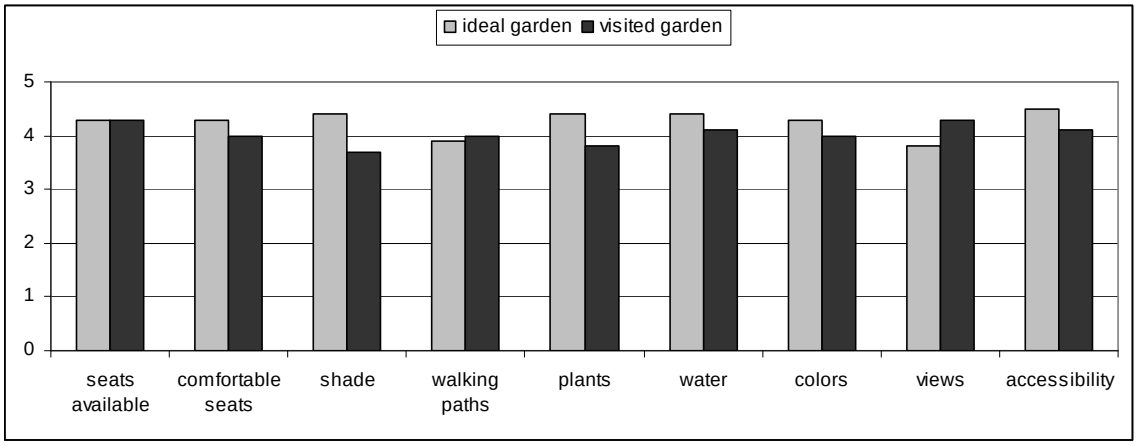


Figure 3.32. LLG Garden Staff Satisfaction with Design

Staff and visitor's satisfaction with design evaluated in the surveys were analyzed using Cannonical Correlations Analysis. This method seeks to identify and quantify the associations between two sets of variables (Johnson and Wichern, 2009). Two set of data in this study included users' rankings of hospital garden design features (as dependant variable), and users' rankings of design feature of an ideal garden (as covariate).

The analysis was performed separately for staff of all gardens and visitors of all gardens. The Kolmogrov-Smirnov test showed that users ranking were not normally distributed. However, a normal distribution of the variables is not strictly required when canonical correlation is used descriptively. The number of cases recommended to obtain an accurate analysis ranges between ten and sixty cases per variable. Considering the maximum number of 50 staff and visitor surveys per garden in this study, canonical correlation was not performed separately for each garden. Instead visitor surveys off all gardens and staff surveys of all gardens were compiled to create two groups of staff and visitor rankings with 119 and 126 cases, respectively. The analysis was performed by using Canonical Correlation macro in SPSS.

The analysis first runs alternative test of significance, including Wilks' Lambda, to find whether the two sets of data have a significant canonical correlation. In this study, visitor ratings of design feature of an ideal garden had a significant canonical correlation with visitors ratings of the garden they were visiting (p value=0, with alpha=0.05). Also, staff ratings of their ideal garden had a significant canonical

correlation with their ratings of the garden they were visiting (p value=0, with alpha=0.05). As a result the canonical correlation analysis was carried out.

Visitor's Ratings of the Garden Features: For visitor's ratings of nine design features in ideal garden and the garden they were visiting, SPSS produced nine canonical correlations, labeled as roots in Table 3.17. The first canonical correlation is the most important. With that, the covariate (ratings of ideal garden features) explains about 98% (.99*.99) of the variance in the dependant canonical variable (rankings of the garden they visited).

Table 3.17
Canonical Correlation between Visitor Satisfaction with Design in the Visited and Ideal Garden

Root No.	Eigen value	Pct.	Cum. Pct.	Canon Cor.	Sq. Cor
1	55.97215	79.29407	79.29407	.99118	.98245
2	6.10147	8.64377	87.93783	.92692	.85918
3	4.98772	7.06595	95.00378	.91268	.83299
4	1.81455	2.57062	97.57439	.80293	.64470
5	1.03854	1.47127	99.04566	.71376	.50945
6	0.60516	0.85731	99.90297	.61401	.37701
7	.04347	.06159	99.96455	.20411	.04166
8	.02494	.03533	99.99988	.15598	.02433
9	.00008	.00012	100.00000	.00908	.00008

The correlations in Table 3.18 are extracted from the SPSS table indicating the structure correlations that show how the dependant variables (visited garden rankings) load in the first canonical correlations. The highest correlations belong to comfortability and availability of seats with values as high as .78 and .72 respectively.

Table 3.18
Correlations between Dependant (Visited Garden Ranking) and Canonical Variables in Visitor Survey

Variable	Load on Canonical Variable 1
seats (availability)	.72082
seats (comfortability)	.78465
shade	.27188
walking paths	.04052
plants	.29456
water	.31469
colors	.51232
views of the garden from inside	.59563
accessibility	.45602

Table 3.19 indicates the correlation between covariates (ideal garden rankings) and the first canonical correlation variables. Comfortability of the seats and views of the garden from inside the building (0.70 and 0.79) in the ideal garden have the highest correlation with the canonical variable in first canonical correlation for visitor surveys. This means that in an ideal garden, visitors anticipate these variables to have the greatest impact on encouraging garden visitation. The final results are summarized in Figure 3.33.

Table 3.19
Correlations between Covariates (Ideal Garden Ranking) and Canonical Variables in Visitor Survey

Variable	Load on Canonical Variable 1
seats (availability)	.43778
seats (comfortability)	**.70818**
shade	.20284
walking paths	.06011
plants	.46784
water	.47013
colors	.56811
views of the garden from inside	**.79010**
accessibility	.34711

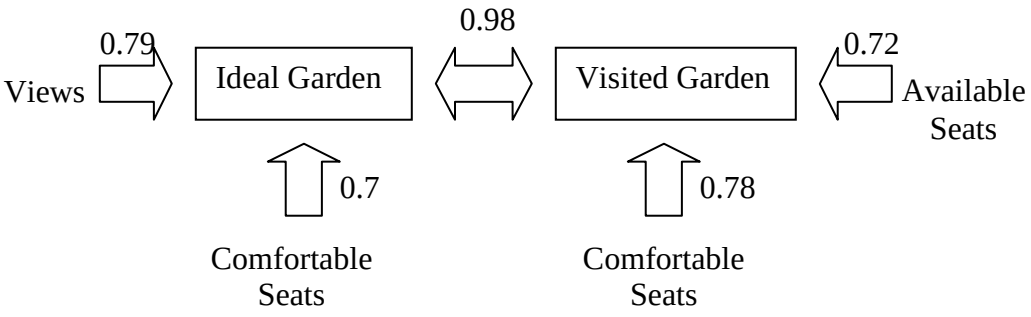


Figure 3.33. Canonical Correlation Analysis: Variables Identified as Most Influential in Visitor Satisfaction with Design

A similar procedure was repeated for staff ratings of design features of an ideal garden and the garden they were visiting. For the first canonical correlation, the covariate (ratings of ideal garden) explains about 83% (.91*.91) of the variance in the dependant canonical variable (ratings of the garden they visited-Table 3.20).

Table 3.20
Canonical Correlation between Staff Satisfaction with Design in the Visited and Ideal Garden

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.	Sq. Cor
1	5.19364	61.44525	61.44525	**.91572**	**.83854**
2	.98984	11.71064	73.15589	.70530	.49745
3	.73310	8.67316	81.82905	.65038	.42300
4	.58856	6.96314	88.79219	.60869	.37050
5	.44587	5.27499	94.06718	.55531	.30837
6	.30835	3.64807	97.71525	.48547	.23568
7	.17341	2.05161	99.76686	.38443	.14778
8	.01970	.23309	99.99995	.13900	.01932
9	.00000	.00005	100.00000	.00204	.00000

The correlations in Table 3.21 are extracted from the SPSS table indicating the structure correlations that show how the dependant variables (visited garden ratings) load in the first canonical correlations. The highest correlations belong to views to the garden from inside (.89), colors (.75), water (.73), plants (.69), and walking paths (.69).

Table 3.21
Correlations between Dependant (Visited Gardens Rankings) and Canonical Variables in Staff Survey

Variable	Load on Canonical Variable 1
seats (availability)	.54226
seats (comfort ability)	.46789
shade	.35957
walk paths	.69173
plants	.69636
water	.73353
colors	**.75340**
views to the garden from inside	**.89487**
accessibility	.62152

Table 3.22 is similarly extracted and indicates the correlation between covariates (ideal garden ratings) and the first canonical correlation variables. Views to the garden from inside (.90) and accessibility (.80) are the most important variables that are correlated with canonical variable. Comfortability of the seats (.73) and walking paths (.72) are the next two most important variables. The final results are summarized in Figure 3.34.

Table 3.22
Correlations between Covariates (Ideal Garden Ranking) and Canonical Variables in Staff Survey

Variable	Load on Canonical Variable 1
seat (availability)	.62066
seats(comfort ability)	.73830
shade	.67005
walk path	.72426
plants	.59746
water	.58370
colors	.60142
views to the garden from inside	**.90722**
accessibility	**.80655**

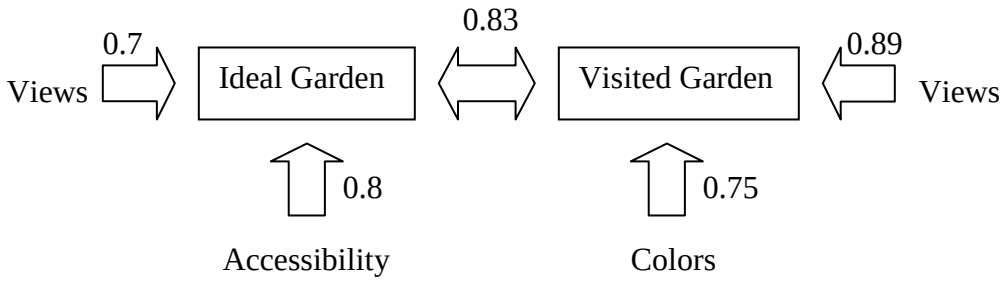


Figure 3.34. Canonical Correlation Analysis: Variables Indentified as Most Influential in Staff Satisfaction with Design

3.3.8. Garden Ranks Based on Satisfaction with Design

For each garden, the average score of each design feature in an ideal garden was subtracted from the average score of same design feature in the visited garden. The resulting value was named “satisfaction score.” Figures 3.35 and 3.36 represent satisfaction scores for each garden and each specific design feature for staff and visitors. Figure 3.35 shows that visitors were most satisfied with TCH and DOG, and they were least satisfied with DLP and LLG. The figure also demonstrates that visitors are very dissatisfied with LLG’s lack of plants or water feature. Figure 3.36, shows that staff were most satisfied with TCH in general. They were dissatisfied with LLG and DLP’s accessibility and lack of water feature. They were also dissatisfied with quality of seats in almost all gardens especially in DOG. To rank gardens based on user satisfaction, the midpoint of each gardens satisfaction score bar was marked. The results are represented in Table 3.23.

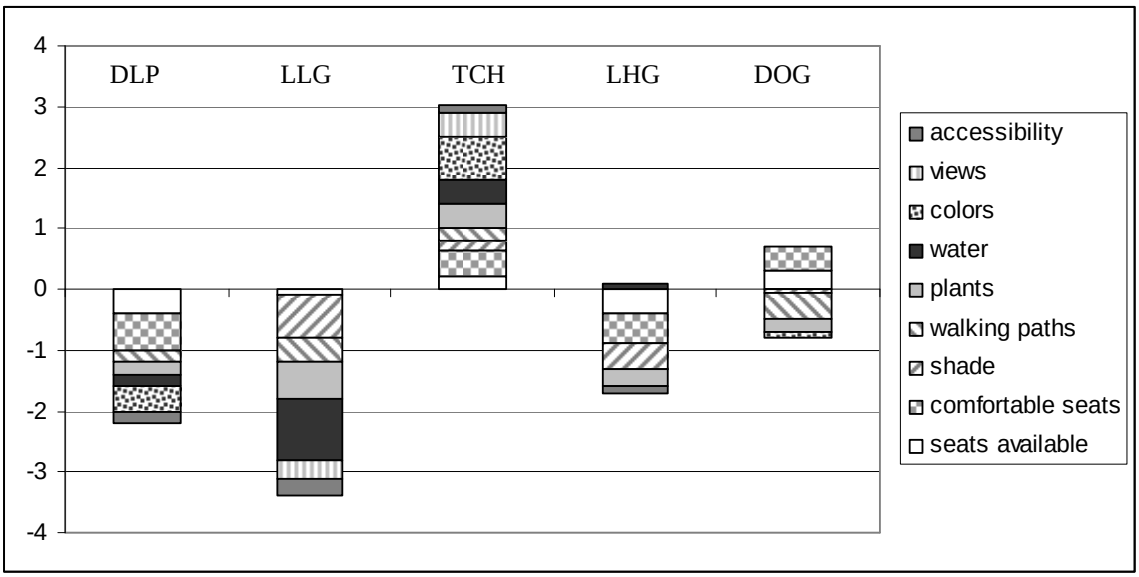


Figure 3.35. Visitor Satisfaction with Design

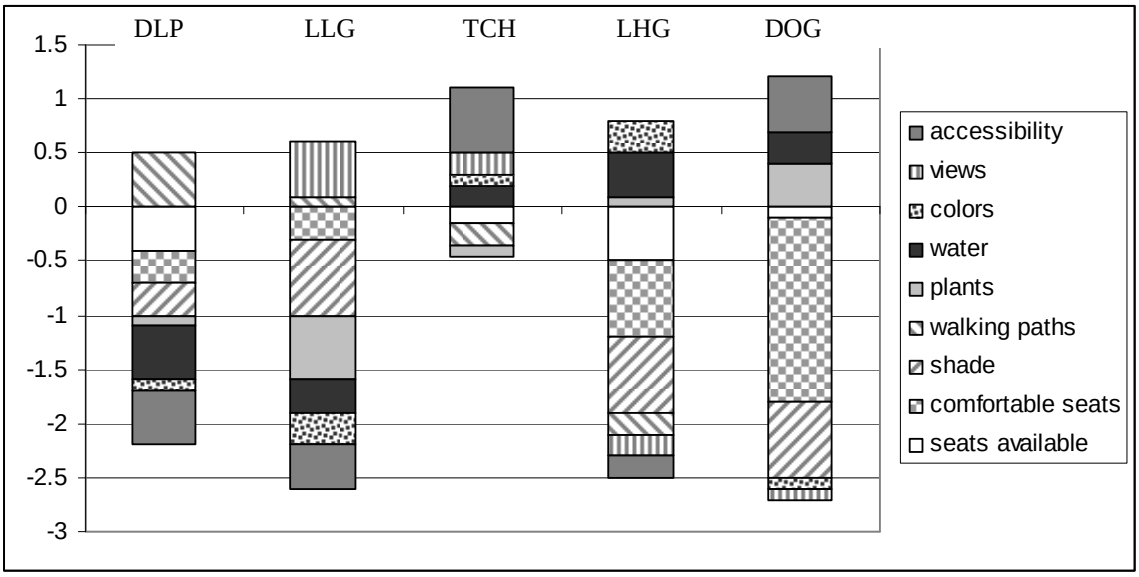


Figure 3.36. Staff Satisfaction with Design

Table 3.23
Garden Rankings Based on Visitor and Staff Satisfaction with Design

Garden	staff Satisfaction	visitors satisfaction
TCH	1	1
DOG	2	2
LHG	3	3
LLG	5	5
DLP	4	4

3.3.9. Open Ended Questions

Responses to the three open-ended questions were analyzed using qualitative methods. Responses were broken to separate sentences or words, creating units of data that were independent from each other. Three main categories emerged from these units of data where respondents had mentioned how the garden make them feel (or how they felt about the garden), how they perceived the overall environment, and specific element they liked or disliked. Tables 3.24 and 3.25 represents these categories of data for staff and visitor surveys. It was noted that respondents shared a common vocabulary and certain words were used repeatedly. The words were ranked based on the number of times they appeared in the responses, and words with higher ranks were placed in the table accordingly.

Table 3.24
Visitor Responses to Open Ended Questions

Garden	Perception	Feels like	Like most	Like least	Comments
TCH	pretty	peaceful, uplifting	Plants, water feature, air sounding ornaments, design, no staff, chairs and tables	Surrounded by office windows and building, Away from my apartment, noise from AC, noisy visitors	-
LLG	-	peaceful	Not facing main road	Few trees and flowers, no play area, not enough shade, design is plain and dull	Play area, information about garden
LHG	beautiful, nice, pleasant	away from hospital, peaceful, inviting	Water feature, plants, seating	not enough shade, seats are not comfortable	more shades, activities for teens
DLP	-	-	-	-	-
DOG	beautiful	peaceful, relaxing, my child love it, my child felt respected and special	water feature, colors, plants, sounds, statues,	not enough shade, few seats, sun reflect off the building windows, too many people, no breeze	

Table 3.25
Staff Responses to Open Ended Questions

Garden	Perception	Feels like	Like most	Like least	Comments
TCH	nice, beautiful	peaceful	water fountain, plants, colors,	Enclosed by windows, little privacy, pigeon droppings	More plants, more privacy, let staff know they can visit, more shade, music, more table, views from patient rooms
LLG	-	Away from hospital, relaxing	Well maintained, nice view, clean, quite	not enough shade, need some color, no water feature	Need playground
LHG	beautiful	Away from hospital, peaceful	Water features ,color, plants, sounds, the view, design, surrounding green and horses, stones	not enough shade, too small, no good seating, road noise	-
DLP	pretty	away from hospital, relaxing, peaceful	plants, space, design	not enough shade, not color, no seating	-
DOG	pretty, beautiful	Peaceful, relaxing, healing, inviting, accessible, I feel like a big kid	colors, water features, walking paths, plants, amenities for children, design	not enough shade, Hard to access, Few seats,	Need to be IV pole friendly ,need water fountain

CHAPTER IV

DATA ANALYSIS: OBSERVATIONAL DATA

4.1. Analysis of Observational Data

4.1.1. Behavioral Culture and Groups of Users

Observational data were first analyzed using descriptive statistics. Total duration of main categories of garden use exhibited by each group of subjects was calculated in minutes. These values are represented in Figures 4.1,2,3,4, and 5 separately for each garden.

The analysis displays the differences among gardens in terms of activities and durations, as well as differences among groups of users.

These figures show that children (patient and non-patient) spent a longer amount of time in DOG. TCH and LHG were the only other gardens visited by patients. DLP was the garden visited the least (Figure 4.4). This garden was visible and accessible from a waiting area with a daily average of ten visitors and children spending at least three hours seating by the garden. LLG, LHG and, TCH were used dominantly by staff (Figures 4.2,3, and 5). It was also observed that female staff spent more minutes in the gardens compared to male staff.

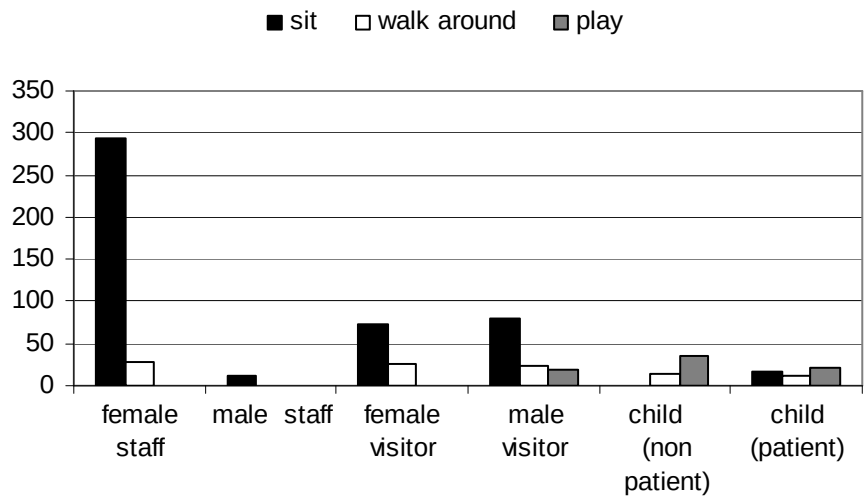


Figure 4.1. Total Duration of Activities Observed in TCH (minutes)

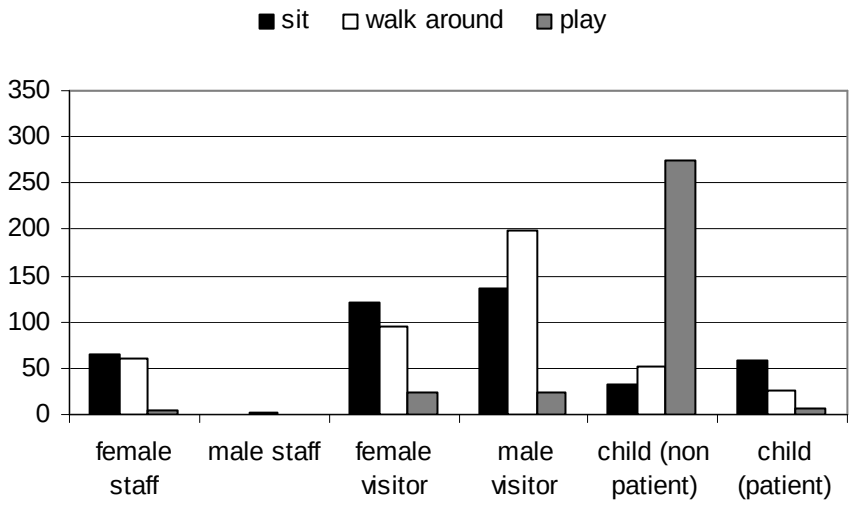


Figure 4.2. Total Duration of Activities Observed in DOG (minutes)

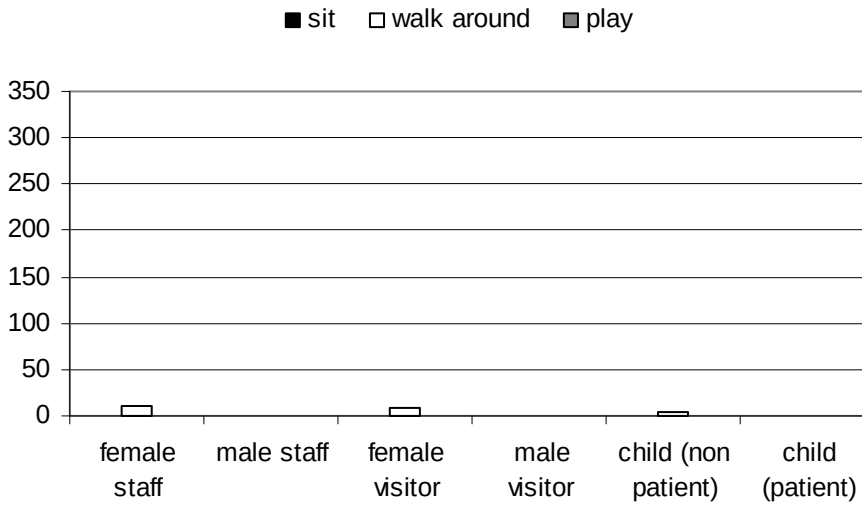


Figure 4.3. Total Duration of Activities Observed in DLP (minutes)

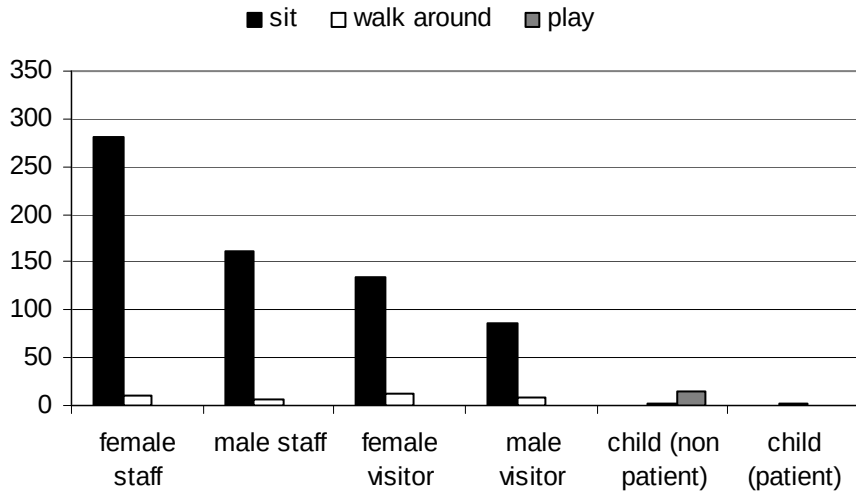


Figure 4.4. Total Duration of Activities Observed in LHG (minutes)

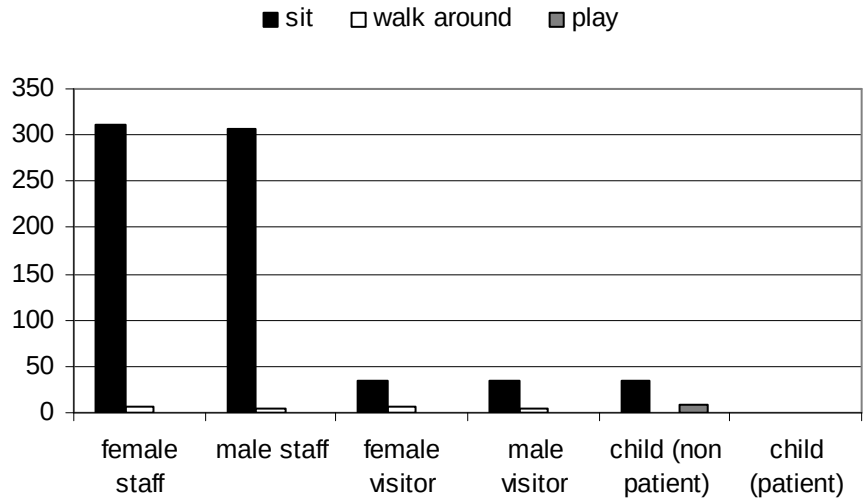


Figure 4.5. Total Duration of Activities Observed in LLG (minutes)

To find the behavioral culture of each garden, the ratio of each level of physical activity (sitting, walking, and playing) to the total duration of all levels of activity was calculated. The calculated ratios for each garden represented the behavioral distribution at each garden. The results are presented in Table 4.1 and Figure 4.6.

Table 4.1
Distribution of Levels of Physical Activity at Gardens

	TCH	DOG	LLG	LHG	DLP
Play	0.116893	0.261876	0.005859	0.037083	0
Walk	0.161388	0.406821	0.070313	0.02843	1
Sit	0.721719	0.331303	0.923828	0.934487	0

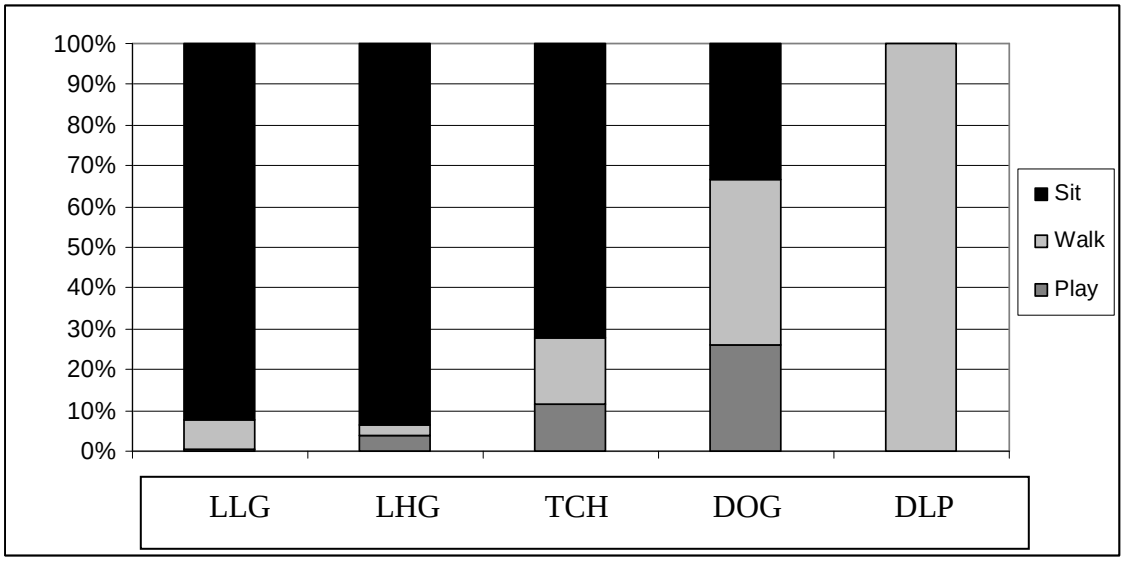


Figure 4.6. Diagram of Activity Distribution at Gardens

To measure similarities of the gardens in terms of activities, Symmetric Kullback Leibler Distance (SKLD), which is a measure of the dissimilarity between two completely determined probabilities, was used. This measure for the distributions p = (p1,p2,…,pk) and q = (q1,q2,…,qk) is defined as follows:

$$d(p, q) = \tfrac{1}{2}(d(p; q) + d(q; p)),$$

where $d(p; q) = \sum pi \log(pi/qi)$.

Since a degenerated distribution was observed for DLP, meaning the variables consisted of only one value, the formal calculation involving this distribution will lead to infinity. As a result, this garden was omitted from further analysis. The SKLD of the gardens are summarized in Table 4.2.

Table 4.2
Symmetric Kullback Leibler Distances between Gardens' Behavioral Cultures

	TCH	DOG	LLG	LHG
TCH Garden	0			
DOG	0.140677	0		
LLG	0.099435	0.471462	0	
LHG	0.081965	0.449876	0.02772	0

A hierarchical clustering was executed based on calculated SKLD. This led to categorize gardens based on their behavioral culture (Figure 4.7). As shown in Figure 4.7, LLG and LHG have the most similar behavioral cultures amongst all five gardens. TCH has a similar behavioral culture to LLG and LHG, while DOG is the least similar. DLP, as already discussed, has an infinite distance from other gardens, because it has a degenerated distribution.

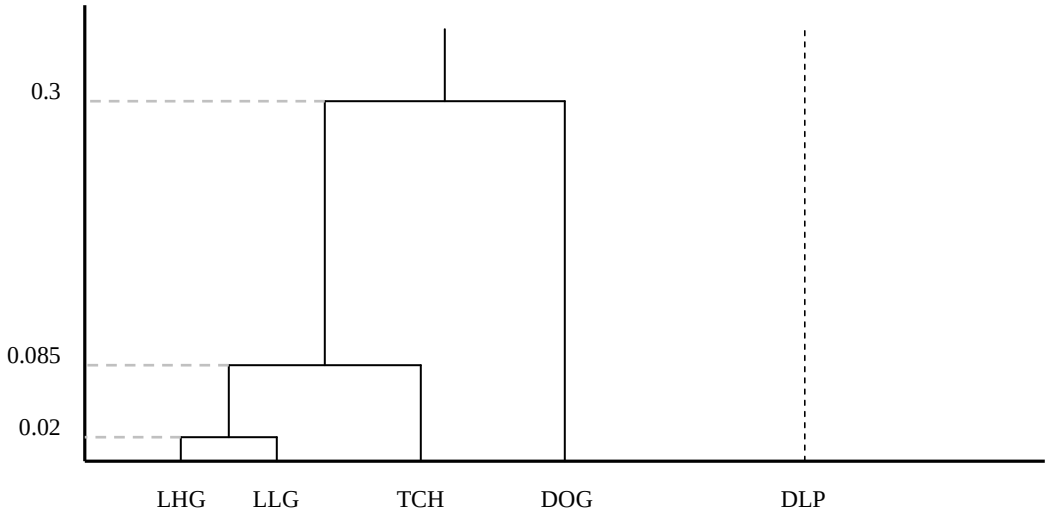


Figure 4.7. Hierarchical Clustering of Gardens Based on Distribution of Activities

4.1.2. Duration of Stay

The behavioral culture of gardens was calculated using ratios rather than actual durations. Average durations of activities at each garden are presented in Figure 4.8. The average length of stay for different groups of users is presented in Figures 4.9 to 4.13.

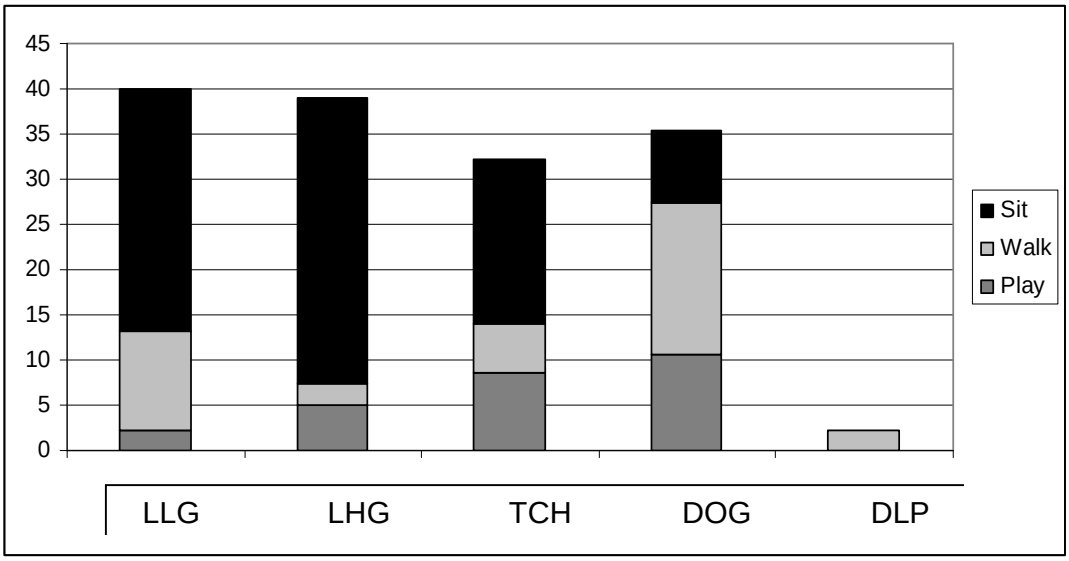


Figure 4.8. Diagram of Average Activity Duration at Gardens

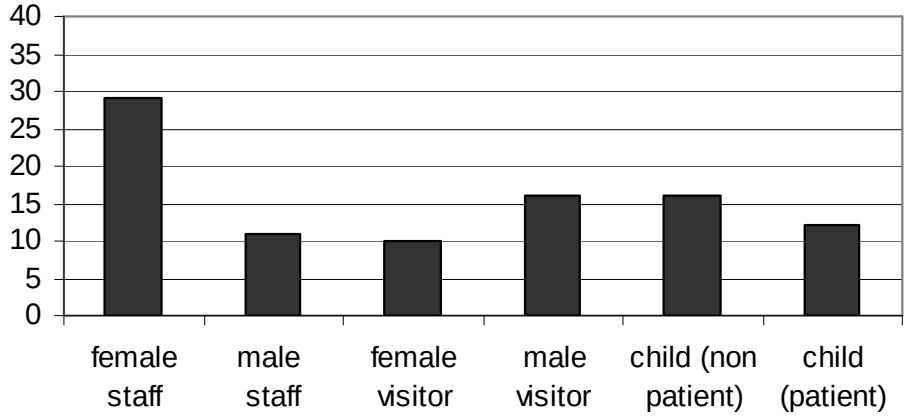


Figure 4.9. Average Duration of Stay Observed in TCH (minutes)

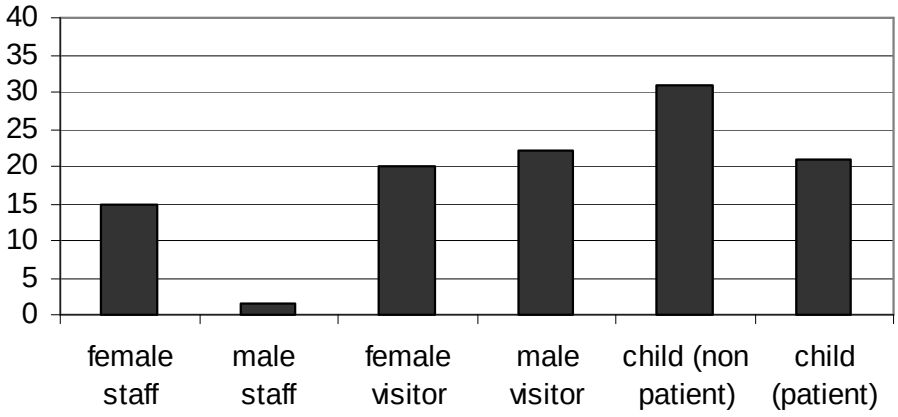


Figure 4.10. Average Duration of Stay Observed in DOG (minutes)

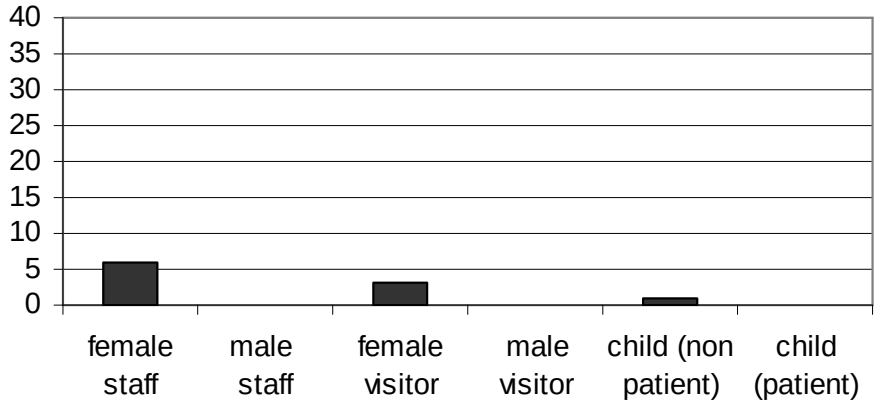


Figure 4.11. Average Duration of Stay Observed in DLP (minutes)

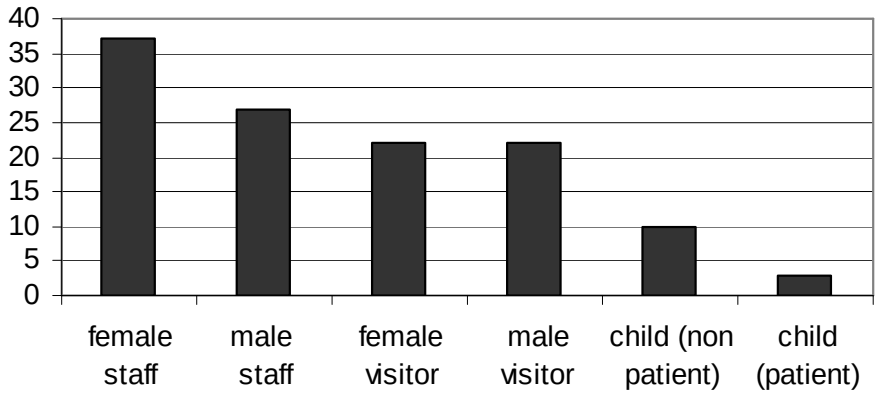


Figure 4.12. Average Duration of Stay Observed in LHG (minutes)

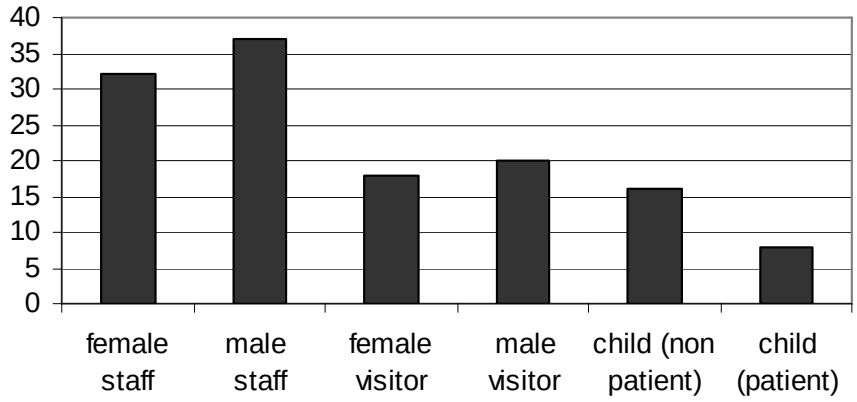


Figure 4.13. Average Duration of Stay Observed in LLG

To find out whether people stayed significantly longer or shorter in a garden, further analysis was required. The Kolmogrov-Smirnov test revealed that behavioral data were not normally distributed. As a result, the non-parametric method of Kruskall-Wallis was used to compare durations of stay at each garden. Durations of time spent by each visitor of the gardens was calculated to find out whether people spent significantly more or less time in any of the gardens (Table 4.3).

Table 4.3
p Values for Comparing Durations of Stay at Gardens

	TCH	DOG	LLG	LHG	DLP
TCH	1				
DOG	.602	1			
LLG	.008	.003	1		
LHG	.003	.001	0.775	1	
DLP	.000	.000	.000	.001	1

According to P values, TCH and DOG are not significantly different in terms of visitor duration of stay. LHG and LLG are also not significantly different (p=0.775). The results show that except for these two cases other gardens are significantly different in terms of durations of stay. Since the p value represents association of gardens, the value 1-p may be considered as a distance between two gardens. Clustering of the gardens based on these values is presented in Figure 4.14 It is note worthy that the two clustering, one based on distribution of behavioral activities and one based on the duration of stay, demonstrated similar patterns.

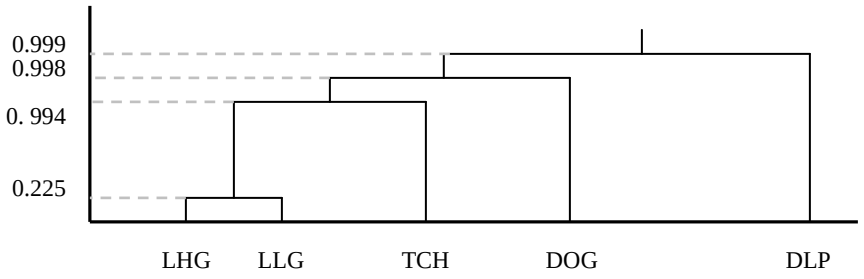


Figure 4.14. Hierarchical Clustering of Gardens Based on Durations of Stay

4.1.3. Behavior Frequencies

A table of frequencies for each level of activity at all gardens was generated (Table 4.4.) The values in the table represent the number of people exhibiting the pertinent behavior in the pertinent garden. As already mentioned in previous chapter, the total hours of observation were similar.

Table 4.4
Count of Behaviors at Gardens

	TCH	DOG	LLG	LHG	DLP
Play	10	53	4	6	0
walk	30	63	86	15	6
sit	28	14	54	34	0

Frequency values were used to perform a Chi Square test to examine independence of the two variables of garden counts for each level of activity. The test resulted in a Chi-Square value of 106.4, with 8 degrees of freedom and a 0.00 level of significance. Therefore, these two variables are dependent. The P values for comparing gardens two by two in terms of frequencies are presented in Table 4.5.

Table 4.5
p Values for Comparing Frequencies of Behaviors at Gardens

	TCH	DOG	LLG	LHG	DLP
TCH	1				
DOG	0.00	1			
LLG	.002	0.00	1		
LHG	.088	0.00	0.00	1	
DLP	.032	.047	.107	.001	1

4.1.4. Garden Ranks Based on Levels of Use

The Principal Component method was carried out to extract components of garden use. Total duration of observed levels of activity at each garden was calculated to represent garden usability. According to the results of the analysis (Tables 4.6 and 4.7), walk and play compose components 1 of garden usability. Sedentary behavior (sitting) is the only representative of component two.

Table 4.6.
Principal Component Analysis of Activities in All Gardens

	Initial Eigen values			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.987	66.237	66.237	1.987	**66.235**	66.235
2	1.006	33.520	99.757	1.006	**33.522**	99.757
3	.007	.243	100.000			

Table 4.7.
Principal Component Analysis: Activities in Gardens Clustered in the Principal Component

	Component	
	1	2
SIT	.003	**1.000**
WALK	**.997**	.056
PLAY	**.997**	-.051

Rotated Component Matrix
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 3 iterations.

Use of garden is defined as variety of activities, duration of use, and variety of users. With the previous Principal Component Analysis, the two components of use were identified as sedentary behavior and active behavior. Total durations of active behavior and sedentary behaviors exhibited by the three groups of users (children, staff and adult visitors) were calculated (Table 4.8). This data was instrumental in next phase of the analysis which is based on groups of users and levels of activity (Table 4.9).

Table 4.8
Groups of Users and Levels of Activity

	Staff Sedentary Behavior (SSB)	Staff Active Behavior (SAB)	Visitor Sedentary Behavior (VSB)	Visitor Active Behavior (VAB)	Child Sedentary Behavior (CSB)	Child Active Behavior (CAB)
TCH	304	28	153.5	74	16	82.5
DLP	0	7	0	4	0	2
DOG	64	68	256	338.5	147	405.5
LLG	618	11	69	11	35.5	9
LHG	442	18	220	22	0	21

Table 4.9
Principal Component Analysis of Groups of Users/Levels of Activity

	Initial Eigen values			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.594	76.570	76.570	4.273	71.209	71.209
2	1.034	17.231	93.801	1.356	22.592	93.801
3	.351	5.857	99.658			
4	.021	.342	100.000			
5	3.380E-17	5.634E-16	100.000			
6	-2.147E-16	-3.579E-15	100.000			

Considering Eigen values in Table 4.9, PCA was carried out with two components. The two extracted components explained 93.8% of total variance. Component 1 included staff, visitor and children active use and visitor and children sedentary behavior. Component two, which explained 22.6% of variability, only had one variable, which was Staff Sedentary Behavior (Table 4.10).

Table 4.10

Principal Component Analysis: Activities/Users Clustered in the Principal Component

	Component	
	1	2
SSB	-.174	**.948**
SAB	**.960**	-.260
VSB	**.855**	.307
VAB	**.942**	-.331
CSB	**.908**	-.259
CAB	**.937**	-.343

Rotated Component Matrix
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 3 iterations.

Figure 4.15 visualizes the two components extracted. According to behavior observations, staff active behavior, including walking and playing mostly occurred with presence of visitors and patients, while staff where giving a tour or accompanying patients and visitors. Hence, the principal component including visitor and children sedentary and active behavior, and staff active behavior was named “non-staff use”. The other component including staff sedentary behavior was named “staff use”.

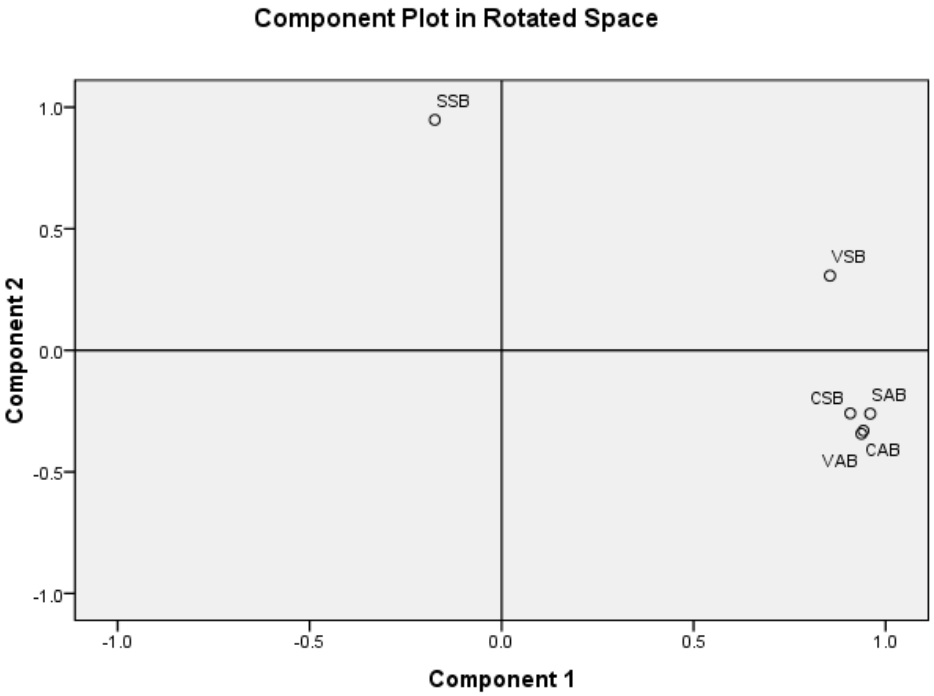


Figure 4.15. PCA Plot Demonstrating Users, Levels of Use

Accordingly, garden use is calculated using durations of time spent in staff seating (component two of use), and sum of visitor and child length of stay and staff active behavior (component two). The coefficients for each of these values were derived from Table 4.9, percentage of variances. The rankings based on usability scores are presented in Table 4.11.

Table 4.11
Garden Rankings Based on Garden Use

Garden	Ranking Based on Levels of Use
TCH	2
DOG	1
LHG	3
LLG	4
DLP	5

4.2. Comparing Garden Rankings

Gardens were ranked once based on use as calculated by survey and observation data. They were also ranked based on design characteristics and users' satisfaction with design. The resulting ranks are presented in Table 4.12. Higher ranks represent lowest scores.

Table 4.12.
Garden Rankings

	observation data	hypothesis variables	Overall design	User satisfaction	survey data(staff)	survey data(visitor)
DOG	1	3	2	2	2	1
LHG	3	2	3	3	3	3
TCH	2	1	1	1	1	2
LLG	4	4	4	5	4	5
DLP	5	5	5	4	5	4

To visualize garden rankings presented in Table 4.12, Figure 4.16 was generated that summarizes research findings. Table 4.12 and Figure 4.16 demonstrate that despite small contradictions, garden rankings are based on various criteria.

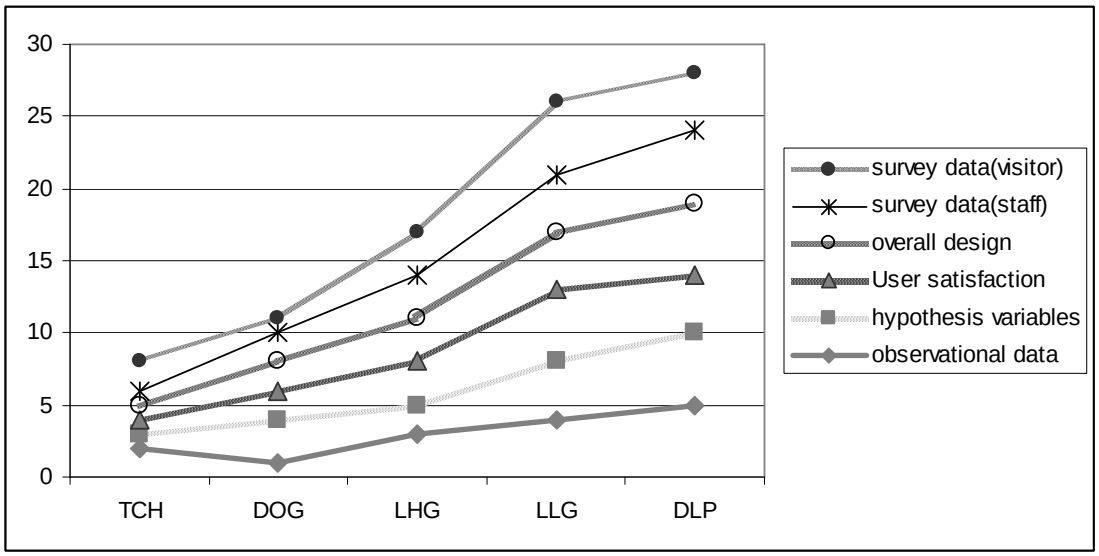


Figure 4.16. Garden Rankings

4.3. Summary

Observational data and survey data were analyzed using descriptive statistics and available statistical tests. Responses to open ended questions were analyzes using methods of qualitative data analysis.

Gardens were scored and ranked based on their overall design characteristics and based on research hypothesis variables. They were also ranked and scored based on levels of use as calculated using observational data and survey data. A third ranking of the gardens was conducted based on users' satisfaction with design as reported in surveys. An overall agreement was observed among all different ranking suggesting that gardens with better scores in design characteristics are the ones used more actively, more often, and for longer periods of time. Users were also more satisfied with gardens with higher design scores.

CHAPTER V

DISCUSSION OF THE RESULTS

5.1. Research Hypothesis

The primary hypothesis of the research was that “availability of seats, shade and plants increase usability of gardens located in high traffic zones of pediatric hospitals in Texas”. Usability was defined as different groups’ frequency and duration of garden visitation and their activities in the garden.

Although, as suggested by the literature, each of the hypothesis variables (seats, shade, and plants) may individually impact levels of usability, it was not possible to test the impact of each of them separately because 1) patterns of change in hypothesis variables among the gardens available for research were not the same (Figure 5.1), 2) number of variables was high compared to number of research sites (four variables and five gardens), and 3) although main barriers to garden visitation such as weather, location and accessibility were controlled, there were still factors that could influence garden visitation and could not be controlled. These factors, including design layout and details, and amenities for children, were measured and considered in the research analysis.

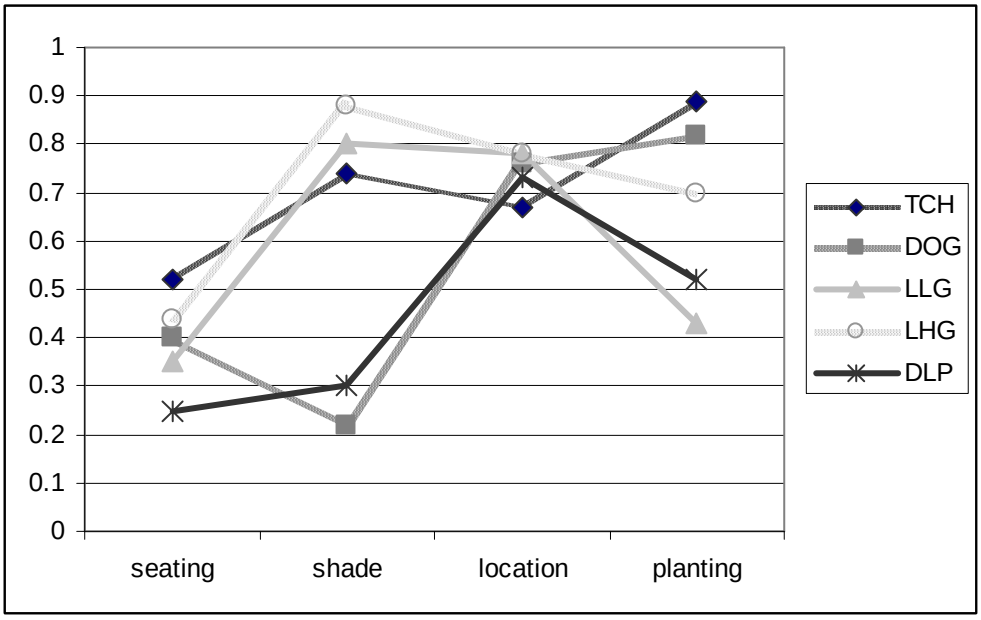


Figure 5.1. Hypothesis Variables Scores in Different Gardens

Having that said, once weighted scores were calculated for each garden using Principal Component Analysis that represented gardens scores in shade, seating, planting, and location, gardens with higher scores in the new scoring system were the ones with relatively higher scores in mentioned categories. The new scoring system made it possible to rank gardens based on hypothesis variables.

The gardens were also scored based on their usability, which is comprised of different groups' frequency and duration of garden visitation and their activities in the garden. Gardens were ranked based on group of users, durations of stay and level of physical activity using observational data. They were also ranked based on users' frequency and duration of stay as reported in surveys.

It was assumed that concordance of garden rankings based on usability with rankings based on hypothesis variables, would confirm accuracy of research hypothesis. Figure 4.2 represents comparisons of the two rankings.

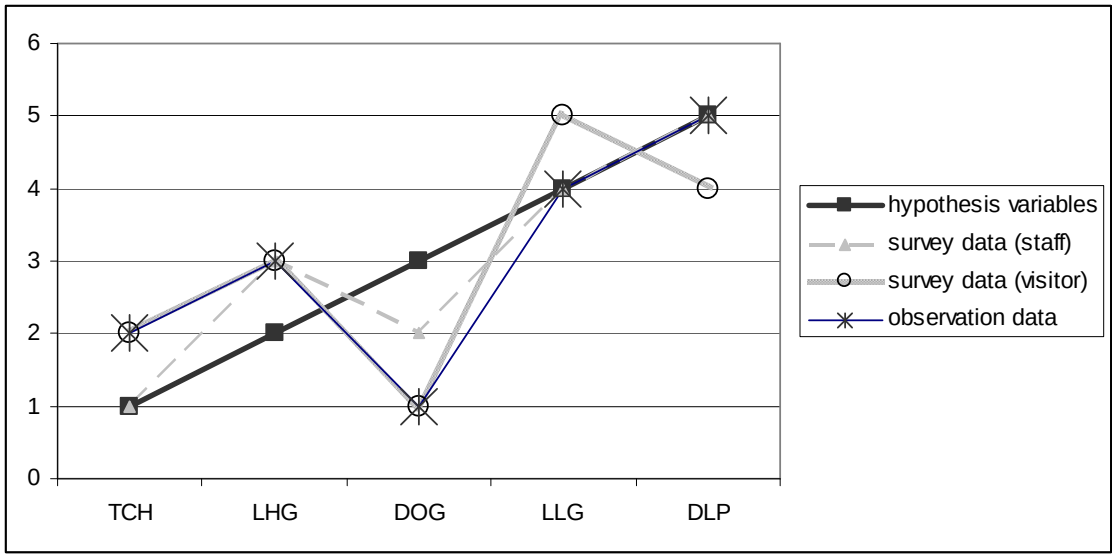


Figure 5.2. Garden Rankings Based on Research Hypothesis Variables and Garden Usability

According to Figure 5.2, the overall rankings are typically in agreement, meaning that gardens with lowest scores in design factors have lowest scores in usability as well. However, some inconsistencies are apparent between rankings based on hypothesis variables and usability rankings. In the case of gardens DLP and LLG, Figure H shows a contradiction between ranking based on visitor survey data and rankings based on staff surveys, observational data and hypothesis variables. Visitor survey data results were examined to find the source of the contradiction. According to Table 3.8 significantly more visitors reported that they stayed in LLG for less than 5 minutes. An evaluation of Figures 3.15 and 3.17 in Chapter III showed that DLP is visited more frequently and

LLG is visited for a longer duration of time by visitors. However, the differences are not statistically significant. The contradictions in the cases of DLP and LLG remain unexplained, but are not statistically significant.

DOG is the garden with greatest contradictions. Reviewing the visitor survey analysis provided an explanation for some of the contradictions. Analysis of the visitor data revealed that frequency of garden visitation and activities in DOG are significantly different than those of the other gardens. Significantly more visitors said that they visit DOG frequently (Table 3.8) and significantly more visitors said that they take their children to DOG to play (Table 3.8). Staff had lunch significantly less in DOG (Table 3.9), and worked significantly more with patients in DOG (Table 3.9). Considering the fact that DOG had the best score in amenities for children among all the gardens, it can be concluded that these amenities have been influential in increasing usability of the gardens for patients and their families.

The contradictions observed in the case of DOG suggest that hypothesis variables are not the only influential variables impacting usability of the gardens. While, it can be concluded that availability of shade, seats, plants increases usability of gardens in high traffic zones of pediatric hospitals in Texas, there are other factors that are influential in encouraging garden visitations. The most important of these factors is availability of amenities for children.

5.2. Research Findings

5.2.1. Garden Usability

Analysis of visitor demographics as reported in visitors' surveys showed no significant difference among respondents' gender, ethnicity, and role in different gardens. TCH had significantly younger visitors, which could be due to the fact that the garden was near the NICU department. Research shows that young mothers have higher rates of premature labor (e.g., Grason & Misra, 2006). Although the surveys were not collected from mothers younger than 22, there were still significantly more 22 to 26 year olds in TCH who completed the survey (Table 3.8). Visitors in TCH also made significantly more hospital visits, which is probably due to the longer hospitalization period for NICU patients.

No significant difference was observed among staff respondents of the surveys in terms of age, gender, ethnicity and role. Staff in TCH typically worked more years in the hospital, which is due to the fact that the other two hospitals were just recently built.

In general, no considerable difference was observed among the staff and visitor population in the five gardens. This means that the different levels of garden usability observed in gardens is not a result of demographics.

Analysis of durations of stay and frequency of behaviors, demonstrated significant differences among gardens. All gardens were significantly different from each other in terms of duration of stay except in a few cases: TCH and DOG were not significantly different in terms of duration of stay, however they were significantly different in terms of levels of physical activity at alpha=0.05 level. LLG and LHG also

were not significantly different in terms of duration of stay, but LHG had a significantly more active behavioral culture at alpha= .05 level. In both cases the gardens with more active behavioral cultures benefited from better scores in categories of layout and pathway and amenities for children. Gardens DLP and LLG were not significantly different in terms of levels of physically activity, but were significantly different in terms of duration of stay. Similarly, LHG and TCH gardens were not significantly different in terms of levels of physical activity, but were significantly different in terms of duration of stay. In these two cases, gardens with longer durations of stay benefited from better seating options. The analysis shows that design characteristics of the gardens can have significant impact on duration of stay and behavioral culture of the gardens.

5.2.2. Quality of Design

Garden rankings based on overall design characteristics were compared against garden usability rankings. As explained in previous chapters, overall design characteristics included categories of CHGAT developed by Marcus and Barnes in 2007 and gardens scores on shade. CHGAT is the only comprehensive audit tool available to evaluate children hospital gardens. As a result it is assumed the categories in CHGAT (planting, shade, seats, location, amenities for children, design layout and details) in combination with shade evaluation, will cover all potentially influential design characteristics. The rankings based on overall design characteristics are compared with usability rankings in Figure 5.3.

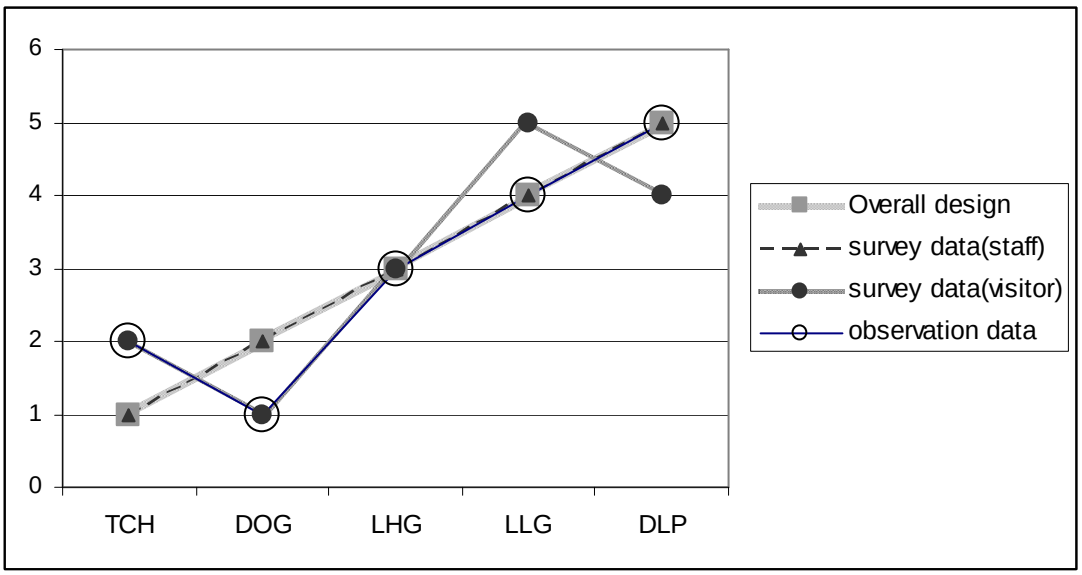


Figure 5.3. Garden Rankings Based on Overall Design Characteristics and Usability

According to Figure 5.3, garden rankings based on staff survey data and overall design scores are similar. Table 3.28 in Chapter III shows that gardens DOG and TCH are not significantly different in terms of gardens users' observed duration of stay, but according to Table 3.30 they are significantly different in terms of levels of activities exhibited by users. Hence, compared to TCH, garden users did not stay significantly longer in DOG but exhibited playing and walking behaviors significantly more often in DOG, which is likely due to availability of play amenities and longer walking paths in DOG.

DLP and DOG were used more than expected. Considering the fact that both gardens are located in one hospital, their relatively higher levels of usability might be impacted by non-design-related factors such as organizational culture or administration policies. In general, few contradictions were observed while comparing garden usability

with garden overall design score. This suggests that considering overall design factors, including shade, seats, garden layout and details, amenities for children, and location may lead to a accurate prediction of gardens' usability.

5.2.3. Number of Hospital Visits

A significant positive correlation was observed between number of hospital visits and duration of the stay at the garden. People who had visited the hospital more, tended to spend more time in the garden compared to other people (Table 3.8). In TCH, where highest number of hospital visits was reported, people who had visited the hospital more than 50 minutes reported longer duration of stay.

Analysis of the cumulative data for the five gardens showed that 1) people who had visited the hospital 10 to 30 times, reported that they stay in the garden 5 to 14 minutes. Also, 2) people, who had visited the hospital, more than 50 times, reported that they stay in the garden over 30 minutes. This could be because people, who visited the hospital more, had the chance to explore the hospital to find out about the garden and stay in the garden. Research also shows that people navigate their ways differently once they have gained familiarity with a new layout (Haq & Zimring, 2003). Gaining familiarity with a setting may also help visitors use the space better in response to their needs.

No significant correlation was observed between staff years of work in the hospital and garden visitation. Also, no significant relationship was observed among number of hospital visits and frequency of garden visitation.

5.2.4. Barriers to Garden Visitation

Whitehouse and colleagues (2001) found four factors as major barriers to the use of healing gardens in hospitals :1) Knowledge of existence of the garden, 2) Accessibility of the garden, 3) Beliefs about the garden, 4) Underlying philosophy toward treatment.

Barriers to garden visitation as reported by visitors were examined to find whether same barriers prohibited people from garden visitation. In this study 57% of the visitor respondents in all five gardens said that they had never walked into the garden, and 45% of the visitors said that they had not visited the garden because of their child's condition or because they were too busy. Twenty-two percent of visitor respondents said that they didn't know about existence of the garden. Weather was the next major barrier mentioned by 13% of the visitor respondents.

Knowledge about existence of the garden was not a major barrier for staff since, in the case of all gardens except DLP they knew about existence of the gardens. Forty-two percent of the staff said that they didn't visit the garden because they were busy, 18% complained of weather, 11% complained of poor shade, and 9% complained of quality or quantity of seats.

Accessibility and knowledge about existence of the garden were not major barriers to garden visitation in this study, which is due to the fact that only gardens located in high traffic zones of the hospitals were included. Also all gardens were wheelchair accessible and had unlocked doors. This suggests that lack of knowledge

about existence of the garden can be resolved by proper positioning of the gardens in the hospital layout.

Regarding beliefs about the garden, only three people (two volunteer workers and one visitor) said that they didn't know the garden was for them to use.

In general, at the alpha= 0.05 level, a significant correlation was observed between barriers to garden visitation and duration and frequency of both staff and visitor's garden visitation: 1) visitors, who mentioned no barriers to garden visitation, said that they visited the garden frequently, 2) visitors who complained from shade or weather said that they visited the garden rarely or occasionally (Table 3.8), 3) staff who mentioned no barriers to garden visitation stayed 15 to 30 minutes in the garden and visited the garden daily, and 4) staff who were not satisfied with quality of seat stayed in the garden less than 5 minutes (Table 3.9).

5.2.5. Activities

Significant correlations were found between users' activities and their duration or frequency of garden visitation. Analysis of cumulative data across all five gardens detected the responsible cells for significance of the relationship as follows: 1) visitors who just passed through the garden or had lunch there visited the garden rarely, 2) visitors who reported that they let their children play in the garden generally said that they visit the garden occasionally, and 3) visitors who said that they walk around the garden visited the garden frequently. With regard to the durations of stay, 1) visitors who stayed in the garden more than 30 minutes generally said that they relax in the garden, 2)

people who sat and wait or had lunch usually stayed in the garden 15-30 minutes, and 3) visitors who took their children to play in the garden, said that they 5 to 14 minutes.

Responsible cells for significance of correlation between activities and garden visitation habits as reported in staff surveys are as follows: 1) staff who said that the had lunch in the garden visited the garden weekly, and 2) stayed in the garden 15 to 30 minutes, 3) staff who said they stay in the garden less than 5 minutes usually just passed through the garden.

The analysis also shows different groups preferred activities in the garden. Staff stayed longer and visited the garden more often to have lunch. Visitors visited the garden more often and for longer periods of time to let their children play or walk around.

5.2.6. Frequency and Duration of Stay

Both staff and visitors who visited the garden more frequently tended to stay in the garden for longer periods of time. The significant correlation found between frequency and duration of visitation in visitor survey was due to 1) visitors who visited the garden frequently, in general said that they stayed there 15 to 30 minutes, and 2) visitors who visited the garden occasionally, usually stayed there 5-14 minutes.

The significance of the correlation between frequency and duration of visitation in the staff survey followed the same pattern. 1) Staff who visited the garden weekly stayed there 15 to 30 minutes and 2) staff who visited the garden monthly, usually spent 5 to 14 minutes in the garden.

Since one of the major barriers to garden visitation for both staff and visitors was their busy schedule, it can be concluded that people who are less busy tend to visit the garden more often and for longer period of time. However, personal preferences and characteristics might also be influential in frequency and duration of garden visitation.

5.2.7. Barriers to Garden Visitation

Analysis of barriers to garden visitation showed that most people don't visit the garden because they are busy. However, descriptive analysis of data also showed that a group of visitors make the effort to walk into the garden, but don't stay there for longer period of time or just pass through the garden. Analysis of data showed 1) staff who said they just pass through the garden were not satisfied with quality of seats and 2) visitors who just pass through the garden mentioned weather as the main barrier to garden visitation (Table 3.9).

Considering the fact that lunch time hours are usually the hottest hours of the day, both visitors and staff who had lunch in the garden were not satisfied with 1) weather (standard residual 2.0) and 2) poor shade (standard residual 5.5). Both of these barriers indicate design that is not compatible with environmental conditions.

5.2.8 User Ratings of Ideal Garden and Visited Garden

The canonical correlation analysis showed a strong association between users' ratings of the design features in the garden they visited, and their ideal garden. This could be due to the fact that different people have different standards and styles for rating, and therefore their ratings for both visited garden and ideal garden follow the same pattern. The canonical correlation also suggests that ratings of ideal garden are affected but the garden to which the raters have been exposed, or vice versa.

Analysis of staff ratings suggest that 1) staff believed views to the garden and colors in the garden encouraged them the most to visit the gardens, and 2) staff believed that in an ideal garden, views to the garden and garden accessibility are the important factors that encourage garden visitation (Figure 5.4).

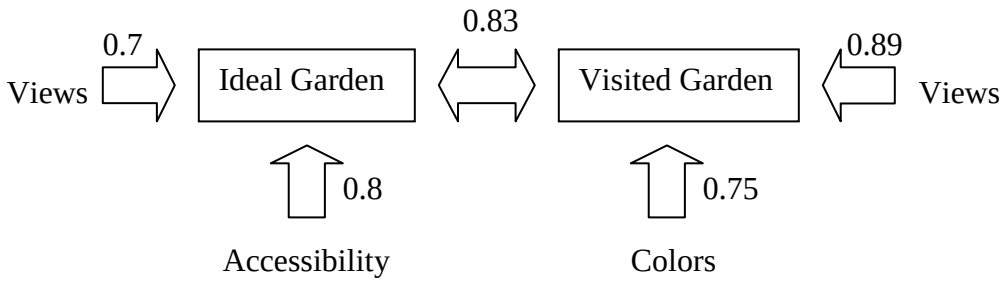


Figure 5.4. Canonical Correlation Analysis: Variables Indentified as Most Influential in Staff Satisfaction with Design

Analysis of Visitor ratings suggest that in general 1) visitors believed that availability and comfortability of the seats in the garden encouraged them to visit the garden, and 2) visitors believe that in an ideal garden, comfortable seats and views to the garden will encourage garden visitation (Figure 5.5).

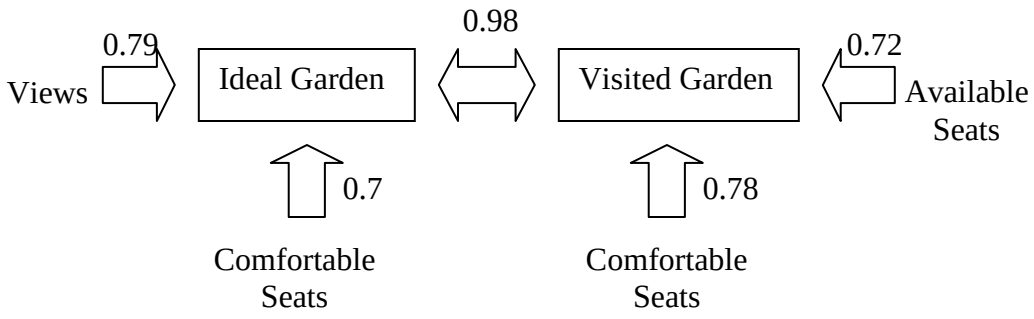


Figure 5.5. Canonical Correlation Analysis: Variables Identifies as Most Influential in Visitor Satisfaction with Design

Two main groups were identified among design features: 1) attributes that provide positive distractions including colors, water and plants; and 2) attributes that provide comfort including seats, shade and easy accessibility. To understand how each design attribute is rated by users, they were ranked based on their calculated association with canonical variable. Features with lower rank are the ones with higher association with canonical variable. Staff rated positive distractions including water feature, plants and colors as more influential in encouraging them to visit the gardens. However, in an ideal garden, they expected comfort providing attributes to be more influential (Table 5.1). For visitors, a mixture of comfort and positive distraction was mentioned and required for the visited garden and ideal garden. However, they slightly preferred positive distractions to be more desirable in an ideal garden (Table 5.1).

Table 5.1
Design Attributes Ranked Based on Their Influence on Satisfaction with Design
(+: positive distractions, ++: comfort)

	Staff		**Visitor**	
	Ideal garden	**Visited garden**	**Ideal garden**	**Visited garden**
1	views to the garden	views to the garden	views to the garden	comfortable seats ++
2	Accessibility ++	colors +	Comfortable seats ++	available seats ++
3	comfortable seats ++	Water +	Colors +	views to the garden
4	walking paths	Plants +	Water +	Colors +
5	Shade ++	walking paths	Plants +	Accessibility ++
6	available seats ++	Accessibility ++	available Seats ++	Water +
7	Colors +	available seat ++	Accessibility ++	Plants +
8	Plants +	comfortable seats ++	Shade ++	Shade ++
9	Water +	Shade ++	walking paths	walking paths

The findings of the canonical correlation analysis would be more useful if enough cases were available for each garden and design attributes could be studied for each garden and case by case. However, even the cumulative data of all gardens barely made the minimum required number of cases to conduct canonical correlation analysis. This specific question had a high number of missing data or outliers especially in case of the visitor survey, which suggests that visitors either did not have the patience to answer

to this question or did not understand the question. It should be taken into consideration that canonical correlation is very sensitive to small changes in the data set. Although the decision to eliminate cases or estimate missing data was considered carefully for this study, the final results of this section should not be considered conclusive.

5.2.9. User Satisfaction with Design

Garden ranking based on staff satisfaction with design was identical to garden ranking based on visitor satisfaction with design (Table 3.23). This suggests that staff and visitors evaluate design attributes similarly. The garden ranking based on user satisfaction was compared against garden usability, design attributes and hypothesis variables (Figure 5.6).

According to Figure 5.6, in general, user satisfaction with design was higher when gardens had better scores in terms of overall design characteristics and hypothesis variables. However, garden scores based on overall design characteristics seems to be a better predictor of user satisfaction. Rankings based on usability of the gardens also showed that, in general, people were more satisfied with the gardens they were using most.

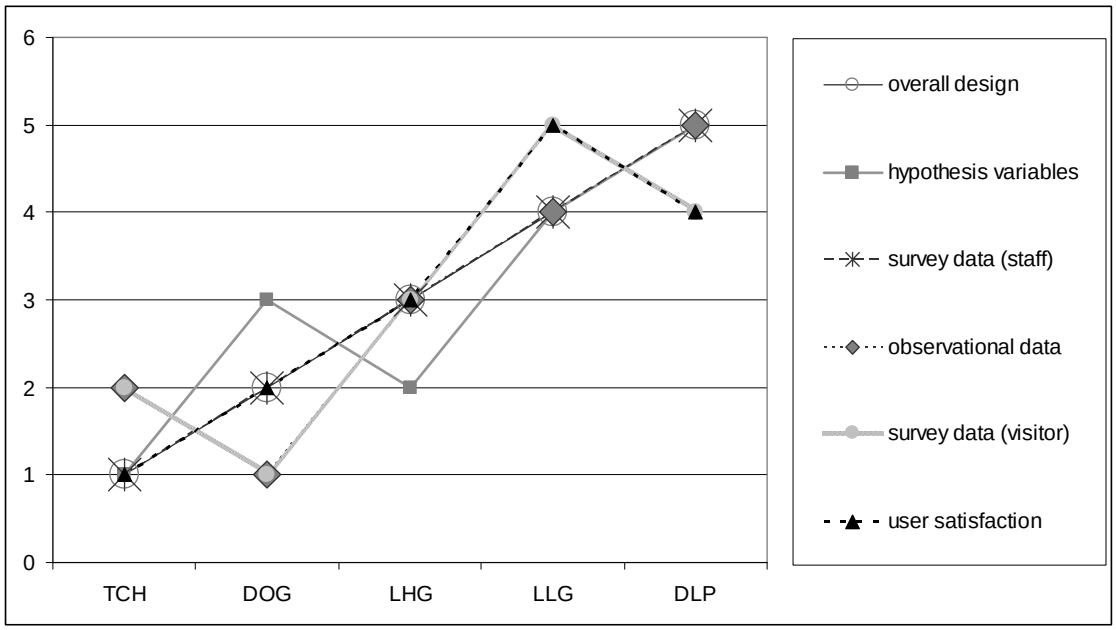


Figure 5.6. Garden Ranks

5.2.10. Components of Garden Use

Principal Component analysis of levels of activity showed that design characteristics form the behavioral culture of the gardens. In this study gardens varied largely in terms of amenities for children, layout and pathways, and planting. Behavioral culture of the gardens also varied largely in terms of levels of activity, with walking and playing as the first principal component. Final analysis of the garden scores shows that gardens with higher scores on planting, layout and pathways, and amenities for children generally have more active behavioral cultures. In general, gardens with better design qualities encourage higher levels of physical activity and longer durations of stay.

5.2.11. Gardens Behavioral Culture

Analysis of the behavioral culture of the gardens in term of groups of users and type of activities showed that staff exhibit more sedentary behavior in the gardens while other groups of the users tend to be more physically active.

Principal Component analysis of the observational data identified two main groups of garden users as staff and non-staff. Non-staff included patients, well siblings, and adult visitors. Staff use was associated with sedentary behavior, while non-staff use was associated with higher levels of physical activity such as walking and playing.

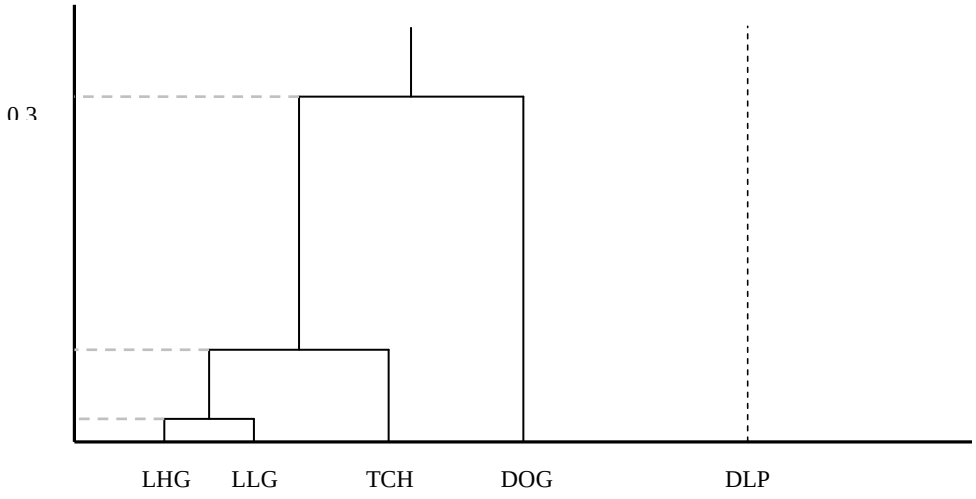


Figure 5.7. Hierarchical Clustering of Gardens Based on Distribution of Activities

Hierarchical clustering of the gardens based on groups of users helped to identify garden groups with different behavioral culture. According to hierarchical clustering (Figure 5.7) LLG and LHG, both located in the same hospital, are closer to each other in terms of distribution of activities. Diagram of activity distribution in (Figure 5.8.) and

total duration of activities (Figure 3.11 and 3.12) show that staff are the main group of users and sedentary behavior is the dominant activity in both gardens. Both gardens LLG and LHG had highest number of seating options (although not the most comfortable seating options) and were close to dining area and cafeteria.

TCH, the next garden close to the cluster of LHG and LLG hosts relatively more walking and playing (Figure 5.8.) and non-staff visitors (Figure 3.5 in Chapter III). However, staff sedentary behavior is still the dominant behavioral culture in this garden. DOG, in contrast, is dominantly used by non-staff groups (Figure 3.1, Chapter III). Highest levels of physical activity were observed in DOG (Figure 5.7). The garden did not have many seating options but was supportive of active behavior by providing walking paths and playscapes.

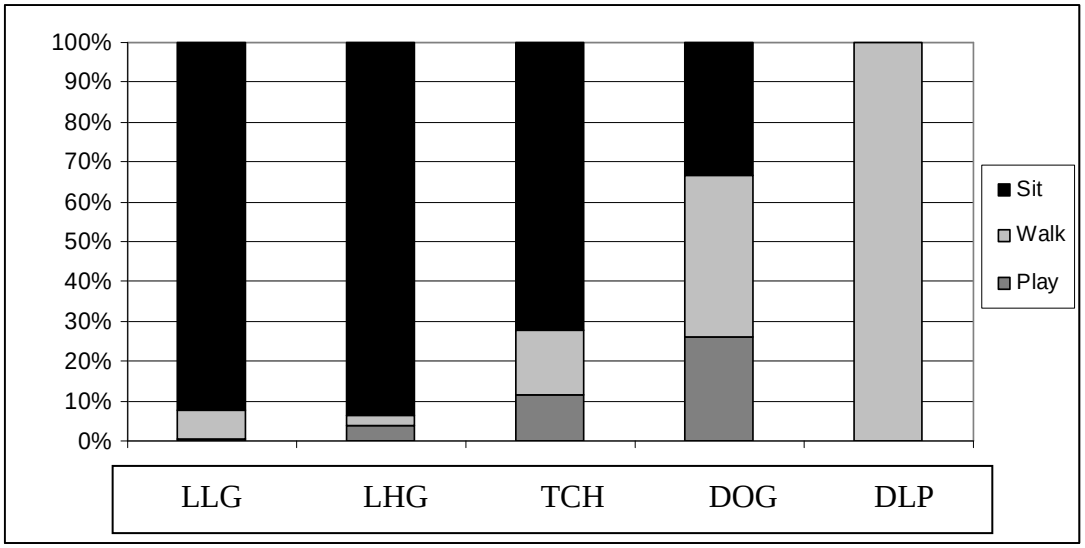


Figure 5.8. Diagram of Activity Distribution at Gardens

In general, gardens providing options for seating were more used by staff. Staff sedentary behavior can be due to garden's design characteristics or staff's job demands. Considering the fact that healthcare profession demands an enormous amount of walking, it is probable that staff use their breaks in the gardens to sit and rest. However, this is not the case for some groups of staff who don't get the chance to be physically active during work hours. Patients and visitors usually remain seated in waiting areas or patient rooms inside the hospital and consequently use gardens as an opportunity to be more physically active.

5.2.12. Open Ended Questions

Three open-ended questions were provided at the end of surveys, which asked users about what they liked the most about the garden they visited, what they like the least and what are their comments about the garden. The answers to the questions were reviewed and four main categories of responses were identified. Users had mentioned their perception of the garden, what it felt like to be in the garden, what they liked the most and what they liked the least (see Table A and B Chapter III). Except DLP and LLG, which were the least used gardens, visitors perceived the gardens as a beautiful environment. The word peaceful was used for all gardens except DLP. Phrases such as "inviting" and "feels away from hospital" were used for LHG. Visitors also commented about how their children felt in DOG, which was the garden with highest score in amenities for children.

In case of the gardens that had water features (DOG, LHG and TCH), visitors mentioned water feature more than any other design attributes as their favorite part of the garden. Visitors disliked poor shade the most. In case of TCH and DOG (with higher rates of use) visitors complained about traffic in the garden. In LLG and LHG visitors asked for play areas for children and teens.

Staff perceived all gardens except LLG as a beautiful environment that was peaceful. They mentioned that LLG, LHG and DLP felt separated from the hospital environment. Similar to visitors, staff mentioned water features the most in the case of the gardens that had them. They also liked plants and colors in TCH, LHG and DOG. Poor shade was the biggest complaint about the garden environment in LLG, DLP, DOL, LHG and they did not like the fishbowl effect in TCH. In the case of LLG, similar to visitor's survey, they suggested a playground for children.

5.3. Discussion of Research Findings

The five gardens in this study were evaluated in terms of design characteristic and ranked based on overall design qualities and research hypothesis variables. Although the research design did not allow for evaluation of the impact of each variable separately, the analysis of survey data helped to realize the importance of some of them separately.

Survey data confirmed the significance of the effect of poor shade on garden usability in Texas. Both staff and visitors named shade as a barrier to garden visitation after factors including "being busy" and "unpleasant weather." It is noteworthy that

unpleasant weather can be ameliorated to a high extent by providing appropriate shading in the hot climate associated with Texas. Poor shade was also a factor responsible for the significance of the correlation between barriers and frequency of use, where visitors who complained about shade or weather said that they visited the garden rarely or occasionally. Poor shade and weather also impacted the significance of the correlation between activities and barriers to garden use. Visitors who just passed through the garden mentioned weather as the main barrier to garden visitation. Visitors and staff who had lunch in the garden were not satisfied with weather and poor shade. Poor shade was also the most mentioned dislike for both visitors and staff surveys.

Cooper Marcus (2005) has extensively discussed the importance of presence of shade (especially in warmer climates) on levels of garden use. Significance of the role of unpleasant weather on garden use was not identified by Whitehouse et al (2001). This is due to more pleasant climate conditions in case of the mentioned research's location (California). In Texas, the pleasant weather time span is relatively short. Despite the fact that the research took place during spring, garden users complained about hot weather conditions.

Availability and comfortability of seats also turned out to be influential in garden usability. Uncomfortable or unavailable seats were the next barriers to use mentioned by both visitors and staff. Staff who were not satisfied with quality of seat stayed in the garden less than 5 minutes (Table 3.9). However, staff were more troubled by inadequate seating. Dissatisfaction with quality of seats contributed to staff's less than 5-minutes stay in the garden. In addition, staff who were not satisfied with quality of seats usually

just passed through the garden. Staff's dominantly sedentary behavior also highlights their need for availability of comfortable seating options. While visitors also realized deficiencies of seating options, this did not affect their garden visitation because of their tendency for more active behavior in the garden. Cooper Marcus (2005) has discussed the importance of availability of seats in outdoor spaces of healthcare facilities.

Garden rankings not only served to demonstrate the impact of shade, seating options, plants, and location on garden usability, but also helped to identify other influential factors including amenities for children. A positive correlation was observed between frequency of garden visitation and availability of amenities for children. Also these amenities encouraged a more active use of environment which according to Ulrich theory of supportive garden design (1999) can be beneficial for garden visitors' physical and psychological health. Higher usability of these gardens is in alignment with children's fascination about the functional aspects of environments as discussed by Gibson (1979) and van Andel, (1990). Francis (1988) noted that while adults consider, "what does it look like," children ask, "what can I do here?" Encouraging children to use gardens more often will deliberately increase garden visitation frequency and duration for parents and visitors as well. However, in case of patients or staff who prefer sedentary behavior, gardens should be supportive of their priorities too.

Gardens with relatively higher scores in design detail and design layout had the longest duration of garden visitation. These categories scored gardens based on diversity of scenes and hierarchy of pathways, in addition to considering use of thematic signage, sculptures, color, and playful hardscape. These elements if used in balance will

contribute to creation of an engaging environment with moderate complexity. Kaplans' 1989 theory of environmental preference also suggests that a balanced complexity is preferred over a simple scene that can be boring and not desirable.

The gardens were ranked based on user satisfaction and usability. Despite some inconsistencies, an overall concordance was observed among different rankings. The overall concordance among survey data and observational data fulfilled triangulation proposes, while the concordance between usability rankings and garden design attributes served to confirm accuracy of research hypothesis. Garden design qualities scores were also in alignment with users' satisfaction with design which suggests that users have a through knowledge about requisites of a good design.

This study incorporated Children's Hospital Garden Audit Tool (CHGAT) along with shade maps to evaluate design features. The overall concordance of the design scores with garden use scores across gardens suggests that the tool is an appropriate device for measuring design characteristics that influence usability of the gardens. However, more research is needed to validate the tool in other climates and geographic locations.

5.4. Summary

Analysis of research data showed that gardens with higher scores in shade, seats, and planting, have higher levels of usability. Especially, availability of shade and seats are important design factors that can significantly impact garden use for all groups. This finding serves to establish accuracy of research hypothesis.

The analysis of research findings also show that higher scores in pathways and amenities for children encourage more active, frequent and longer garden visits for non-staff groups. It can be concluded that availability of seats, shade and healing nature contributes to promote garden use for all groups, however, there are other factors influencing garden use for non-staff users. Availability of amenities for children and walking paths are two influential factors identified by this study.

CHAPTER VI

CONCLUSION

This research examined the impact of availability of shade, seats and healing nature on use of gardens located in high traffic zones of the pediatric hospitals in Texas. The primary conclusion of this study was that levels of gardens use is positively correlated with presence of hypothesis variables. The following sections describe the implications of this research in terms of design guidelines, the limitations of the study, and suggestions for future research.

6.1. Design Guidelines

This research generated design guidelines, which will be instrumental in increasing garden usability for various groups of users including visitors, family members, staff and patients. The following design recommendations and guidelines provided in this section are based on the literature review in Chapter I, research findings presented in Chapter V, researcher's observations, and users responses to the open-ended questions. Although some of the recommendations provided here have already been suggested by previous researchers, this study serves to demonstrate the significance of their impact on garden use. Recommendations based on observations and responses to open-ended questions may also serve as new directions for future research.

6.1.1. Quality and Availability of Seats

Providing comfortable, movable, and diverse seating options in the garden can increase duration and frequency of stay for all groups especially for staff. Whitehouse et al. (2001) recommended providing seating options throughout the garden. Cooper Marcus and Barnes (1995) suggested that chairs with backs and cushions arranged in groups or alone in adequately shaded areas will offer opportunities for social interaction or seclusion. Picnic tables, or tables and chairs that support dining are also recommended (Figure 6.1). Also, desirable is child-scale seating options, seats along the walking paths, and seats close to play areas that support supervision encourage and support children's play (Figure 6.2).

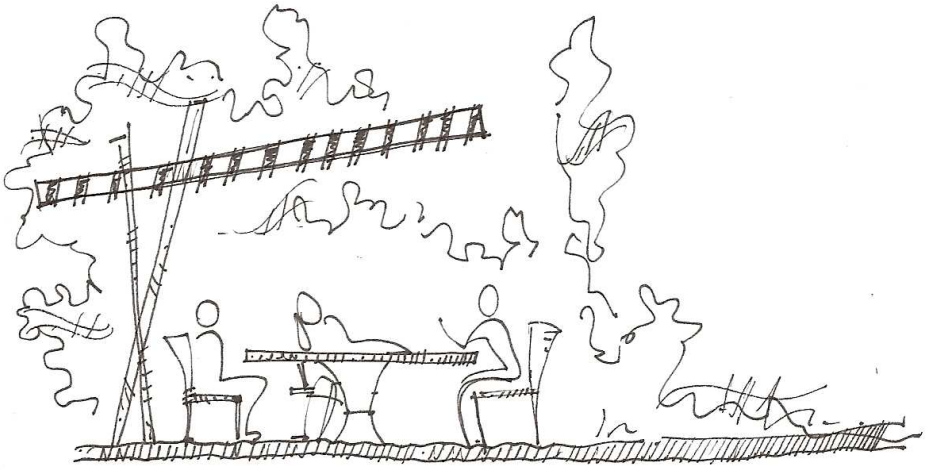


Figure 6.1. Cushioned Movable Seats in Private Corners Support Comfort

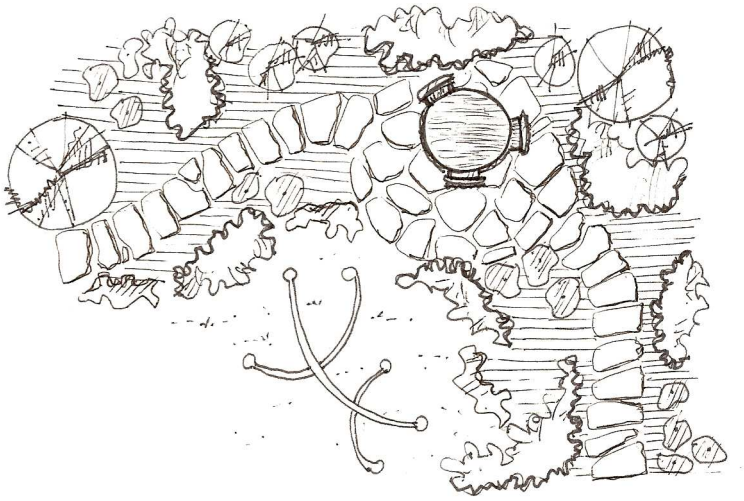


Figure 6.2. Seating Options Close to Children's Play Area Support Family Visit

6.1.2. Design Details and Garden Layout

Gardens with relatively higher scores on design layout and design details were used for longer periods of time. Paying attention to design details and garden system of pathways can engage garden visitors by stimulating their curiosity and encouraging them to stay in the garden for longer periods of time. This category of design details includes sculptures, colors, and thematic signage. The category of garden layout places into consideration the hierarchy of pathways, private corners, and diversity of scenes (Figure 6.3).

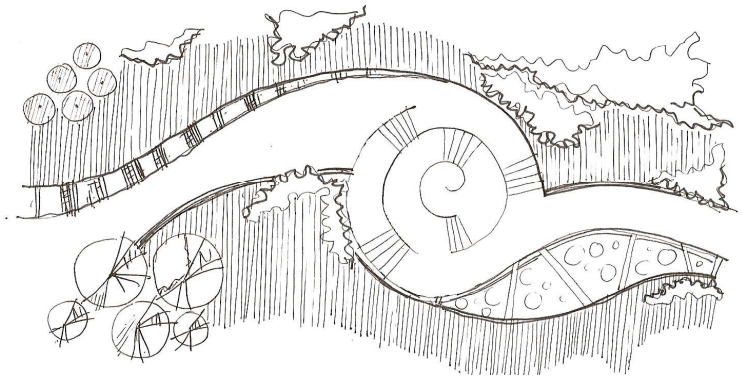


Figure 6.3. Playful Pathways, Sculptures, Artwork, and Diverse Vegetation Evoke Visitor Curiosity and Prolong Duration of Stay

6.1.3. Shade

Exposure to hot, direct sun and inadequate shade were the main dislikes in all gardens in this study. Visitors who complained about lack of shade or uncomfortable weather said that they visited the garden rarely or occasionally. Visitors who just passed through the garden mentioned weather as the main barrier to garden visitation. Considering that staff usually use the garden during lunch hours, which are the hottest hours of the day, appropriate shading is important. Appropriate positioning of the garden within the hospital layout will help achieve desired levels of shading. Shading structures and adjustable umbrellas can be also incorporated (Figure 6.4) as suggested by Cooper Marcus and Barnes (1995). Eco-design guidelines should be considered to ameliorate environmental conditions. Shade, water fountains, and plants can create pleasant microclimates in Texas.

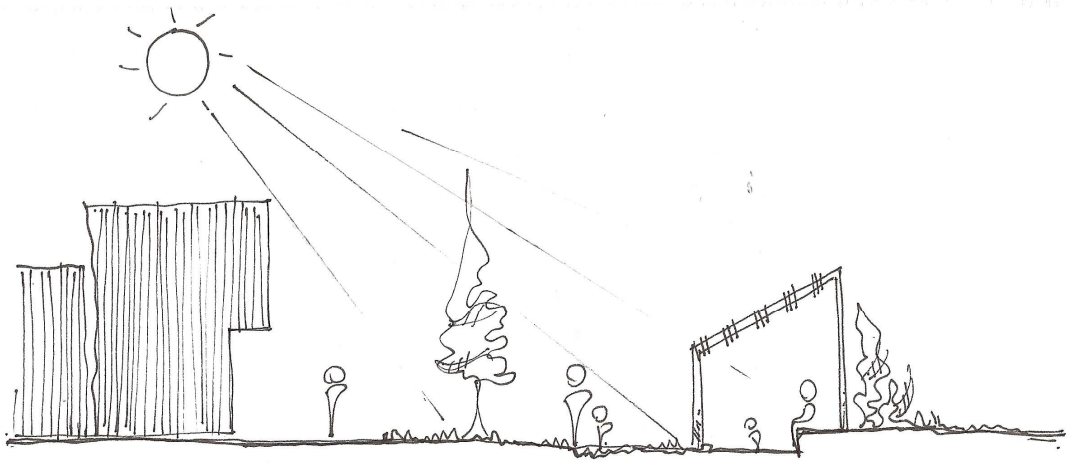


Figure 6.4. Adjacent Buildings, Plants, and Various Shade Devices Provide Desired Shade Levels

6.1.4. Amenities for Children

Playgrounds, playscapes, sculptures, and design features that support play will encourage higher levels of physical activity for children and their family members. Said et al. (2005) found that pediatric patients perceive the role of play equipment more quickly than the role of plants or microclimatic factors and therefore readily use play equipment. They suggest that play equipment can be manipulated to increase physical and cognitive performance (Figure 6.5).

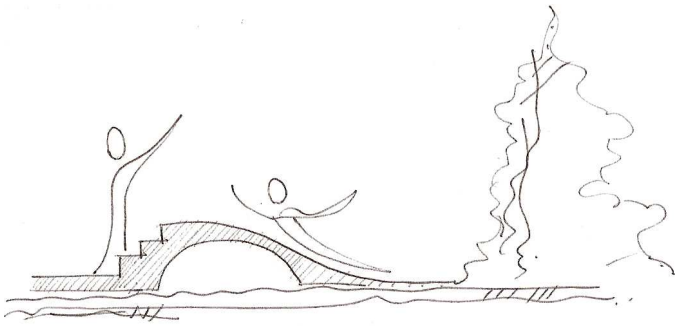


Figure 6.5. Traditional Playgrounds, Manipulative Play Equipment, and Creative Hardscape Design Encourage Play

Regarding amenities for children, Nebelong (2008) suggests that children might need play equipment or design elements which encourage them to playing alone or together, however, it is their imagination that brings the experience to life. Environmental *playscapes* can replace traditional equipment as part of a new approach toward natural play environments (Keeler, 2008). Regarding garden features such as play equipments and walking paths, the designer must be aware that healthy children and hospitalized children have different needs (Whitehouse, 2001). In addition to health

status, age, gender and differences in ability should be considered in the development of playgrounds (Nebelong, 2008).

6.1.5. Accessibility and Proximity

Most pediatric patients observed in the gardens were touring the garden in wheelchairs. As a result, proximity to patient rooms and wheelchair friendly paths are essential to support patient's garden visitation. Wheelchair accessible paths have been recommended by Whitehouse (2001) and Copper Marcus and Barnes (1995).

In addition, considering exclusive gardens for different groups of users facilitates finding the best location for each garden within the hospital layout. Patient gardens should be adjacent to patient rooms while staff garden is adjacent to staff lodging and dining area (Figure 6.6).

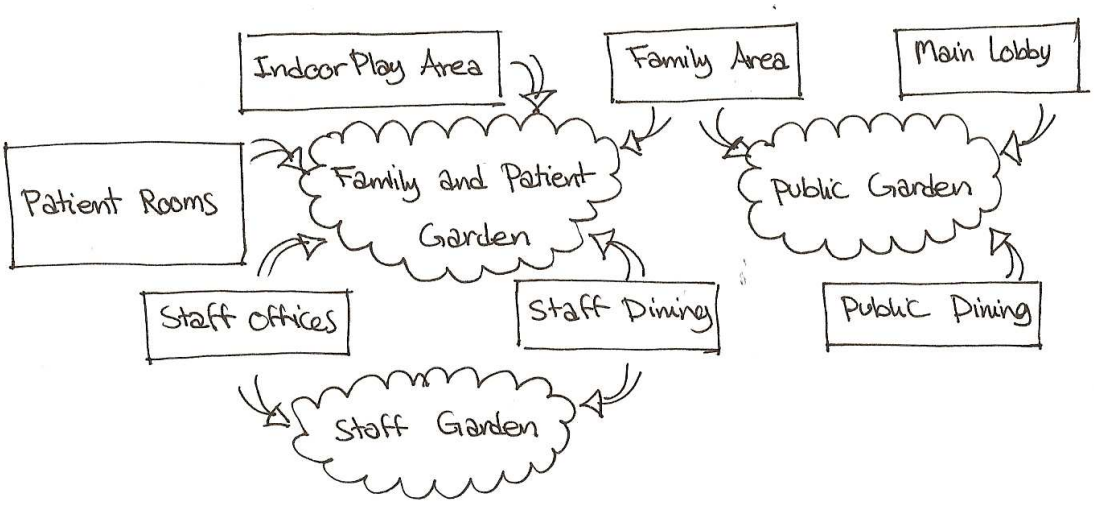


Figure 6.6. Proximity and Accessibility Support Garden Use

6.1.6. Garden Familiarity

The research showed that people, who had visited the hospital more, tended to spend more time in the garden. Garden familiarity and inviting atmosphere can encourage newcomers to start visiting gardens sooner (Figure 6.7). Information about gardens should be shared with people new to hospital through signs, brochures, articles, or word of mouth. Cooper Marcus and Barnes (1995) also suggested educating employees about the garden and encouraging medical staff to plan events in the garden to promote garden use.

Garden familiarity also serves to create a homelike environment that encourages visitors and patients to visit. Said et al. (2005) found that children preferred gardens to the ward because of their familiar setting in contrast to the strange and different physical attributes of the ward.

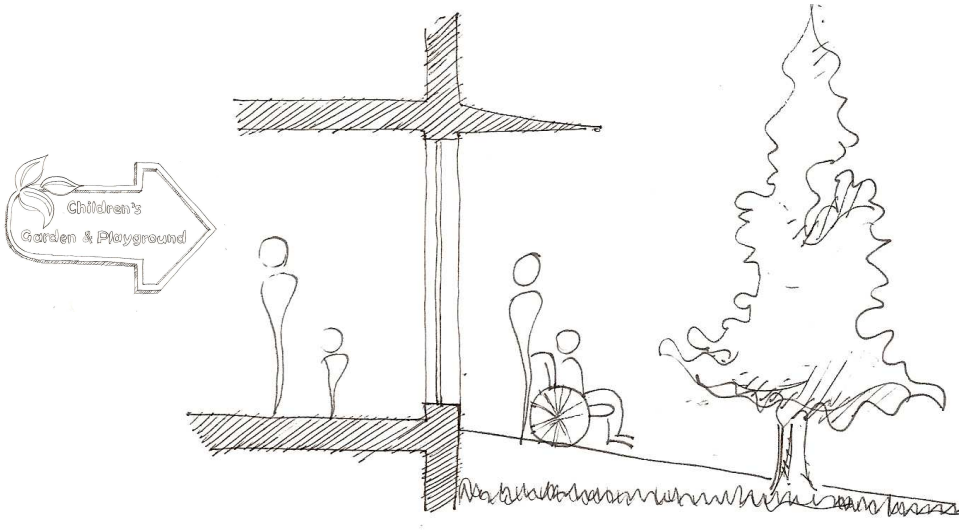


Figure 6.7. Views to Garden and Adequate Signage in the Hospital Introduce the Garden to Potential Garden Users

6.1.7. Exclusive Outdoor Spaces for Staff

Responses to open-ended questions revealed the tendency of staff to seek refuge from patients and visitors during their break time. Many of the staff liked the gardens because they felt like they were getting away from hospital environment. Dedicating exclusive space or gardens for staff can provide a more relaxing environment for staff to spend their break time. Sherman et al. (2005) also found that staff prefer their own private outdoor space, where they can relax separately from patients and family members. Designing separate gardens for staff and visitors also facilitates decision-making regarding garden location, design characteristics, and size.

Gardens designed to host staff need to be supportive of their sedentary behavior. Comfortable sitting and dining furniture, presence of shade in hot climates, and nature views are recommended. Family members and visitors in contrast would benefit from design amenities such as walking paths and play features that encourage active use of spaces. Theme gardens may be designed for staff and visitors, such as meditation gardens, dining outdoor spaces, and gardens for play and entertainment (Figure 6.8). Designing exclusive gardens for staff and visitors facilitates assigning appropriate functions to the gardens.

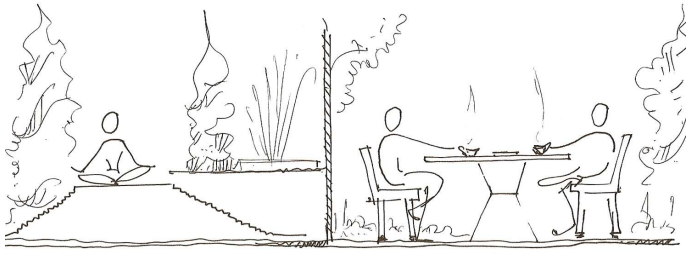


Figure 6.8. Exclusive Gardens for Staff Can Be Used for Dining, Mediation and Educational Purposes

6.1.8. Garden Functionality

The main barrier to garden visitation for both staff and visitors is their busy schedule. Integrating garden spaces with spaces people use in their daily routine can increase garden use rates. Gardens adjacent or integrated with waiting areas, cafeteria, dining hall, gift shops will be visited more often compared to gardens that support no specific activity and are tucked away in an isolated corner of the hospital (Figure 6.9).

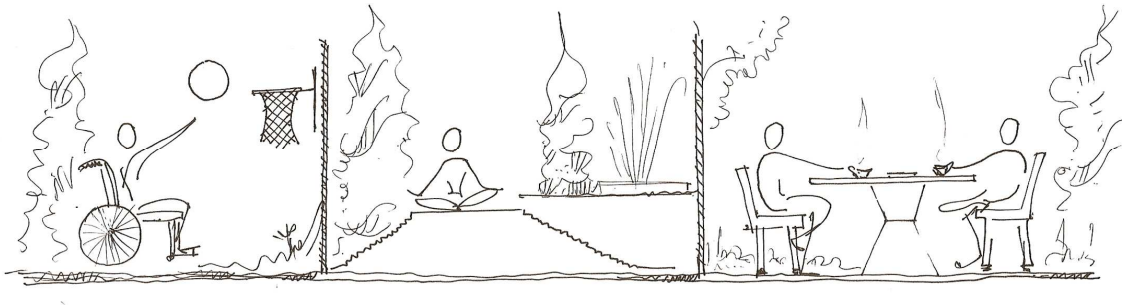


Figure 6.9. Gardens Can Support Different Functions or Activities such as Physical Therapy, Dining or Meditation

6.2. Research Limitations

6.2.1. Generalizability

This research incorporated quantitative research methods to investigate garden visitation habits in five pediatric hospital outdoor spaces. All hospitals were located in Texas. Although the hospitals geographical proximity enabled controlling for factors such as culture and climate, it also imposed some limitations to generalize the research findings. For example, impact of shade on garden usability may be different in other climates.

6.2.2. Confounding Variables

The main barriers to garden visitation such as weather and accessibility were controlled for, however, as a field study; other unknown environmental factors could impact garden usability. The contradictions in observations between different rankings could be due to these variables that were ignored or not evaluated accurately.

6.2.3. Sample Size

Also, the small number of gardens and large number of variables is a main limitation of the study that warrants consideration. To be able to calculate significance of the correlation between rankings based on design features and user satisfaction or garden use, around thirty gardens is desired. However, it might be impossible to find this number of gardens in same climatic, cultural, and geographic region. Having that said, conducting experimental research is more practical and productive.

6.2.4. Lack of Qualitative Data

A lack of qualitative data on healthy and hospitalized children's perception of an ideal garden is one of the limitations of the study. Researchers are recognizing increasingly the importance of directly recording the perspectives of children (Carter, 2002; Cohen and Emanuel, 1998; Coyne, 1998; Oldfield & Fowler, 2004). Interviewing pediatric patients is essentially helpful in finding design elements that can make garden visitation a more joyful experience especially for pediatric patients.

6.3. Directions for Future Research

Future research is needed to address limitations of this study. Similar research needs to be conducted in different geographical locations and climates to evaluate impact of design factor on garden use. Variables such as shade may have different impact on garden use in different climates. Conducting research experiments, can resolve limitations associated with high number of confounding variables, and small sample size in this study. Future study may also focus on obtaining qualitative data, especially from hospitalized children view points.

In 2001, Whitehouse et al. suggested that regarding garden features, different needs of healthy children and hospitalized children should be considered. The amenities that might be of interest to individual groups of patients, and to healthy siblings should be identified. Research is needed to explore preferences of pediatric patients who are not able to actively use the spaces.

It is noteworthy that pediatric patients compose a small percentage of garden users. Their needs and limitations for garden visitation should be studied exclusively and in depth. Specific groups of patients, such as chemotherapy patients have particular needs regarding shade or infection control. Patients' limited physical ability requires special consideration for distance and accessibility that should be studied. Children and teenagers, either healthy or ill, have different preferences for garden spaces. Attitudes of healthy children towards pediatric patients should also be considered.

While the research suggests integrating functional attributes with garden spaces, a through examination is needed to identify the best functions that can be assigned to the gardens. Furthermore, recommended design guidelines for each function should be explored. Future research may focus on staff and visitors preferred activities in the gardens. Also, efficient methods of introducing gardens to hospital visitors and patients should be studied. Various methods such as signs, brochures or word of mouth could be compared to each other or incorporated in an assortment of combinations.

This research aimed to identify barriers to garden visitation and introduce design guidelines that encourage garden visitation in pediatric hospitals for all groups. In addition, it served to statistically support design guidelines suggested by previous researchers. Due to scarcity of quantitative data in this field, the findings and methods of the study can be used as the basic foundation of future relevant studies.

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APPENDIX A

IRB LETTERS

TEXAS A&M UNIVERSITY
DIVISION OF RESEARCH AND GRADUATE STUDIES - OFFICE OF RESEARCH COMPLIANCE

1186 TAMU, General Services Complex
College Station, TX 77843-1186
750 Agronomy Road, #3500

979.458.1467
FAX 979.862.3176
http://researchcompliance.tamu.edu

Human Subjects Protection Program

Institutional Review Board

DATE: 09-Mar-2009

MEMORANDUM

TO: PASHA, SAMIRA
77843-3578

FROM: Office of Research Compliance
Institutional Review Board

SUBJECT: Initial Review

Protocol Number: 2009-0151

Title: Usability of Outdoor Spaces in Children's Hospitals

Review Category: Exempt from IRB Review

It has been determined that the referenced protocol application meets the criteria for exemption and no further review is required. However, any amendment or modification to the protocol must be reported to the IRB and reviewed before being implemented to ensure the protocol still meets the criteria for exemption.

This determination was based on the following Code of Federal Regulations:
(http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm)

45 CFR 46.101(b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless: (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (b) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Provisions:

This electronic document provides notification of the review results by the Institutional Review Board.

TEXAS A&M UNIVERSITY
DIVISION OF RESEARCH AND GRADUATE STUDIES - OFFICE OF RESEARCH COMPLIANCE

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Human Subjects Protection Program

Institutional Review Board

DATE: 19-May-2010

MEMORANDUM

TO: PASHA, SAMIRA
77843-3578

FROM: Office of Research Compliance
Institutional Review Board

SUBJECT: Amendment

Protocol Number:	2009-0342
Title:	Usability of Outdoor Spaces in Children's Hospitals-Surveys and Observations
Review Category:	Exempt from IRB Review

It has been determined that the referenced protocol application meets the criteria for exemption and no further review is required. However, any amendment or modification to the protocol must be reported to the IRB and reviewed before being implemented to ensure the protocol still meets the criteria for exemption.

This determination was based on the following Code of Federal Regulations:
(http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm)

Provisions:

This electronic document provides notification of the review results by the Institutional Review Board.

THE UNIVERSITY OF TEXAS
SOUTHWESTERN MEDICAL CENTER
AT DALLAS

Institutional Review Board

TO: Kristen Romig, MS

FROM: Ahamed Idris, MD
Institutional Review Board 4 Chairperson
IRB - 8843

DATE: April 26, 2010

RE: **Expedited Approval of NR1-Exp, Protocol/Project Summary, Consent Form Script, and Acknowledgment of Study Questionnaires/Documents.**
IRB Number: 042010-006
Title: Usability of outdoor spaces in children's hospitals

The Institutional Review Board reviewed this research activity via an expedited review procedure in accordance with 45 CFR 46.110(a)-(b)(1), 63 FR 60364, and 63 FR 60353. Having met the conditions as set forth by the IRB Chairman on April 13, 2010 your research protocol is now approved for a period of 12 months. This approval period will begin April 26, 2010 and last until April 12, 2011. If the research continues beyond approval period, the study will require continuing review from the IRB and a reminder will be mailed to you 60 days prior to the expiration date stated above.

Your approved subject sample size is 40 subjects.

Important Note: Unless a verbal consent process or waiver of consent was approved, you must use a photocopy of the attached IRB-approved and stamped consent form(s) to document each subject's willingness to participate. Use of a copy of any other version of the consent form is prohibited.

A photocopy of the signed consent form(s) and HIPAA Authorization should be given to each participant. The copy of the consent form(s) bearing original signatures should be kept with other records of this research for at least five years past the completion of the study. For research involving treatment or invasive procedures, a photocopy of the signed consent form(s) should be on file in a subject's medical record.

Federal regulatory law requires that you report to the Institutional Review Board any unexpected and/or serious adverse events/unanticipated problems, as defined on the IRB website at http://www.utsouthwestern.edu/irb , that occur to research subjects or others during the course of your study.

In the future, should you require a change or need to modify the research, including the informed consent document(s) and HIPAA Authorization, per federal regulation you must obtain prospective review and approval of the Institutional Review Board. For any change to the

research, prior review and approval before implementing such changes is mandatory except when prompt implementation is necessary to eliminate apparent immediate hazard to a subject.

Approval by the appropriate authority at a collaborating facility or performance site is required before subjects may be enrolled on this study.

If you have any questions related to this approval or the IRB, please contact the IRB office at 214-648-3060.

Enc: NR1-Exp
Protocol/Project Summary
Consent Form Script
Study Questionnaires/Documents

AI/tm

January 20, 2010

BCM
Baylor College of Medicine

MARIANNA M SOCKRIDER
BAYLOR COLLEGE OF MEDICINE
PEDIATRICS: PULMONARY

Baylor College of Medicine
Office of Research
One Baylor Plaza, 600D
Houston, Texas 77030
Phone: (713) 798-6970
Fax: (713) 798-6990
Email: irb@bcm.tmc.edu

H-26213 - USABILITY OF OUTDOOR SPACES IN CHILDREN'S HOSPITALS

Dear Dr. SOCKRIDER

We have received and reviewed correspondence regarding the above noted study. Your protocol is exempt from IRB review based on the following category(ies):

45 CFR 46.101(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

If we can be of further service to you, please call 713-798-6970. Thank You.

Sincerely yours,

Gabriel Habib

GABRIEL HABIB, M.D.
Institutional Review Board for Baylor College of Medicine and Affiliated Hospitals

Seton Family of Hospitals

April 19, 2010

Anne Claire Hickman, CCLS, CIMI
Sr. PICU Child Life Specialist
Dell Children's Medical Center
4900 Mueller Blvd
Austin, Texas 78723

Re: (10-SIRB-570) Usability of Outdoor spaces in Children's Hospitals

Dear Ms. Hickman:

This letter is to confirm that your response to stipulations for the above-referenced protocol was reviewed by the Seton Institutional Review Board (SIRB) Chair on April 13, 2010, and was **determined to meet the criteria for Exempt Review criteria and is Approved.** This determination will be reported at the SIRB Board meeting on May 6, 2010.

The documents below were reviewed:

- **Request for Exemption from Seton IRB Review**
- **Initial Protocol – with contingencies shown on SIRB letters dated February 22 and April 6, 2010**
- **Initial Consent Form – with contingencies shown on SIRB letters dated February 22 and April 6, 2010**

Approval by the SIRB does not indicate institutional commitment of resources nor does it indicate privileges to perform new procedures. The Institutional Review Board of Seton Healthcare is a duly constituted Institutional Review Board, under 21 CFR Part 56, and operates in compliance with Good Clinical Practices.

Responsibilities of the Principal Investigator:

- Report immediately to the IRB all deaths of subjects, regardless of cause;
- Report immediately to the IRB any severe adverse reaction or serious problem, whether anticipated or unanticipated;
- Report any significant findings that become known in the course of the research that might affect the willingness of subjects to continue to take part;
- Ensure that only formally designated investigators (as approved by the IRB) enroll subjects;
- Submit for review and approval by the IRB all modifications to the protocol or consent form(s) prior to the implementation of the change;
- Submit a Progress Report for continuing review by the IRB;
- Notify the IRB when the study has been completed and prepare a final report;

- The proposed research project will be conducted by the PI or one of the study team under close supervision;
- The proposed research project will be conducted in accordance with the protocol submitted to and approved by the IRB;
- The IRB shall have the authority to suspend or terminate approval of the research project if it is not being conducted in accordance with the IRB's decisions, conditions, and requirements;
- The PI will be responsible for completing mandatory human subjects' protections education every 3 years and providing documentation of compliance with this requirement (e.g. printed certificate of completion at the time of study annual renewal);
- The PI will assure that all research investigators and research team members have completed mandatory education in the protection of human subjects and provide documentation of compliance with this policy by using the documentation form (see Appendix 5);
- An online training tutorial for protection of human subjects is available at the CITI Program website: www.citiprogram.org. In addition, some research investigators and research team members may have access to online training programs in human subjects' protections provided by the University of Texas Medical Branch at Galveston IRB or the University of Texas at Austin IRB. Documentation of completion of these educational programs will all fulfill this compliance requirement.

Please direct all inquires to the Seton Healthcare Office of Research Administration, 1400 North IH-35, Suite 2.230, Austin, Texas, 78701, (512) 324-7991.

Sincerely,

Sharon D. Horner, PhD, RN, FAAN
Chair, Institutional Review Board
Seton Healthcare

SDH:jmb
Reference: CR-10-048

VITA

Name:	Samira Pasha
Address:	College of Architecture, c/o Mardelle Shepley, 002 Williams Admin, Bldg., Texas A&M University, College Station, TX 77843-3137
Email Address:	samira.pasha@gmail.com
Education:	M.Arch, Architecture, Shahid Beheshti University, 2006 Ph.D, Architecture, Texas A&M University, 2011