DESIGN CORRELATES OF PATIENTS' TRAVEL EXPERIENCE AND SATISFACTION IN THE HOSPITALS OF BANGLADESH

By

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Abstract

Understanding patients' experience is important for designing patient centered healthcare environments. Patients get their first impressions of the healthcare experience from the environment, which may affect their healthcare expectations even before receiving any services. Studies on patients' satisfaction have shown that the physical environment of hospitals can directly or indirectly affect patients' experience and the perceived quality of care. Very few of these studies, however, show how environmental variables affect patients' experience and satisfaction in wayfinding situations in hospitals. Even fewer studies look at this issue in the hospitals of developing countries, where the quality of care is a big concern. Therefore, this study focuses on patients' experience in wayfinding situations in the hospitals of Bangladesh. The study uses data collected from 349 male and female patients in the outpatient departments of six regional hospitals of Bangladesh. The data include 180 hours of field observation of wayfinding behaviors over a period of six weeks, patients' interviews using a pre-coded questionnaire, and the floor layout analysis that included the measurement of actual route distance, travel distance, and spatial network distances. The findings of the study suggest that patients' travel experiences may depend on patients' interpretations of a situation based on psychological processes, social factors and the environmental variables of the settings. Among the environmental variables that seem to have affected patients' experience and satisfaction more in the outpatient departments of Bangladeshi hospitals are included the identification and directional signage elements, the location of information desks, and the proximity of necessary functions. These findings should help hospital designers and administrators make hospitals more patient-friendly in Bangladesh and elsewhere.

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1.1. Introduction

Hospital environment is a powerful force in shaping a patient's experience. When patients move through a hospital their experience depends on how they understand the environment through their cognitive, emotional and sensory connections, how the environment meets their expectations, and how well the environment supports the hospital functions they seek (Robert, 2007). An understanding of the patients' experience is important for designing a better healthcare environment and for improving patients' satisfaction.

Research on evidence-based design shows that a well-designed environment can make hospitals less risky and stressful, can promote more healing for patients, and can improve their experience and satisfaction (Zimring, Joseph et al. 2005). Noise, spatial disorientation, excessive light, and isolation experienced by patients and employees are associated factors that can increase stress in the hospital environment and can create negative experience of hospitals (Urlich, Zimring et al. 2004; Cesario 2009). Environmental variables that help make the hospital environment legible can also reduce stress during hospital visits and improve patients' travel experience and satisfaction (Carpman et al., 1993; Weisman, 1981). Studies have shown that spatial disorientation is a major source of stress for patients and their families in hospitals (Carpman et al., 1993; Cesario, 2009; Zimring, Joseph, & Choudhary, 2005). When people are unfamiliar with their surroundings, they feel uncomfortable, get frustrated, and face difficulties in finding their way to destinations. Many studies in wayfinding literature have tried to understand how people find their way in a complex hospital building. These studies focus on various components of wayfinding systems such as floor numbering, signage systems, (Carpman et al., 1993), and the

complexity of the spatial layout (Dogu & Erkip, 2000; Weisman, 1981; O'Neill, 1991), focus on the problem-solving activity of wayfinding to overcome negative experiences such as stress, fear, and anxiety.

However, the current wayfinding literature does not fully acknowledge a wide range of variables that affect patients' travel experience and satisfaction in wayfinding situations. Therefore, to fill in the gap, the present research focuses on understanding patients' satisfaction in terms of patients' wayfinding experience in hospital environments. It also focuses on how patients interact with hospital environments as they travel to their destinations. It is expected that a more comprehensive understanding of the association of wayfinding with environmental variables will enhance our understanding of patients' experience in hospital environments, and will help us make the hospital environment more patient friendly.

1.2. The Statement of Problem

In developing countries, providing quality healthcare to the entire population is a big challenge for the government and healthcare personnel. In Bangladesh, for example, a large segment of the population has been deprived of many basic health care services. Literature shows that improving quality, increasing access, and reducing costs are three major challenges to healthcare delivery in Bangladesh (Ashrafun & Uddin, 2011). In addition, the services delivered by health care providers in the public hospitals of the country are not up to the level of patients' needs and expectations (Siddiqui & Khandaker, 2007). Therefore, the health care delivery system of Bangladesh has increasingly put more emphasis on improving the quality of services through understanding patients' perception about the quality of care (Aldana, Piechulek, & Al-Sabir, 2001). However, research on patients' satisfaction as a measure of the quality of health services remains relatively rare in Bangladesh.

A very few studies that focused on patients' satisfaction in Bangladesh mainly tried to understand patients' opinion about the quality of service in the hospital (Ashrafun & Uddin, 2011; Omer, Cockcroft, Andersson ,2011; Islam & Jabbar, 2008; Siddiqui & Khandaker, 2007; Andaleeb, Siddiqui, Khandakar, 2007; Andaleep, 2000, 2001). Andaleep (2000, 2001) identified the service quality factors that were important to patients and that had an effect on patients' satisfaction in the hospitals of Bangladesh. His research pointed out that responsiveness, assurance, communication, discipline, and *bakseesh* (i.e., tips) were important factors that affect the patients' perceived quality of care and patients' satisfaction in the public hospitals of Bangladesh. In another study, Andaleeb, Siddiqui & Khandakar (2007) foundd that availability and accessibility to doctors, the tangible quality of facilities and staff, treatment cost, and responsiveness of nurses to patients were key factors influencing patients' satisfaction in the public hospitals of Bangladesh.

To understand the factors associated with patient satisfaction in hospital inpatient units of Bangladesh, Ashrafun & Uddin (2011), conducted a questionnaire survey covering 10 dimensions of satisfaction (appointment waiting time for doctors after admission, doctor's treatment and behavior, the behavior and services of nurses, *boys* and *ayas* (i.e., service personnel), toilet and bath room conditions, the quality of food, the number of days in the hospital, the cost for treatment, and the gift/tips culture in the hospital). The study was carried out in the inpatient unit where patients received medical and surgical care for urinary, cardiovascular, respiratory, and ophthalmology diseases at the Dhaka Government Medical College Hospital of Bangladesh. Their findings show that doctors' treatment, services and behavior of nurses, and boys/ayas were powerful predictors of patients' satisfaction with hospital services. The cleanliness of the hospital, toilet and bathroom conditions, the quality of food, and

the gift/tips culture were also important factors contributing to patients' dissatisfaction in Bangladesh. Additionally, the Ashrafun study also tried to understand the effect of inpatients' socio-economic characteristics such as education, occupation, and monthly family income on patient satisfactions. The findings showed that patients' socio-economic characteristics such as years of education and family income acted as influential factors contributing to patient dissatisfaction with the quality of care. However, the cost for treatment and the numbers of days in the hospital had no effect on patients' satisfaction in inpatient units.

To assess the patients' satisfaction with the outpatient department services, Islam & Jabbar (2008) carried out a descriptive cross sectional study on 299 patients visiting outpatient departments (OPDs) of the Dhaka Medical College Hospital (DMCH) in Bangladesh. In this study, the authors tried to understand patients' satisfaction regarding different aspects of the waiting room including adequacy of space, cleanliness, sitting arrangement, adjacent toilet facilities, supply of drinking water, and helpfulness of OPD staff. The findings suggested that although there were long waiting time in OPDs, most patients were satisfied with waiting room facilities, but they were highly dissatisfied with toilet facilities and the supply of drinking water. Most patients were dissatisfied with OPD staffers with respect to their willingness to listen and help with patients' problems and with doctors and dispensers (i.e., medical assistants) for their failure to provide adequate medication instructions. The research also identified that the level of satisfaction varied with sex: women patients were more satisfied with OPD services than male patients. In addition, patients' satisfaction was inversely related to monthly income and levels of education.

Omer, Cockcroft, Cockcroft, & Andersson, (2011) tried to understand patients' experience and satisfaction with different aspects of their care as a part of Hospital Improvement Initiative (HII)

in five district hospitals in Sylhet, Bangladesh between 1998 and 2003. In this study, a questionnaire survey was conducted with 300 outpatients and 300 inpatients. The survey concerned waiting and consultation time, use of an agent (i.e., volunteer) for admission, and satisfaction with privacy, cleanliness, and staff behavior. A field observation was executed on cleanliness and privacy arrangements. In this study, changes in patients' experience and views over the period of the HII program were examined. The findings suggested that although the satisfaction of patients appeared slightly higher in 2003 than in 2000, the changes over time were not statistically significant. The field observation recorded improvement in general cleanliness in all the hospitals in 2003 compared with 2000. Privacy concerns remained unchanged in both 2000 and 2003, because outpatients were examined in an open room with other patients and their relatives.

From the above literature review, it is evident that some studies have used patient satisfaction as an indicator of the quality of healthcare services, and some have examined the association between patients' perceived quality of care and satisfaction to understand their experience of healthcare services. From the perspective of healthcare design, patients' satisfaction studies in Bangladesh focus more on the patients' perception about the physical appearance of the hospital, denoting that the quality of physical environment is an important determinant of patients' satisfaction in both inpatient and outpatient contexts. However, patients' perception of the hospital layout, functional adjacency of different departments, and the signage system were totally ignored in these studies. Therefore, this research is an attempt to understand patients' experience about the design of hospitals in Bangladesh. The main focus here is to understand the spatial and environmental variables that help patients find their destinations during their visit to

outpatient departments of the hospitals of Bangladesh, and to understand how these variables affect their experience.

In Bangladesh, the spatial layout of public hospitals has serious problems concerning patients' wayfinding. In the past, hospitals were often housed in large building complexes that were not built as hospitals but were modified to work as hospitals. Lately, a good number of public hospital buildings were designed by the Public Works Department of Bangladesh. But, these newer public hospitals lack spatial coordination among different departments that were built over time in multiple phases. In addition, the improper use of signage systems and landmarks makes it more difficult for patients to find their destinations. As a result, patients often need to tour the whole hospital building in order to get to their destinations or to receive services. Moreover, in Bangladesh, the lower literacy level makes it difficult for poor patients to follow the written signage system.

At least one study has been done to understand the problems that a pregnant patient faces in accessing healthcare in Bangladesh. The findings show that 63 percent of patients believe that "knowing where to go" is the barrier to access healthcare in Bangladesh (NIPORT, 2001). In wayfinding literature, "knowing where to go" is a wayfinding problem that may cause delay in getting services–before reaching the healthcare facility or after reaching the healthcare inside a hospital. One reason why pregnant women are not getting appropriate care when needed in Bangladesh due to the amount of time they need to reach emergency obstetric-care (EmOC) facilities (Killewo, Anwar, Bashir, Yunus, and Chakraborty, 2009). Of the three types of delay, 'the reported time taken to reach a facility' was the longest (median of 150 minutes) for pregnancy-related conditions. Additionally, if pregnant patients succeed in reaching the

outpatient department (OPD), the confusing spatial layout of poorly designed hospitals can increase the time needed to get the required services due to wayfinding difficulties.

Literature shows that spatial disorientation due to the confusing layout of the hospital may cause anger, hostility, discomfort and indignation, and may affect patients' satisfaction and travel experience (Carpman et al., 1993). A legible environment helps patients orient themselves in the hospital. Kevin Lynch (1960) describes a legible environment as a place organized in a coherent and recognizable pattern. Therefore, in this research we hypothesize that the legibility of outpatient departments in the hospitals of Bangladesh may affect patients' travel time and wayfinding behavior, which may indirectly affect patients' travel experience and satisfaction.

In Bangladesh, the use of patients' satisfaction as a measure of the quality of health services remains relatively rare. Some studies have used patient satisfaction as an indicator of the quality of services, and some have examined the association between the perceived quality of care and patients' satisfaction (Ashrafun & Uddin, 2011; Omer,Cockcroft, Andersson, 2011; Islam &Jabbar, 2008; Siddiqui & Khandaker,2007; Andaleeb, Siddiqui, Khandakar, 2007; Andaleep, 2000,2001). No study has been done to understand patients' travel experiences and satisfaction during their visit in the outpatient department in Bangladesh. Moreover, the concept of wayfinding is totally ignored in the design of hospital layouts in this country. Therefore, the purpose of this research is to promote experience-based healthcare design in Bangladesh through understanding patients' experience in wayfinding situations. To do so, the research will explore will explore (1) the effect of hospital layouts, signage systems, design quality, and visibility of the environment on wayfinding problems;(2) the effect of wayfinding behavior on patients' travel experience and satisfaction; and (3) how personal, social, and cultural aspects of the

physical environment along with wayfinding difficulties help shape the patients'travel experience in the hospitals of Bangladesh.

1.3. Framework to Analyze Patients' Experience and Satisfaction

In experiential learning theory, experience is defined as a transactional relationship between the person and the environment. There are dual meanings of the term "experience". One is subjective and personal, referring to the person's internal state as, for example, an experience of joy and happiness. The other is objective and environmental, referring to the interaction between human and environment (Dewey, 2005). According to Dewey, "experience occurs continuously, because the interaction of live creature and environing conditions is involved in the very process of living" (Dewey, 2005: p.26). He mentions that experience doesn't go on simply inside a person. A person faces lots of dispersion and distraction along the way to experience. Experience mainly depends on what people observe, what they think, what they desire, and what they get. The environment interacts with personal needs, desires, purposes, and capacities to create the experience. When the environmental condition and human condition come together, they form a situation.

In the real world, people live in a series of situations. The conceptions of situation and interaction are inseparable from each other. According to Blumer (1969), human beings act toward things on the basis of the meanings that the things have for them. The meaning of such things results from social interaction. The processes of interaction that construct meanings define a situation for people. That means the process of meaning-making helps to make the sense of experience to patients and others.

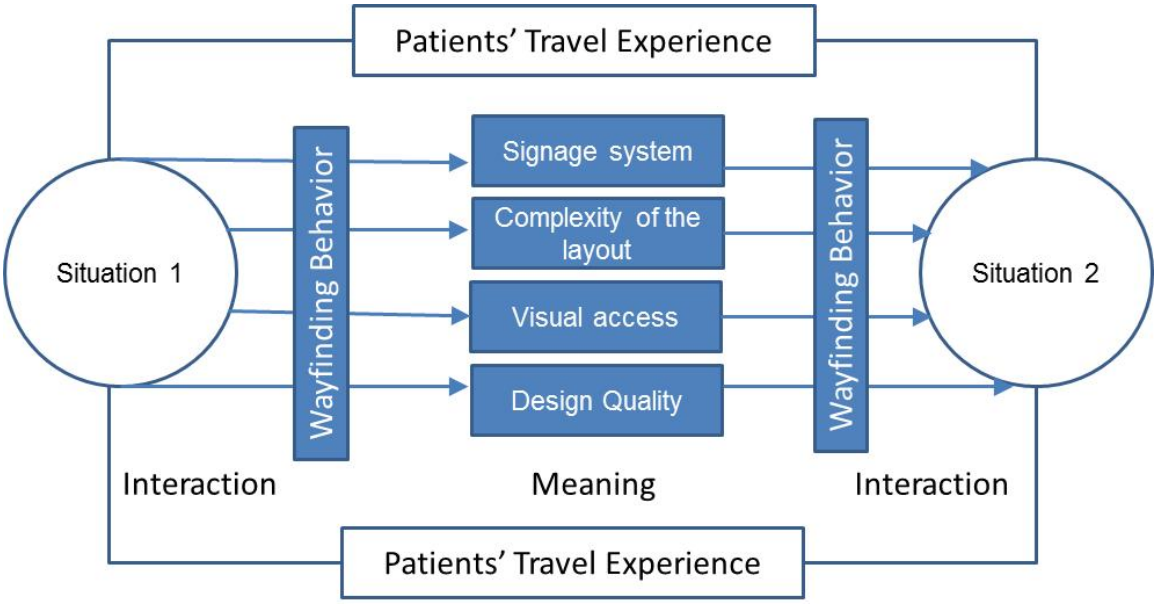

Figure 1-1 Framework to Study Patients' Travel Experience in Wayfinding Situation

From the perspective of the wayfinding situation, when moving from one situation to another to find his or her destination department, each patient goes through a network of existing situations (Figure 1-1). Figure 1-1 schematizes how, during this journey through the outpatient departments in hospitals, one situation acts as a major decision point in navigating to the next situation. When information is readily available in the environment, patients process that information and incorporate it into the existing situation. However, when too much or too little information is provided, patients may be unable to process that information (Carpman, Grant, & Simmons, 1993). This inability can cause patients to become frustrated, confused, and lost in the environment. According to Passini (1992, p.163), "the pleasure of solving problems, the pleasure of being entertained and the pleasure of acquiring new knowledge are three major source of satisfaction derived from wayfinding in complex environments." When the environment provides patients with the opportunity and the ability to solve wayfinding problems in order to move from one situation to another, then the environment helps to increase patients' satisfaction.

During this movement, when patients explore new information and acquire new knowledge, their experience can be motivated by the pleasure of seeing new things, of encountering people, and of being exposed to unexpected situations (Passini, 1992).

According to Wiseman (1981), four major environmental factors help people to move from an existing situation to a preferred situation in wayfinding. These are differentiation of environment (or environmental design quality), visual access, layout complexity, and signage (Figure 1-1). Visual access is a degree to which different parts of one situation can be seen from various points of view. Visual access develops a visual connection from one situation to another, when patients move to reach their destination. Greater visual access helps to orient a person in a particular situation. In the wayfinding situation, it is not necessary for a patient to build a cognitive map of a building when the desired destinations are within the patients' field of vision. Spatial layout helps connect different situations into a relational pattern using pathways. In this case, the complexity of the spatial connections of different situations mainly influences patients' experience. Signage aids in self-orientation in a situation. Effective signage may provide information from a distance when a patient moves from one situation to another. And the environmental quality of each situation helps differentiate one situation from another, thus facilitating a successful wayfinding experience.

Therefore, we can say that patients' travel experience in the outpatient department in wayfinding situations is the result of cumulative experience of patients acting in a network of interconnected situations. In order to create a wayfinding experience that fulfills patients' needs, wants, and desires, it is important to understand environmental variables that have an effect on patients' emotional state. According to John Dewey, experience occurs when a work is finished in a satisfactory way (Deway, 2005) supporting the idea that satisfaction can be a measure for

understanding patients' experience in wayfinding situation. In addition, measuring patients' satisfaction provides information both about the outpatient environment– how spaces affect patients' behavior in different wayfinding situations - and about psychological processes – how people feel about and respond to the spaces they move from one space to another.

1.4. Organization of the Dissertation

This dissertation research uses the above framework to study patient experience and satisfaction in relation to wayfinding situations in the hospitals of Bangladesh. An overview of the next few Chapters presenting the dissertation research is given below.

The next chapter, chapter two, of the dissertation describes the development of the instruments for this research. It presents the pilot study that was carried out at Lawrence Memorial Hospital (LMH) in Lawrence, Kansas, in order to develop these instruments.

Chapter Three provides a brief description of the six hospitals in Bangladesh used as case studies for this research, including the characteristics of the study area and the criteria applied for selecting the case studies. It also provides a detailed description of the methods used for collecting and analyzing the data for this study based on the pilot study discussed in Chapter Two. The discussion of the case studies focuses mainly on the spatial and morphological characteristics of these hospitals, the functional description of the outpatient departments, and the spatial sequence of outpatient activities.

The next three chapters of the dissertation present the findings of the research. Chapter Four presents patients' satisfaction in relation to wayfinding using all the data gathered at the six hospitals. Chapter Five presents patients' satisfaction in relation to wayfinding based on gender. Chapter Six presents patients' satisfaction in relation to wayfinding based on hospital layout type. In each chapter, the signage system, the complexity of the layout, the overall quality of

design, the visibility and accessibility of the layout, and wayfinding behaviors are examined in explaining patients' satisfaction.

Chapter Seven discusses the findings presented in the preceding three Chapters. The discussion focuses on environmental, personal, and social factors — that may affect patients' satisfaction when they are in wayfinding situations.

Chapter Eight, the final chapter of the dissertation, provides a conclusion focusing on the factors associated with patients' satisfaction and travel experience in wayfinding situations. The chapter also discusses the limitations of this study.

Chapter 2 : DEVELOPMENT OF RESEARCH INSTRUMENTS

2.1 Introduction

Patient experience in the healthcare environment is an important factor for patients' satisfaction and care outcomes. In hospitals, patients get their first impression of the healthcare experience from the environment. Interactions with the environment can influence a patient's experience and satisfaction level even before he or she receives any services. In an unfamiliar environment, poor signage systems can increase anxiety (Carpman et al., 1993), and can influence patients' travel experience and satisfaction. In the outpatient department, the long distances, complicated routes, and complexity of the functional distribution can give the patient a poor travel experience. Literature shows that the plan and layout of the hospital might impact the ease of wayfinding and the speed of travel to various locations (Carpman, Grant, & Simmons 1993). In addition, interior design features like floor finish, color, artwork, and the layout of furniture can also affect patients' physical comfort and, therefore, can influence their experience (Arneill & Devlin 2002; Becker & Douglass 2008; Harris et al. 2002). Furthermore, physical and visual accessibility of a layout as measured by its syntactic properties can also affect wayfinding (Haq, 1999, 2003; Haq & Girotto, 2003; Tzeng & Huang, 2009) .Therefore, we assume that the factors of spatial layout, the signage system, and design quality can affect patients' travel experience and satisfaction through their direct or indirect effects on patient's movement, travel time, and wayfinding.

To develop the instrument for a research study investigating how hospital buildings may affect patients' travel experience and satisfaction through their direct or indirect effects on patient's movement, travel time, and wayfinding, a pilot study, described below, was carried out at Lawrence Memorial Hospital in Lawrence, Kansas.

2.2 The Pilot Study

The aim of the pilot study was to understand patients' travel experience and their satisfaction in relation to wayfinding in outpatient departments. The study focused on patients' journeys from reception to three outpatient departments: Pain and Endoscopy, Laboratory and Radiology and Surgery. The data for the study was collected using multiple methods, including systematic behavioral observation, patient survey, and the floor layout analysis.

2.2.1 Patient Survey

A standardized questionnaire for patient survey was developed for the pilot study. The contents of the questionnaire were based on the study of Craig Zimring developed for the Center for Health Design in 1994 for conducting health care facility visits. To the questionnaire accord with the guidelines mentioned in the book *Design that Cares: Planning Health Facilities for Patients and Visitors* by Janet R. Carpman, Myron A. Grant, and Deborah A. Simmon (1993).

The questionnaire had four parts. The first part included questions regarding patient background. It also included questions asking whether the patient was accompanied by another person and how many times the patient had visited the hospital in the month before this visit. The cardinal pre-coding technique was used for answering questions of this section.

The second part of the questionnaire was designed to understand the attitude of patients towards the spatial layout of the healthcare environment. This section asked questions about patients' travel experience and satisfaction related to wayfinding. The main intention was to record the patients' travel experience and satisfaction regarding spatial layout during the journey to the destination/s. In this section, "the likert attitude scale" (Zeisel, 2005) was used. A standardized five scale score was assigned from high agreement with positive statement to high disagreement with negative statement.

The third part consisted of questions related to wayfinding and signage information. The intention was to understand what people observed in the environment during wayfinding. More specifically, the questions in this sections were asked in order to learn how people make sense of their surrounding environment, how they use graphical and environmental information when they are in wayfinding situations, how they behave as they find their way in the hospital. This section also used "the likert attitude scale" (Zeisel, 2005).

The fourth part consisted of questions regarding the design quality of the environment. The aim was to understand how environmental qualities such as lighting, floor finish, and furniture layout, affect patients' satisfaction. This section also used "the likert attitude scale" (Zeisel, 2005)

2.2.2 Systematic Behavioral Observation

A systematic behavior observation was used to observe patients' behavior in wayfinding situation. The main objectives were to generate data on how hospital environments support or hinder patients' wayfinding behaviors and, at the same time, how these environments affect their travel experience and satisfaction. According to Ziesel (2005, p.193), the systematic observation method "is empathetic and direct, deals with dynamic phenomena and allows researchers to vary their intrusiveness in a search setting." The observation of a patient's wayfinding behavior allowed delving into the nuances that the patients feel or experience in the setting. During the survey, people often tend not to report their experiences to interviewers as they think these are unimportant and therefore not worth reporting (Ziesel, 2005). In this research at LMH, direct observation through tracking patients on site allowed the researcher to refine the understanding of wayfinding situations.

For field observation, the researcher took her position as a recognized outsider at the reception area. According to Ziesel (2005), the patients who knew that they were being observed as a part of an experiment often changed the way they acted. This is called Hawthorne effect. In this pilot study, to reduce the Hawthorne effect, the researcher spent more time in the setting; wore similar to that of the hospital staff; and involved her selves as a wayfinder so that they could blend more easily in the setting.

After the patient had given consent to participate in the survey at the time of registration, s/he was tracked, and travel time from the reception area to the destination department was recorded. Observation was conducted by the researcher with a synchronized watch and data collection sheets (Figure 2.1). All observations were recorded in time format (i.e., 2:30 PM) on data collection sheets. In addition, the individual patient's route and travel behavior, such as the number of stops to make a decision, the number of times he or she looked around to find the way and the number of times he or she asked for directions, were recorded on the floor plan. A notation system was developed to record the above-mentioned behaviors. The researcher also recorded the individual patient's route on the floor plan of the hospital. Recording patients' travel behavior and travel route on floor plan helped the researcher to get a better sense of how patients used environmental information. Observations occurred over a 2-week period. In the study, 60 patients were observed in 80 hours of data collection.

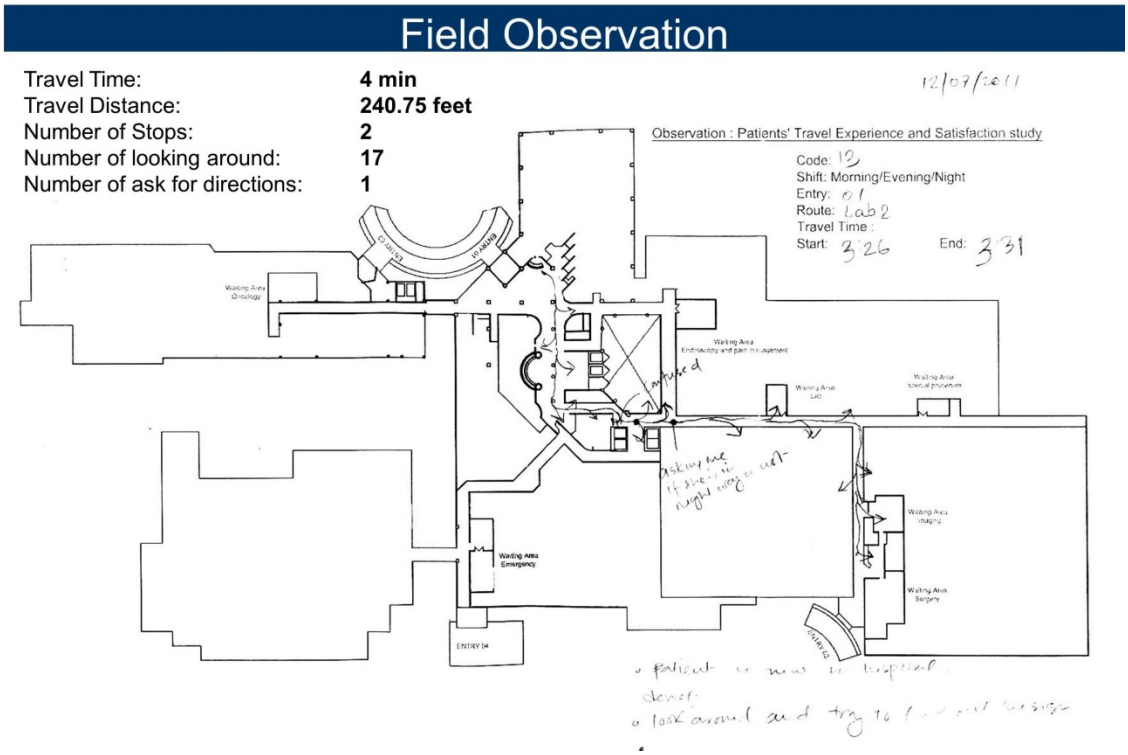

Figure 2-1 Observation Sheet of Behavioral Tracking at LMH

2.2.3 Floor Plan Analysis

The primary source of data on physical design of LMH was collected from the floor plan drawings of the hospital. Floor-plan analysis gave an understanding about the shape of the setting, which is needed to develop a visual and perceptual relationship between patients and hospital environments. In this research, visual accessibility and layout complexity were analyzed using space syntax theories and method (Hiller and Hanson, 1984). Space syntax represents the visibility relationship of space by graph analysis of a building represented as the axial map composed of the fewest and longest lines of sight or axial lines (Hillier and Hanson, 1984).

In space syntax research, the "axial map" is similar to the "cognitive map" that people use to describe spatial cognition (Kim & Penn, 2004; Penn, 2003; Zimring & Dalton, 2003). Montello

(2001) refers to cognitive maps as internally represented spatial models of the environment that store the knowledge of landmarks, route connections, distance-directional relations, non-spatial attributes, and emotional attributes. An axial map constitutes a continuous web of axial lines that cover all convex spaces in the setting under investigation. Axial maps also reflect the effective visibility structure for people navigating through the building (Long, Baran, & Moore, 2007). Kim (2001) suggests that the axial map not only represents the syntactic view of the physical environment but also reflects our memories of experience as well. It provides a linkage between the way people perceive their physical environment and the ways in which they communicate about it.

By graphing the structure of the axial map, one can easily understand how many changes of direction are required to reach any space from any other space in the system. For studies on environmental legibility, the axial map provides information on layout complexity and visual accessibility. Various research studies have demonstrated that space syntax variables can predict deliberate use of space in wayfinding situations (Haq, 1999, 2003; Haq & Girotto, 2003; Haq & Zimring, 2003; Penn, 2003; Peponis, Zimring, & Choi, 1990; Montello, 2007).

For the pilot study and the dissertation research study, an axial map was produced in two ways: one for the whole spatial system and the other for the publicly accessible route only (Figure 2-2). The whole spatial system refers to all circulation spaces on the ground floor that can potentially be used by patients, staff nurses, and doctors on the ground floor. The publicly accessible route refers to all spaces that are accessible by the patient. For the syntactic analysis of the layout, the computer program, "Depthmap 10" (Joao Pinelo & Turner, 2010) was used.

In this study, integration, connectivity, and intelligibility measures of space syntax were used. These are described below.

Integration:

Integration is the major graph-based measure used in space syntax literature. The integration of a space is a function of the mean number of lines and changes of direction that need to be taken to go from that space to all other spaces in the system. Integration is therefore about syntactic, not metric, accessibility. The word "depth" rather than "distance" is used to describe how far a space lies. The integration value of a line is a mathematical way of expressing the depth of that line from all other lines in the system (Hillier & Hanson 1984). In other words, integration measures the relative position of any space or axial line with respect to all the lines in the axial map of a building layout. A higher integration value indicates better accessibility. So, for example, for integration-3, the relationship of one space to others up to three steps or turns away from it is considered. The measure of integration, or its opposite, segregation, is expressed by Real Relative Asymmetry or RRA value. This value is obtained by the analysis of a graph representing the number of changes in direction between one axial line and space to all other lines or spaces. It is based on the number and depth of spaces that must be traversed from one space to all other spaces in the configuration.

Mathematically, integration is measured by the inverse of relative asymmetry (RA). This is given by the equation $RA=2(MD-1) / (k-2)$, where MD is the mean depth and k is the number of spaces in the system. The value below 1 indicates more segregation, while a value of 1 and above shows strong integration.

Connectivity:

Connectivity, another graph-based measure, is a simple local measure of connection. It refers to the number of links associated with a given space. Connectivity is measured by counting the

number of lines or spaces that are directly connected to a line or space. It provides the degree of choice on the line. A higher connectivity value represents more choice of movement on that line.

Intelligibility:

A higher order of measure in space syntax is intelligibility. This value refers not to individual environmental units, but to the entire system. A system's "intelligibility" is measured by the correlation between global and local variables, most commonly between global integration and local connectivity. Intuitively, in a more intelligible system, information about local connectivity allows a person moving through the system to comprehend the overall structure of the configuration more easily (Hillier, Hanson, & Peponis, 1987).

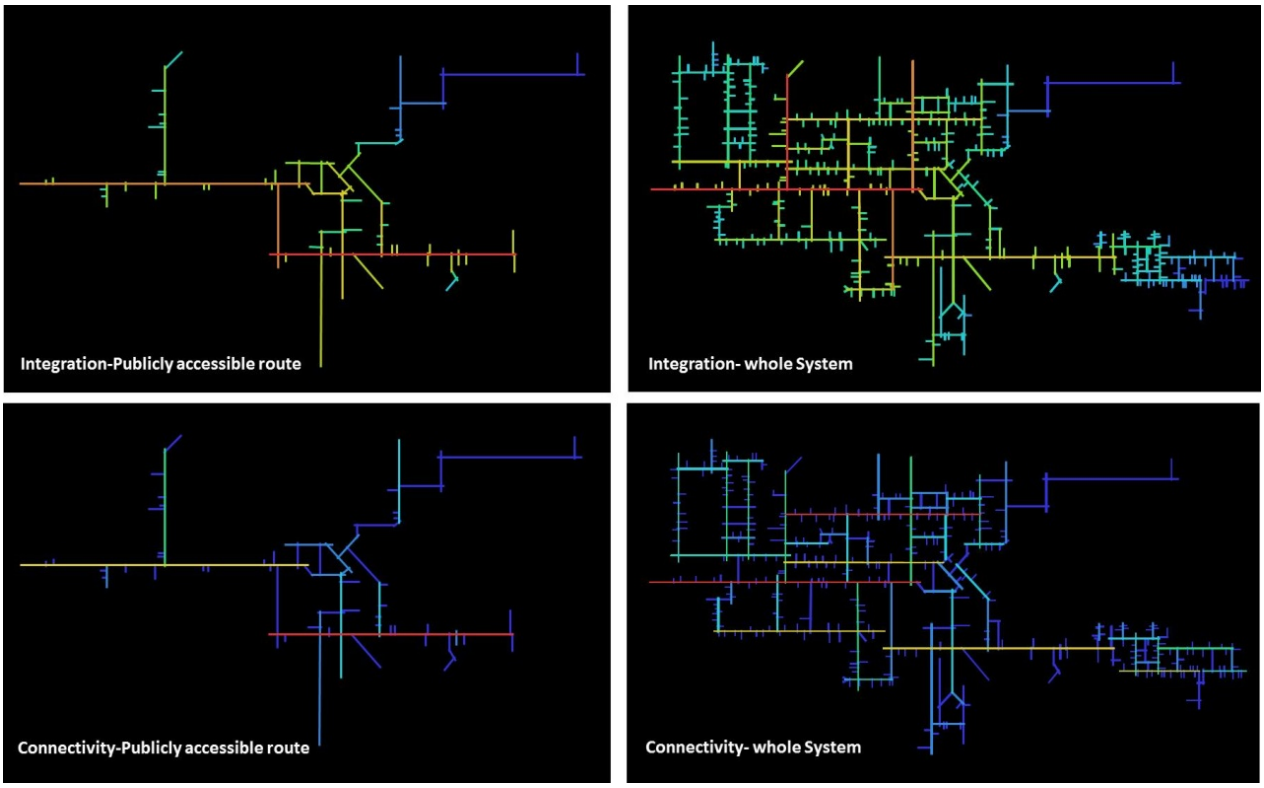

Figure 2-2 Axial Map Analysis of LMH (Whole System and Publicly Accessible System)

2.4 Analysis

The research evaluated patients' overall satisfaction with their hospital experience, and explored differences in patients' satisfaction across four outpatient departments of the Lawrence Memorial Hospital. All data were analyzed in SPSS 20. In this analysis, patient satisfaction is measured in relation to patient demographic characteristics, spatial attributes, and spatial configuration.

2.4.1 Patients' Demographic Characteristics and Satisfaction

Patient demographic characteristics are an important determinant in studying patient satisfaction (Cleary & McNeil, 1988). In this pilot study, the aged patients (+60 years) showed higher satisfaction whereas the middle-aged groups (36-65) and young were less satisfied with signage system, overall layout, and design quality (figure 2-3, 2-4, 2-5). The findings of this study are consistent with prior research that shows aged people are always more satisfied than younger and middle-aged people (Rahmqvist, 2001; Schoenfelder, Klewer, & Kugler, 2011).

Literature also shows that gender difference has an impact on patient satisfaction (Rahmqvist, 2001; Schoenfelder, Klewer, & Kugler, 2011; Sitzia & Wood, 1997). The findings of this pilot study show that in wayfinding situations, female patients are less satisfied than male patients in relation to spatial layout, signage system, and overall design quality (Figures 2-3, 2-4, 2-5). Various research studies (Lawton, Charleston, & Zieles, 1996; Lawton & Kallai, 2002) reported that females are more stressed and anxious in wayfinding situations than males. In wayfinding situations, more stress can be a reason for less satisfaction among female patients.

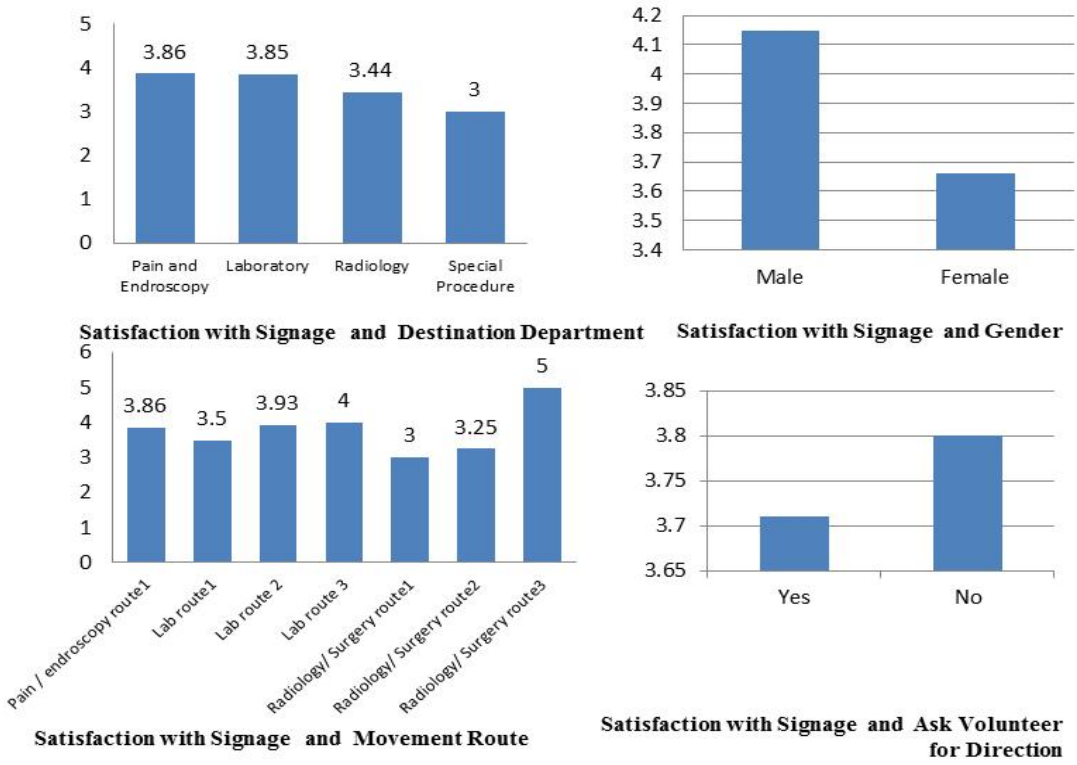

Figure 2-3 Patients' Satisfaction In Relation To Signage

The Lawrence Memorial Hospital study showed that patients who asked for volunteer help in wayfinding situations are less satisfied with the signage system, overall layout, and quality of design. It is possible that patients asked for volunteer assistance when they were not confident in finding their way, and, as a result, they were also less satisfied.

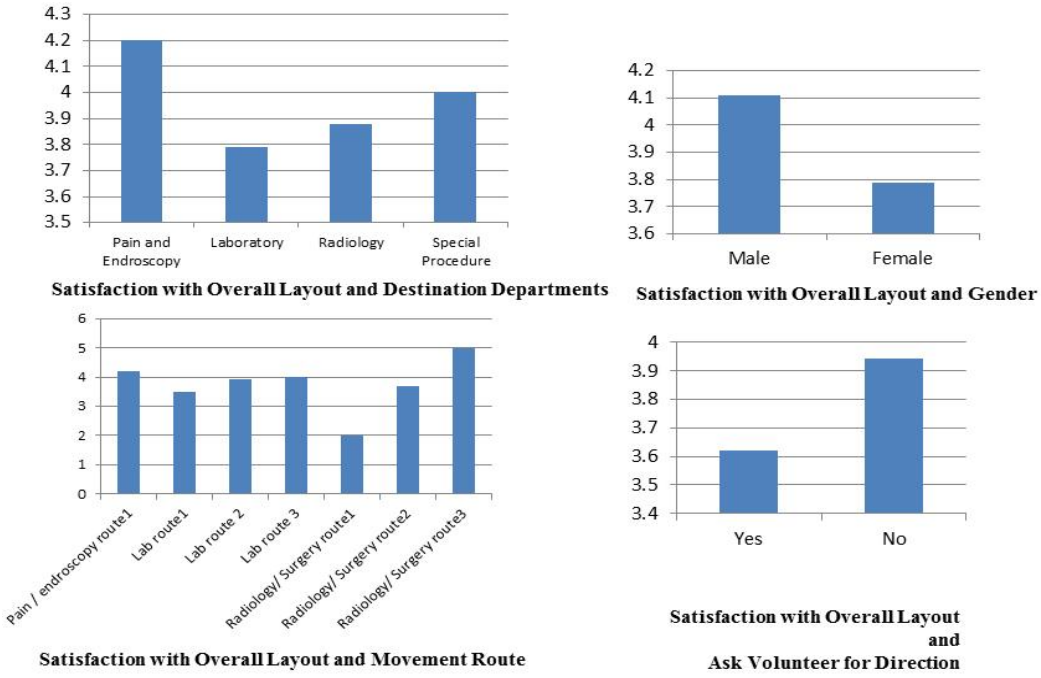

Figure 2-4 Patients' Satisfaction in Relation to Overall Layout

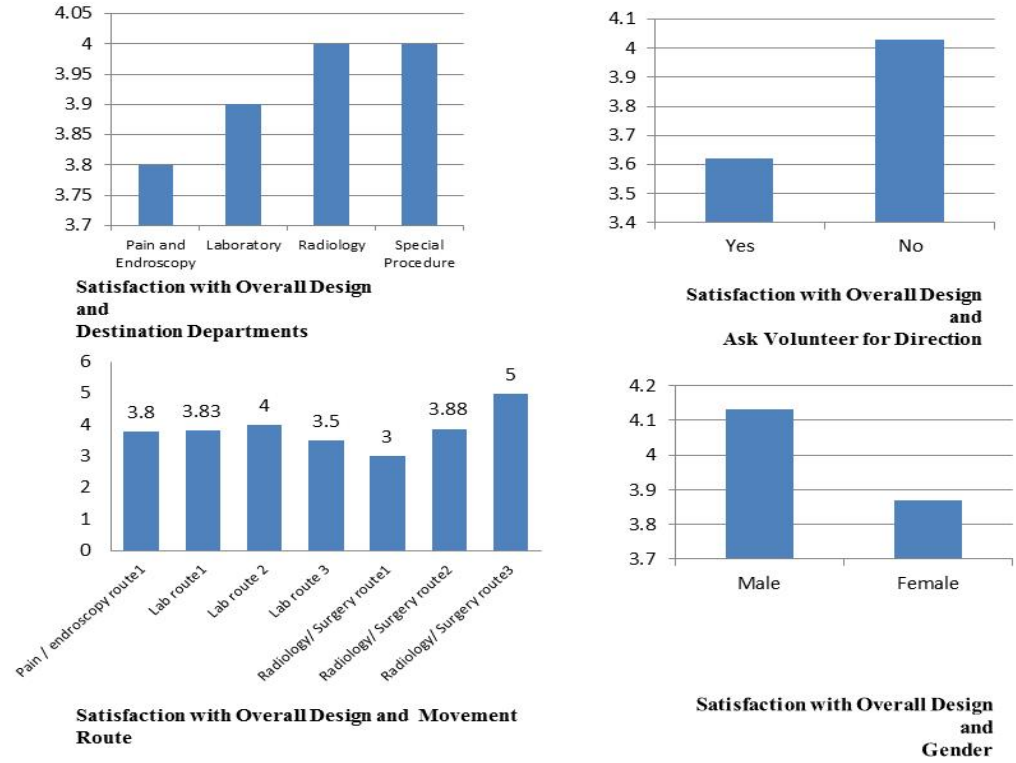

Figure 2-5 Patients' Satisfaction in Relation to Overall Design

The study also showed that patient satisfaction depended on the number of visits and the frequency of visits (Figures 2-3, 2-4, 2-5). Patients who visited this hospital for the third time (about 10%-13% of all observed patients) were more satisfied with the signage, overall layout, and design than patients on their first, second, and fourth visits. This finding supports that familiarity with the environment reduces the stress level of patients in wayfinding situations and at the same time increases their satisfaction level.

		Pain Management& Endoscopy	Laboratory			Radiology and Surgery		
		Route1	Route 1	Route 2	Route 3	Route 1	Route 2	Route 3
No of directional change		1	4	4	5	5	5	6
Distance from entry		116.42 (ft.)	246.00(ft.)	240.75(ft.)	279.67(ft.)	359.5(ft.)	354.25(ft.)	383.33(ft.)
Signage on	Wall	4	4	7	7	8	10	13
	Floor	1	1	4	4	1	2	4
	Roof	7	7	8	8	14	12	14
Landmark		You are here map	You are here map	You are here map	You are here map	You are here map	You are here map	You are here map
		Atrium	Atrium	Atrium	Atrium	Atrium	Atrium	Atrium
				Shop and setting	Shop and setting		Shop and setting	Shop and setting
					Elevator lobby1			Elevator lobby1
								Elevator lobby 2

Table 2-1 Spatial Attributes at LMH

Within the three departments (Pain and Endoscopy, Laboratory, and Radiology and Surgery), only seven different routes were considered for the observation of patients' wayfinding behavior. Table 1 shows the total length, the number of directional changes, the number of directional signs, and the type and the number of landmarks along these routes. The 'You are here' map, food court atrium, gift shop, and elevator lobby were considered as the landmarks in the study. The map was placed in the central position of the atrium facing the entry. Therefore, it was visually and physically accessible to the patients as they entered the hospital. The information

desk was also physically and visually accessible from the entry. The findings showed that the number of signage and the length-of-travel route increased as the number of directional changes in the route Increased (Table 2-1).

2.5.2 Spatial Attributes and Patients' Satisfaction

The correlation analysis between spatial attributes and patients' satisfaction with overall signage system, overall layout, and quality of design showed no significant relationship in this study. This may denote that the number of signs was not related to patients' travel experience and satisfaction in wayfinding situations. However, the number of signage was highly correlated with patients' travel behavior (Table 2-2). The increase in the number of sign also increased patients' travel time, travel distance, number of stops, number of instance of looking around, and number of instance of asking for direction.

2.5.3 Spatial Configuration and Patient Satisfaction

As noted above, the axial-map analysis was done for both the publicly accessible system and the whole spatial system. Lab route 2, which takes patients from the reception area to the Laboratory, had the highest global integration value (Rn=2.03) (Table 2-3). The axial-map analysis of the publicly accessible system shows that the connectivity value and global integration were highest for Pain and Endoscopy route 1 which takes patients from reception to the Pain and Endoscopy department. The axial-map analysis of the floor plan reveals poor correlation between global integration and connectivity (Rn-Cn) for the whole system (R^2=0.108, $p<0.5$) and as well as for the publicly accessible system (R^2=0.211, $p<0.5$) (Figure 2-3). Hillier, Hanson, & Peponis (1987) define this correlation as the degree of intelligibility of a layout that

helps to predict the spatial structure of a whole system. In this regards, the spatial structure of the outpatient department might not have been intelligible in terms of wayfinding.

	Satisfied with overall signage system	Satisfied with amount of time taken to reach services	Satisfied with overall layout	Satisfied with overall quality of design	Travel time	Travel distance	Number of stops	Number of Looking Around	Number of Asking for directions
Number of Wall Signage	-0.048	-0.072	-0.003	0.095	0.634**	0.855**	0.433**	0.678**	0.468**
Number of Floor Signage	0.185	-0.038	0.23	0.11	0.414**	0.511**	0.403**	0.486**	0.337**
Number of Ceiling Signage	-0.194	-0.139	-0.173	-0.033	0.521**	0.651**	0.254	0.500**	0.344**
Number of Landmark	0.097	-0.07	0.197	0.078	0.502**	0.657**	0.457**	0.620**	0.481**

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 2-2 Correlation between Spatial Attributes, Patients' Travel Behavior and Satisfaction

Correlation(R2)			Mean Syntactic Measure	Pain Management & Endoscopy	Laboratory			Radiology and Surgery		
				Route1	Route 2	Route 3	Route 4	Route5	Route6	Route7
Whole System	Rn-CV	0.108	Integration	1.81	2.03	1.88	1.84	1.95	1.87	1.89
			Connectivity	24	24	19.14	23.11	25	19.14	22.36
Publicly accessible system	Rn-CV	0.211	Integration	1.42	1.36	1.31	1.27	1.29	1.26	1.23
			Connectivity	9.5	7.2	6.57	5.67	7.33	6.75	5.9

**

**Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 2-3 Syntactic Measure of Patient's Travel Route

In the correlation analysis, patient satisfaction did not show any association with patient travel behaviors and syntactic attributes of the layout. However, male and female patients' satisfaction and travel behavior, separately, did show correlation with syntactic properties of the layout. For male patients, the higher integration and connectivity value of the publicly accessible route decreased travel distance and the number of stops, and at the same time increased their satisfaction about overall design (Table 2-4). If male patients chose the publicly accessible route with high integration and connectivity, they were more satisfied in finding their destinations. On the other hand, when female patients chose routes with higher integration and connectivity value,

their travel time, travel distance, and the number of travel behavior decreased. At the same time, female patients were less satisfied with the overall layout and design quality (Table 2-5).

Male Patient	Whole System				Publicly Accessible System			
	Department route		Patient route		Department route		Patient route	
	Integration	Connectivity	Integration	Connectivity	Integration	Connectivity	Integration	Connectivity
Travel Time	-0.053	-0.009	0.097	0.148	-0.309	-0.455	-0.249	-0.478
Travel distance	0.004	-0.404	0.473	-0.201	-0.846**	-0.614*	-0.437	-0.712**
Num_ stop	-0.444	-0.421	-0.109	-0.361	-0.704**	-0.452	-0.552	-0.656*
Num_ Looking around	-0.184	-0.469	0.227	-0.289	-0.611*	-0.476	-0.527	-0.546
Num_ Ask for direction	-0.228	-0.4	0.054	-0.489	-0.54	-0.117	-0.394	-0.36
Satisfied with overall Signage system	-0.149	0.049	-0.174	0.261	0.186	0.24	0.075	0.454
Satisfied with amount of time taken to reach service	0.409	0.085	0.325	0.16	0.181	-0.049	0.27	0.118
Satisfied with overall layout	-0.05	-0.174	0.012	-0.092	-0.03	-0.081	-0.01	-0.013
Satisfied with overall quality of design	0.266	0.306	-0.094	-0.033	0.742*	0.806*	0.729*	0.801**

**Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 2-4 Male Patients' Travel Behavior, Syntactic Route Attribute and Satisfaction

Female Patient	Whole System				Publicly Accessible System			
	Department route		Patient route		Department route		Patient route	
	Integration	Connectivity	Integration	Connectivity	Integration	Connectivity	Integration	Connectivity
Travel Time	0.087	-0.261	0.411**	-0.115	-0.761**	-0.471**	-0.749**	-0.526**
Travel distance	0.282	-0.385**	0.654**	-0.126	-0.910**	-0.699**	-0.870**	-0.709**
Num_ stop	-0.075	-0.213	0.089	-0.248	-0.407**	-0.324*	-0.450**	-0.412**
Num_ Looking around	-0.006	-0.255	0.277	-0.151	-0.712**	-0.528**	-0.762**	-0.599**
Num_ Ask for direction	-0.097	-0.137	0.038	-0.179	-0.360*	-0.256	-0.435**	-0.377*
Satisfied with overall Signage system	-0.144	-0.111	-0.108	-0.11	0.014	-0.097	-0.009	-0.094
Satisfied with amount of time taken to reach service	-0.431**	-0.179	-0.334*	-0.181	0.203	0.192	0.213	0.224
Satisfied with overall layout	-0.377*	-0.105	-0.295	-0.132	0.042	0.054	-0.016	0.027
Satisfied with overall quality of design	-0.143	-0.274	0.054	-0.204	-0.275	-0.295	-0.278	-0.316

**Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 2-5 Female Patients' Travel Behavior, Syntactic Route Attribute and Satisfaction

2.6 Conclusion

The aim of this pilot study was to develop the instruments for the dissertation research on patients' travel experience and their satisfaction in relation to wayfinding in outpatient departments. This study focused on patients' travel experience from reception to three outpatient departments - Pain and Endoscopy, Laboratory, and Radiology and Surgery – in the Lawrence Memorial Hospital. The study showed that spatial layout, the signage system, and the design quality of the environment were important factors for improving patients' travel experience and satisfaction in the wayfinding situation.

More particularly, the study showed that the numbers of signs on the route had an effect on patients' travel behavior. The study also showed that, in wayfinding situations, patients' personal characteristics like age, gender, and familiarity of the environment affected patients' satisfaction levels. For example, the integration and connectivity of the publicly accessible route showed good correlations with male and female satisfaction separately. At the same time female patients were always less satisfied with the spatial layout, signage system, and overall quality of outpatient department in the wayfinding situation than were male patients.

Therefore, the findings of this research help us understand how legibility of the environment and gender differences may affect the satisfaction level of patients in a hospital building. Based on these findings, the following hypotheses can be developed for further testing: (1) legibility of the environment can affect patients' satisfaction in the wayfinding situation; (2) patients' wayfinding behavior can predict patients' satisfaction in the wayfinding situation; and (3) Patients' satisfaction can vary according to gender in the wayfinding situation.

The limited number of participants, too few destination departments, and the simplicity of the hospital layout were among the limitations of this pilot study. Therefore, a larger study was

conducted involving a larger number of patients in a larger number of more complex hospitals in Bangladesh as a part of this dissertation. The following chapters report the procedure and result of this larger study.

Chapter 3 : METHODOLOGY

3.1 Introduction

This chapter provides a description of the research methodology, the case-study hospitals in Bangladesh, and the participants of the study. In the previous chapter, the findings of the pilot study at the Lawrence Memorial Hospital showed that there were significant correlations between environmental variables and patients' satisfaction. Also, patients' wayfinding behavior showed strong associations with patients' satisfaction related to the wayfinding experience in the outpatient departments. Therefore, this research attempts further to validate the findings in a larger sample of hospitals in Bangladesh following the same methodology that was used in the pilot study. The data included: (1) the amount of time needed for a patient to reach a unit of service after the patient had been greeted at the reception of the outpatient department; (2) the distance a patient walked from the reception area to reach his or her destination; (3) the number of times a patient stopped, looked around, and sought for directions on his or her way to destinations; (4) the measures of physical and visual accessibility of different units of services as defined using space syntax methods; and (5) patient wayfinding experience collected using a modified version of the structured questionnaire survey used previously in the pilot study.

This Chapter starts with a brief description of the context and the case study hospitals, including the characteristics of the study area and the criteria applied for selecting the cases studies. It also provides a description of the spatial and morphological characteristics of the case study hospitals, the functional analysis of the outpatient departments, the spatial sequence of outpatient activities, the methods for collecting and analyzing the data, and the description of study participants.

3.2 Context

Bangladesh is one of the world's most densely populated countries. According to the demographic report of 2011, more than 161 million people live in Bangladesh. Approximately 50% of the country's entire populations are women. Over 88% of the people are Muslim. Over 98% of the entire populations are speaking Bangla. According to the 2010 Bangladesh Literacy Survey, the literacy rate of population aged 7 years and over is 57.53% at the national level, and the corresponding rates for males and females are 60.15% and 54.84% respectively.

Bangladesh has a good healthcare network covering both rural and urban areas. There are 3,976 healthcare facilities in the public sector and 975 privately-run hospitals/clinics. The healthcare-delivery system of the country compares favorably with that of many other Asian countries. In Bangladesh, the largest service provider in the health sector is the government. The construction of public health facilities in Bangladesh involves a close collaboration of various agencies. The Department of Architecture of the Ministry of Works is responsible for architectural design, while the Department of Public Works is responsible for the structural design, construction, supervision and maintenance of health facilities with more than 100 beds. Despite recent developments in the healthcare sector, there is still a great concern about the quality of healthcare facilities in Bangladesh. The main reasons behind this are a lack of knowledge about medical and construction technology that would be locally appropriate, and a lack of interest in facility design among the medical staff.

Bangladesh, being one of the poorest countries of the world, does not have an appropriate infrastructure for healthcare services. Even though the healthcare system of Bangladesh has made remarkable progress over the last two decades, the progress has been inadequate and unsatisfactory in the areas of health service utilization, sustainability, cost-effectiveness, and the

quality of medical and nursing care. In many cases, the general rundown appearance of hospitals, as well as staff behavior in the hospitals, hint at the quality of services those patients can expect there. A basic sense of order and discipline is always ignored in the hospital environment, thus heightening the suffering of the patient (Andaleeb, 2001).

In addition, because many hospitals have been constructed in multiple phases over time, the spatial layout of hospitals in Bangladesh, especially that of public hospitals, impedes coordination among the different hospital departments. Moreover, a lack of knowledge about the wayfinding system and a poorly used signage system make it difficult to move patients and services efficiently through the hospital. So far, very few steps have been taken to design hospitals that would help improve the performance of the total health service delivery system. Therefore, it is important to understand patients' perception about they receive and the quality of the environment in which they receive it in order to improve the quality of healthcare service.

3.3 Case-Study Selection

In this research, the selection process of the case studies was based on the location, size, and layout-type of public hospitals. According to the Directorate General of Health Services Report (DGHS, 2011), at present Bangladesh has 64 administrative units which are called districts, or Zila (Bengali). Each district has a defined geographic boundary and has strong identity in terms of culture, economy, and language. Each of these 64 districts has a public hospital, better known as the district hospital. All the case study hospitals included in this research were district hospitals (Figure 3-1). Often, a district hospital is also called Sader hospital, where the word "Sader" means "town" in the local language.

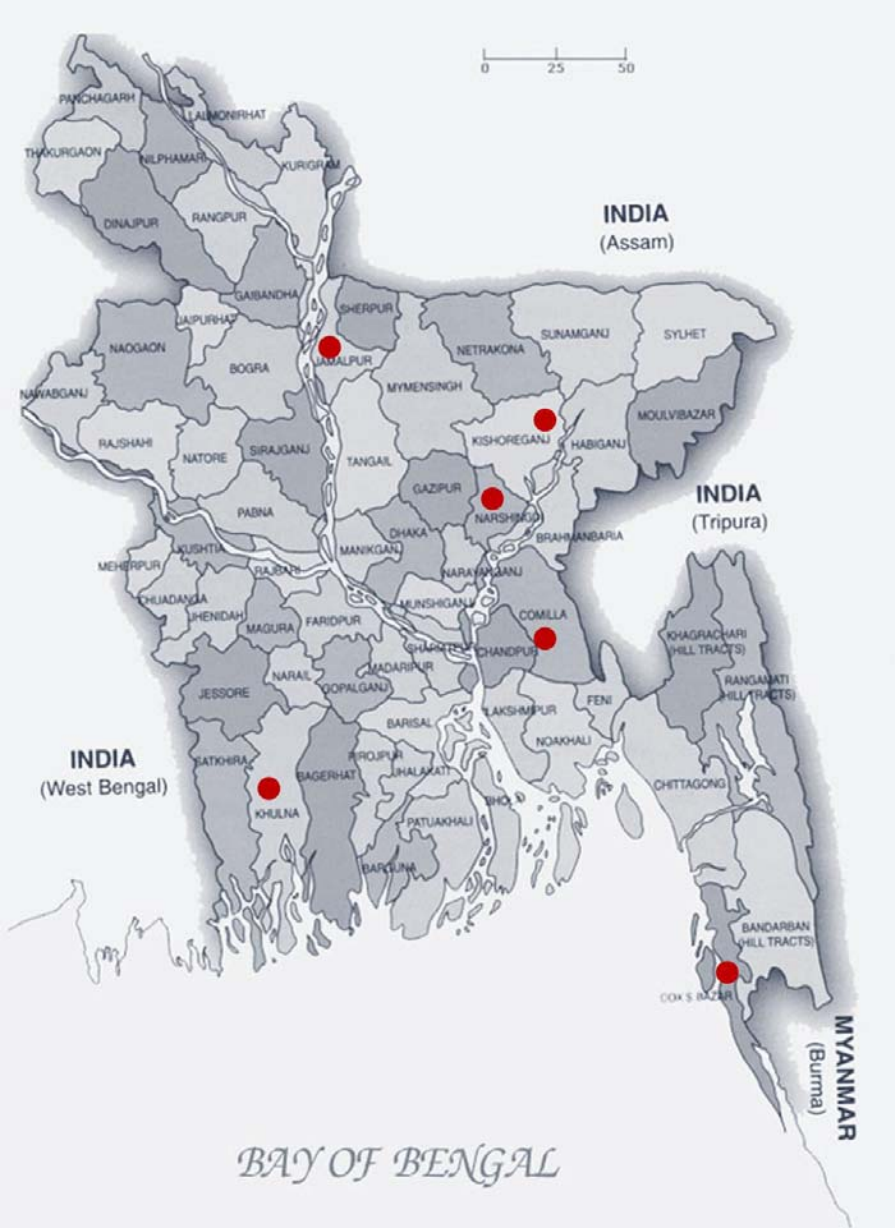

Figure 3-1 Location of Case Study District Hospitals in Bangladesh

The size of a hospital was also a criterion used for the selection of case studies. In this study, six 250-500 bed district hospitals were chosen. In Bangladesh, the 250-bed provides outpatient, inpatient, emergency, laboratory, and imaging services to the people. A great variety of shapes and layouts have been used for 250-bed district hospitals in Bangladesh. Among these hospitals, three 250-bed district hospitals of compact-link-type layout, one 250-bed district hospital of

courtyard-type layout and two 250-beds district hospital of hybrid-linked -type layout (Figure 3-2) were selected for the study. The two hybrid-linked-type hospitals were recently converted to 500-bed hospitals. These hospitals of different sizes and layout types were included in the study to understand how patients' satisfaction might vary according to layout type and how the layout might affect patients' satisfaction when an old layout was changed to accommodate an extension.

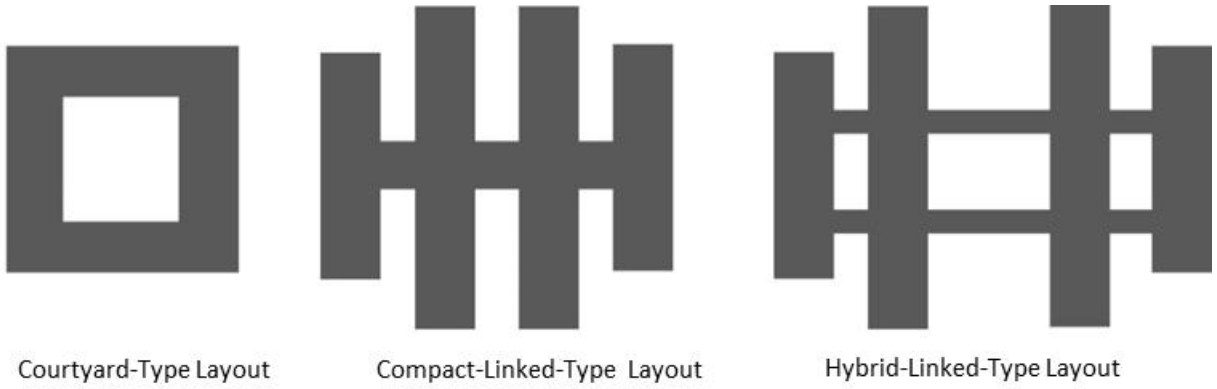

Figure3-2 Different Type of 250-Bed District Hospital Layout in Bangladesh

In the courtyard layout, the compartmentalization of hospital functions is evident. All programmatic functional spaces are designed in separate blocks around a courtyard and are connected with each other through corridors. Visually, this type of layout provides certain degree of hierarchy, security, and privacy. Hospital A (Kishorgang 250-bed district hospital) represented this layout type (Figure 3-3).

In the compact-linked-type layout, three to four blocks constitute the floor plan. All the blocks are connected with short corridors and separated by open spaces. This type of layout reduces the walking distance between departments and also ensures privacy and security. Hospital B (Narayangang 200-bed district hospital), Hospital C (Jamalpur 250-bed district hospital), and Hospital D (Cox's Bazar 250-bed district hospital) represented this layout type (Figure 3-4).

The hybrid-linked- type layout is a combined version of courtyard type and compact linked block type layout. The study includes two cases of this type: Hospital E (Khulna 500-bed district hospital), and Hospital F (Comilla 500-bed district hospital). As noted earlier, they were designed as 250-bed hospitals, but were converted to 500-bed hospitals (Figure3-5). All clinical functions are arranged around multiple courtyards in this hospital layout type. Blocks are connected with long corridors. As a result, this type of layout increases the walking distance between the outpatient department and other clinical functions within the hospital.

3.4 Growth and Changes

Most case-study hospitals seemed to have grown and altered their floor plan without any definite growth plan. In most of the case-study hospitals, the growth of inpatient department took place in large volumes, but in outpatient department the growth was in small increments. Where land available, the hospital was horizontally extended; where there was no land available, the hospital was extended vertically. Sometimes, when the structure could not support vertical extension, new blocks were added horizontally. Kishorganj and Jamalpur District Hospitals (Courtyard-type) were first designed as 50-bed hospitals; then, they were converted to 250-bed district hospitals. To accommodate growth, Kishorganj Hospital was extended both vertically and horizontally. Jamalpur Hospital extended horizontally by adding a new block for the inpatient department. Narayangang and Cox's Bazar Hospitals did not show any growth and changes. The Khulna and Comilla District Hospitals were designed as 250-bed district hospitals which were converted to 500-bed hospitals. To accommodate the extra beds in each of these hospitals, a new outpatient department was designed in a separate building with connections to the main structure via short corridors. In the converted version, therefore, the functional distribution of clinical functions in a hybrid-linked-type layout does not seem to follow any logical order.

3.5 Morphological Description of Hospital Layouts

In this section, the functional arrangement of clinical department within different layout type of hospitals was studied by using the techniques of space syntax. This study was important to the research because it revealed both the depth and the choice of the functional arrangement of the clinical departments. Justified graphs were analyzed for each hospital using the exterior as a root (Figures 3-3, 3-4, 3-5). In these graphs, each space-a room or a clearly differentiated space supporting clinical functions- was represented by a gray circle. Each transition or circulation space- passageways, lobbies and stairs –was shown as a blue circle. All clinical functions were aligned in levels representing the minimum number of spaces one must cross from the root to reach a space.

The analysis used *depth* and *choice*–two of the configurational properties of spatial layout. *Depth* describes how directly clinical functions are accessible from the transitional space (corridor). If the space is directly accessible from a transition space, the space is described as being at depth 1 from the transition space. If it is necessary to pass one intermediate space to get to the space under consideration, then that space is described as being at depth 2 from the transition space. Likewise, if the space passes through a minimum of two spaces, then it is described as being at depth 3, and so on.

Choice defines the presence of absence of circulation rings in the layout. A layout with more rings provides more choice of movement from any particular space by adding connections within the configuration. In contrast, a tree-type layout with no rings provides less choice of movement. The movement in tree-type layout is highly controlled and predictable and supports “highly framed social interaction”, whereas the ring-type layout provides less control on movement and therefore supports “more social interaction” (Hanson, 1998).

In the courtyard type layout (Hospital A), clinical functions are always accessible directly from the most integrated transitional space at depth 1. This layout has three entries which form two rings with the exterior and a ringy circulation pattern. All clinical functions are placed on the ringy route. It is possible that multi-phase construction of hospital A from a50-bed to a 250-bed hospital helped develop more connections among different functions, thus making the layout more ringy. Most transition spaces show more than two links indicating more choice of movement in the layout. In addition, each transition space makes an internal local ring between different floor levels by means of staircases (i.e., the vertical circulation spaces)

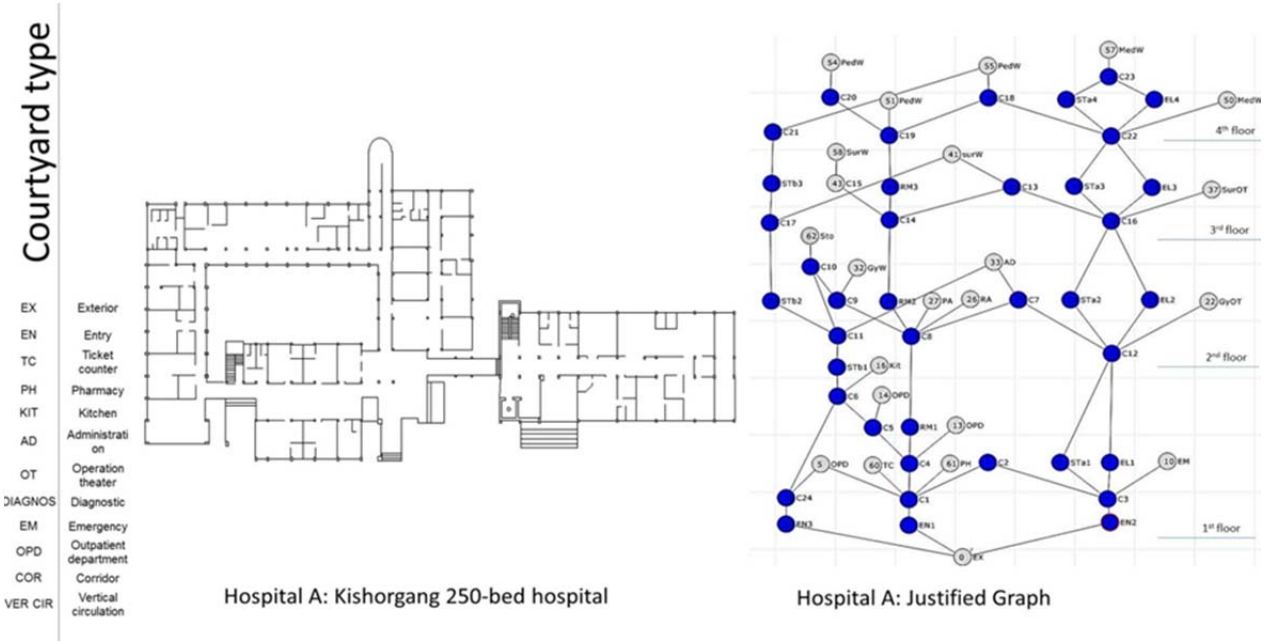

Figure 3-3 A graph Analysis of Courtyard Type 250-Bed Hospital Layout

In the compact-linked-type, the three hospitals show similar patterns that form locally ringy but globally bush like sub-complexes (Figure 3-4). At the same time, all clinical departments are linked in tree- like layout. In all cases, the transition spaces are linked to the clinical department at depth 1. These layouts show two entries that form one single ring with the exterior. Compared to the courtyard plan, the linked-block layout provides less choice of movement from the exterior

to enter the building. The Emergency Department always lies on the exterior ring and makes a connection between exterior and interior allowing more choice of movement through it. As in the courtyard-type, the transitional space (corridor) in this type makes a local ring with upper floors through vertical circulation. In the linked-compact block type layout, except for the Emergency Department, no functional space participates in the ringy route that passes through the exterior. This characteristic provides more controlled movement to clinical functions.

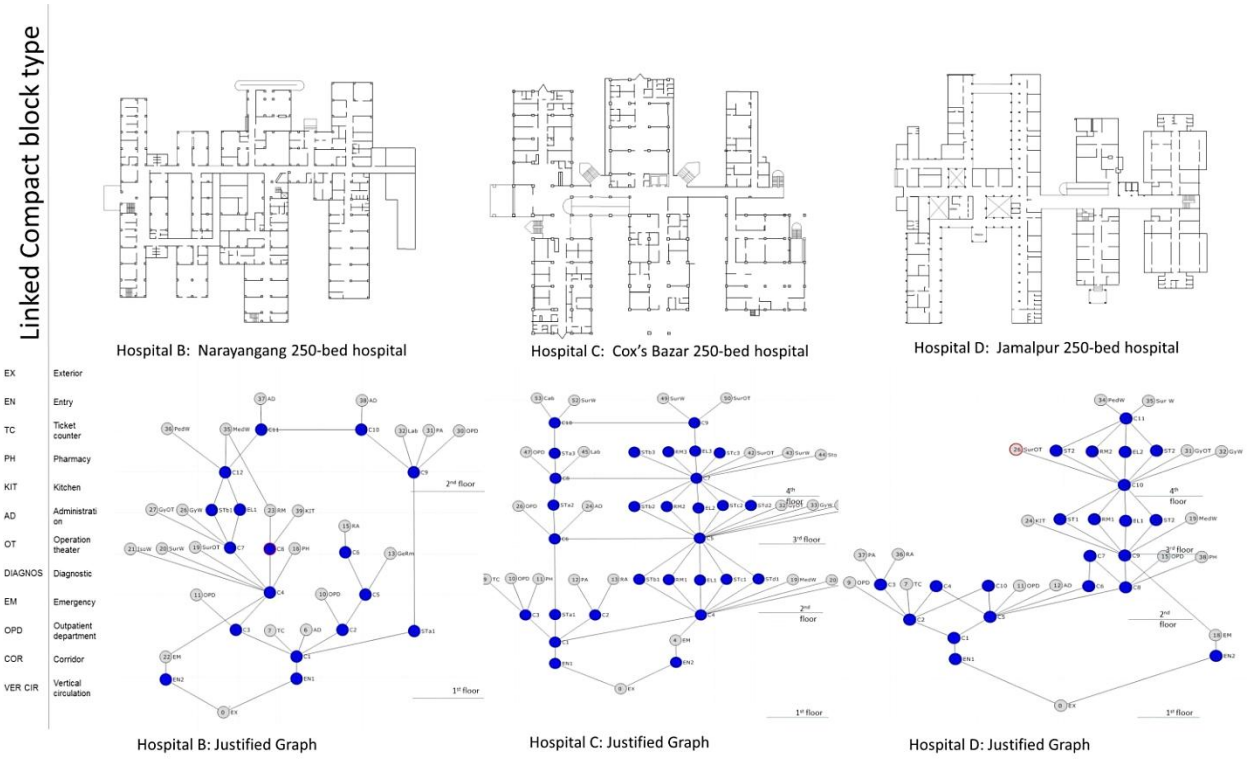

Figure 3-4 A-graph Analysis of Compact-Linked -Type 250-Bed Hospital Layout

In hybrid-linked-type layout, the analysis shows a more complex pattern that forms both ringy and bush-type layouts (Figure 3-5). Like the courtyard-type, the layout shows three entries that form two rings with the exterior. Most of the clinical functions are connected with the transitional space at depth 1, but some clinical functions are embedded in the ring layout. The transitional space (corridor) makes a local ring with upper floors through vertical circulation. The

new outpatient block is directly connected with the exterior and forms a ringy pattern on one side of the existing structure. This characteristic encourages more movement through the outpatient department (OPD). At the same time, it increases the travel distance from other functions of the hospital.

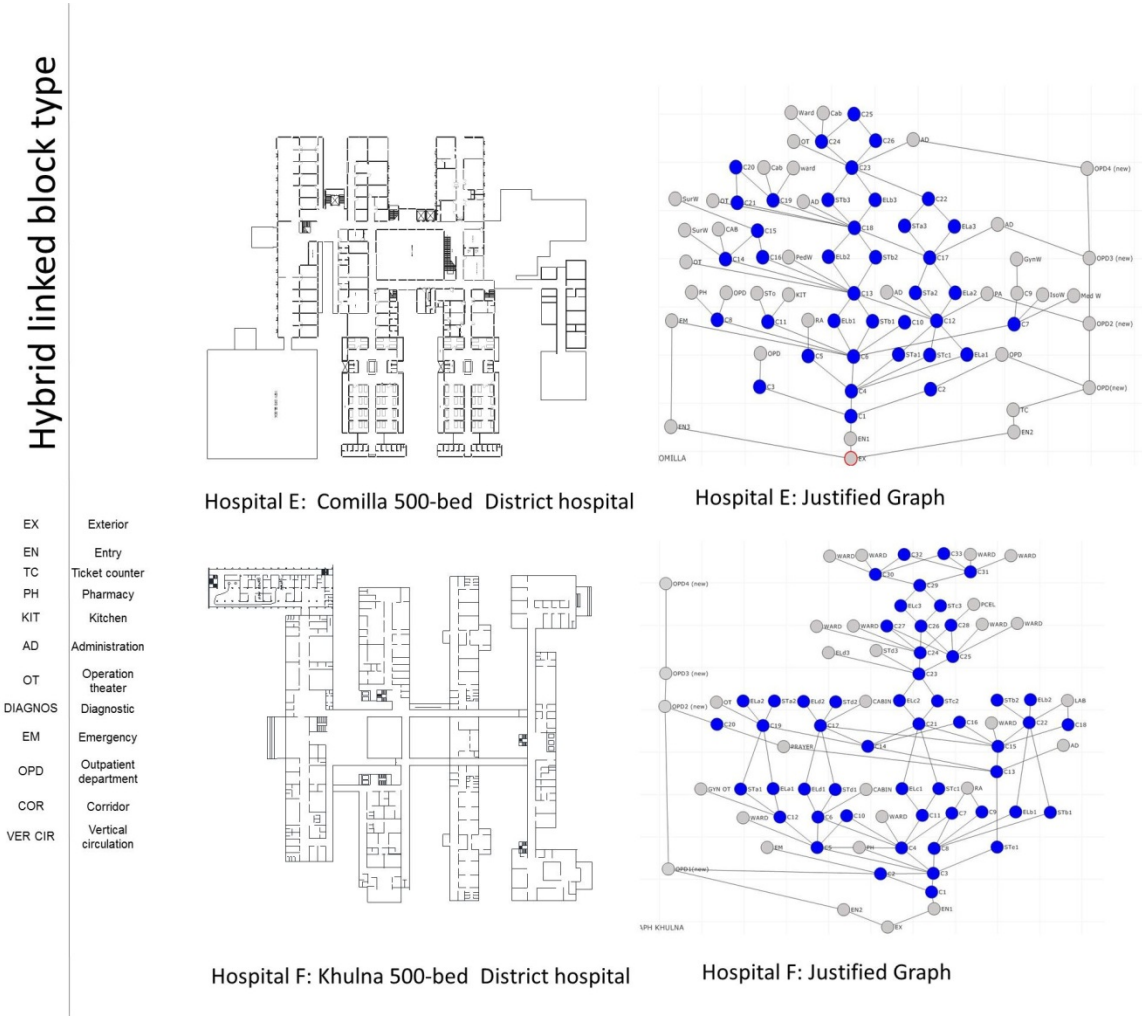

Figure 3-5 A-graph Analysis of Hybrid-Linked-Type 250-Bed Hospital Layout

3.6 Spatial Organization of Outpatient Departments

The outpatient departments of the 250-bed hospitals in Bangladesh consisted of consultancy services including the gynecology, dental, ENT, surgery, orthopedic, dermatology and the general medicine departments, pharmacy, radiology and laboratory. In the courtyard type layout (Kishorgang), all the consultancy services were organized around the courtyard on the 1st floor, and the laboratory and the Radiology department were located on the 2nd floor. Staircases, elevators and ramps were used for multilevel circulation.

In two of the three compact-linked-type layouts (Cox's Bazar, Narayangang), all consultancy services were organized within a single block at multiple levels. Only staircases were used for vertical circulation. In Jamalpur Hospital, consultancy services and other outpatient functions like radiology, pharmacy, and laboratory were scattered throughout the first floor.

In the hybrid-linked type layout, consultancy services were organized in a new building at multiple levels connected with the old main building by a short corridor (Khulna). Radiology, laboratory, pharmacy and some other parts of consultancy services remained at the same location in the old building.

Since in this study patients were observed from ticket counter to their destination departments, their journey covered only three areas in the outpatient departments: (1) reception and registration area; (2) corridors, and (3) the waiting areas of the departments providing services. In the next section, therefore, the functional description of the outpatient areas covers these three areas only.

3.6.1 Reception and Registration Area

The reception and registration area was the area where patients reported, registered and received tickets before they could be seen by doctors (Figure 3- 6). Sometimes, people at the information

desk helped patients and visitors by providing direction to their destinations. In most cases, the reception and registration area was very close to the entry lobby area and had direct visual access from the entry. Exceptions were Jamalpur and Cox's Bazar Hospitals. In Jamalpur Hospital, the original entry was closed and a new entry was designed for the outpatient department. There was no formal reception area in this hospital, and there was no visual access to the registration area from the entry. So people had to walk a long distance through the outpatient environment to reach the registration area. In Cox's Bazar Hospital, separate registration areas were provided away from the entrance area. Since patients and visitors had to stand in a line to get tickets, the area surrounding the registration desk of this hospital was always overcrowded.

In all cases, segregation of gender was evident in the layout of registration counter. Sometimes two different registration counters were designed at two different places, one for men and one for woman (examples: Khulna, Kishorgang, Jamalpur, and Cox's Bazar); and sometimes one registration area had two windows for male and female patients (examples: Narayangang, and Comilla). In the courtyard and compact-linked type a layout, the lighting condition was good sincethe outpatient department was located near the entry. But this space did not have any outside view from the registration area. The lighting condition was also good in Jamalpur Hospital (courtyard-type layout) since the registration area was designed on the corridor beside a courtyard. In Comilla Hospital (Hybrid-linked-type), the lighting condition was much better than Khulna Hospital since the new block of the outpatient department brought in lighting through the roof. In all cases, there was no seating provision in the registration area. For flooring, these hospitals used terrazzo.

Figure 3-6 Spatial Condition of Registration Area at Six District Hospital in Bangladesh, 2012

In all cases, it was evident that an identification sign (that display the name and function of a department, hence the identity of a location) was widely used on the door of each functional space, such as the consultancy room, radiology, etc. The size of identification signage was too small to read from a long distance. In the registration area, there was no directional signage that could guide people to their destination department. Only in the Jamalpur Hospital was directional signage used, but it was located on a column and the text was not legible. In Narayanganj and Kishorgang Hospitals, orientation signage, signage that offers an overview of the whole hospital, was used in the lobby area, but very few people used the signage because they were illiterate. Khulna and Jamalpur Hospitals had their orientation signage near the old entry. Cox's Bazar and Comilla Hospitals did not have any orientation signage in their registration areas.

3.6.2 Circulation Area

The circulation area or corridor mainly connects the reception area with the waiting area. In all cases we found that circulation areas accommodated additional people waiting for services at the outpatient department. In Khulna and Comilla Hospitals, the width of the circulation corridor was 10-12 feet approximately. In Narayanganj and Cox's Bazar, the circulation corridor size was about 8-10 feet. In Jamalpur and Kishorganj, the size was about 7-8 feet. Most circulation area had ample lighting condition and outside view option. The exception was Cox's Bazar, where the lighting condition was poor and there was only a little view to the outside. The waiting area of a consultancy room was placed in the circulation corridor in most cases. Therefore the circulation areas were always overcrowded with people who were waiting and/or passing through the space. The corridor in the outpatient departments did not have any directional signage.

Figure 3-7 Spatial Condition of Circulation Space at Six District Hospital In Bangladesh, 2012

Figure 3-8 Spatial Condition of Waiting Room at Six District Hospital in Bangladesh, 2012

3.6.3 Waiting Area

Since these hospitals did not take appointments for services, patients needed to wait in the waiting area for indefinite time before receiving consultancy services. In the waiting area, there were never enough seats for patients and visitors. In all cases, patients had to spend time standing. As most of the waiting areas were placed along corridors, the people had sufficient lighting and also had windows to look through to the outside. In these district hospitals, the floor finish was also good. In the waiting areas, identification signage was used to mention the name of the consultancy department, but because of the inadequate size of the text, the signage was not readable from a distance.

3.7 Spatial Sequence of Outpatient Activity

The outpatient departments remained open for six days a week from Saturday to Thursday, between 8 AM and 2 PM. Although the OPD was open for six hours each day, the arrival of patients was not evenly distributed during the period. Since the OPD did not operate on an appointment system, the patients came at their own convenience. Most of the patients presented themselves at the hospital between 9:00 PM to 12:00 PM. The influx of patients during these three hours affected the working pattern of the outpatient departments.

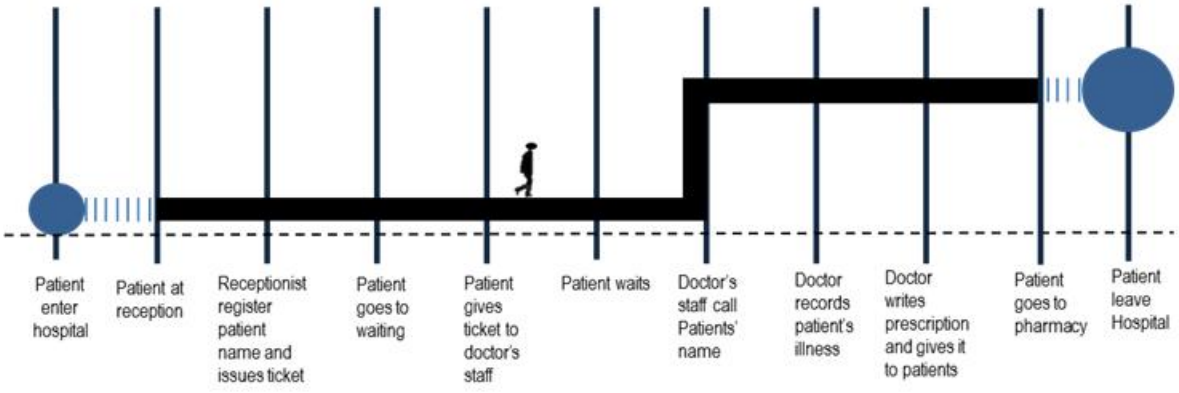

Figure 3-9 Sequence of Outpatient Activity at District Hospital in Bangladesh

Observations revealed that the sequence of activity in the outpatient departments was more or less similar in all hospitals. In the outpatient departments, a patient's journey starts when s/he enters the hospital. After entering the hospital, the patient goes to the reception area and stands in a line to register her/his name and get a ticket by paying 10 Taka (80 Taka = $1.00). After the patient gets the ticket, s/he starts searching for the destination department based on the room number written on the ticket. After reaching the waiting room of the department, the patient gives the ticket to the medical staff seated in front of a consultancy room. The patient has to wait in the waiting area until his or her name is called out. When her/his name is called s/he enters the doctor's room to receive care. The doctor sees the patient and writes a prescription (or treatment plan) and gives it to the patient. The patient then goes to the hospital pharmacy to collect medicine before leaving the hospital. This sequence of activities becomes more complex when a patient is referred to the specialist for further consultation or is sent to the laboratory for further investigation.

3.8 Methodology

The study examined the relationships between spatial structure and patients' travel experience and satisfaction in several outpatient departments at six district hospitals of Bangladesh. Multi-method data collections were used in this study, including systematic behavioral observation, questionnaire survey, and the floor layout analysis.

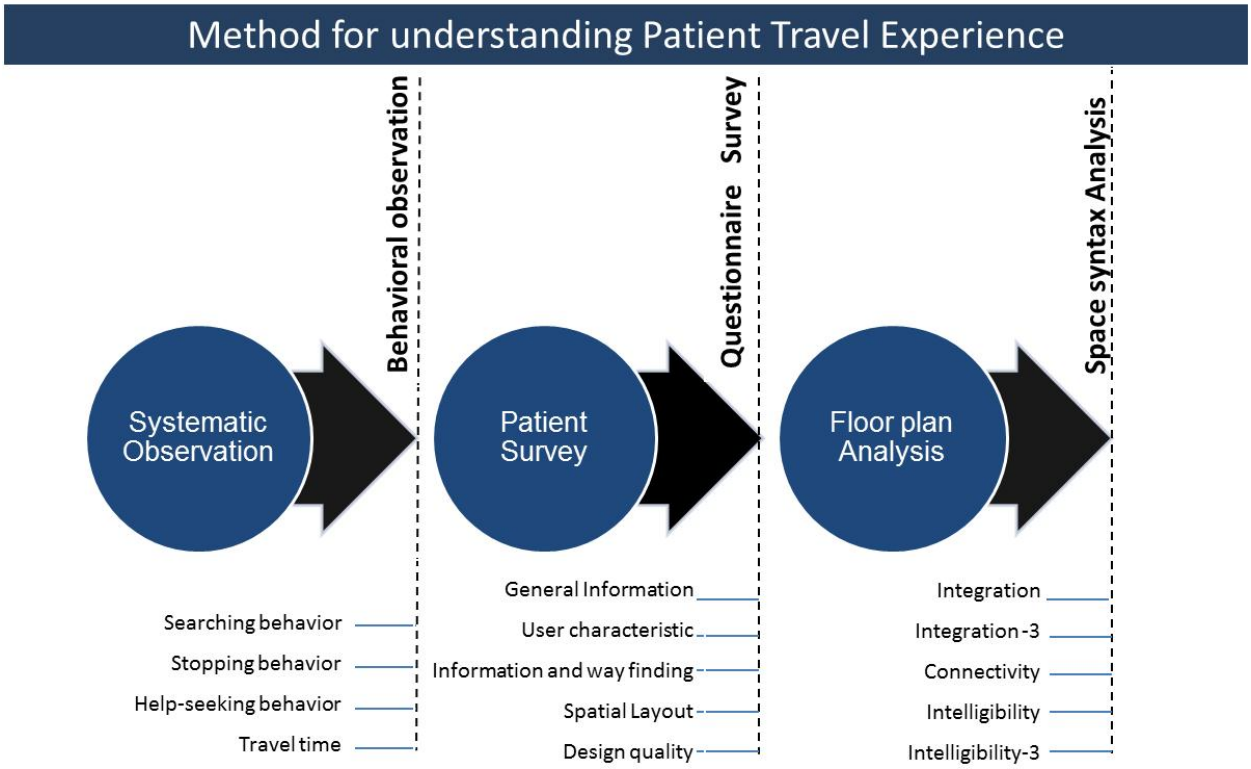

Figure 3-10 Research Methodology

3.8.1 Systematic Observation

As in the pilot study, all patients who entered the reception area of the outpatient department were invited to participate in the study. Informed consent of patients was taken before patients' behaviors in wayfinding situations were observed. Observation was conducted with synchronized watch and data collection sheets. Each patient was tracked from the entry (reception area) to the destination (clinical department). The travel time needed to complete each trip was recorded on data collection sheets. In addition, individual patient route and travel behavior, such as the number of decision-making stops, the number of times the patient needed to look around to find the way, and the number of times the patient needed to ask for directions on the movement route, were also recorded on the observation sheet.

3.8.2 Patient Survey

Every consenting patient was asked to fill out a survey questionnaire concerning his/her travel experience and satisfaction when s/he reached destination and was waiting for services. The questionnaire was developed in English since it was used in the pilot study at Lawrence Memorial Hospital. It was translated into Bengali, a language spoken in Bangladesh, and was pre-tested in one hospital in Bangladesh with 25 patients purposefully sampled to identify questions that were unclear or confusing and to test the observation method. Based on these data, the survey items were modified, and the final questionnaire was developed for fielding. As most of the patients were illiterate in Bangladesh, the researcher often read and filled out the questionnaires for the patients.

3.8.3 Floor Plan Analysis

As in the pilot study, space syntax methodology was used to measure the accessibility and inter-connection of the layout. For analysis, an axial map, which represents a set of the minimum number of longest sight lines that cover every circulation space in the layout, was produced for the whole spatial system of the study floor. To recall, the "whole spatial system" includes all the circulation spaces on the study floor that were used by patients, staff nurses and doctors. Again, "Depth map 10", a space syntax software program, was used to assess the relational pattern of the axial lines in the axial map.

In this study, connectivity, integration, depth, and the intelligibility measure of space syntax were used to measure the properties of the layout. Again, to recall, the integration value measures the relative position of any space or axial line with respect to the all space and lines in the building's layout. Higher integration values represent better accessibility to and from axial lines. "Integration-radius n" represents the relationship of each space with every other space in

the hospital layout as a whole. “Integration–radius 3” is the local measure that represents the relationship of one space to others up to three steps or turns away from it. Connectivity is the local measure that represents the relationship of each space with its immediate neighbor. It is arrived at by counting the number of lines or spaces that are directly connected to a line or space. It provides the degree of choice on the line: higher Connectivity values represent more choices of movement for axial lines. Intelligibility represents the correlation between local and global syntactic measures, such as between connectivity and Integration-radius-n, or between Connectivity and Integration-radius 3. It has been argued in the literature that more syntactically legible layouts have higher intelligibility values (for example, see Hillier, 1996).

3.9 Description of Study Participants

In total, 349 patients were interviewed and observed in this study. Among them, 174 patients were in the compact-linked-type layout, 47 patients in the courtyard-type layout, and 128 patients were in the hybrid- linked-type layout. Among the 349 participants, 31.8% were male and 68.2% female in this study. Next, 62.8% of the patients were between 18-35 years, 24.9% between 36-40 years and 12% of the patients were above 50 years. Then, 21.2% of the patients had no education, 20.9% had primary educations, 27.8% had completed high school, and 10.9% had completed middle school. Among all participants, 46.7% asked volunteers for directions and 63.9% visited the hospital with one or more family members.

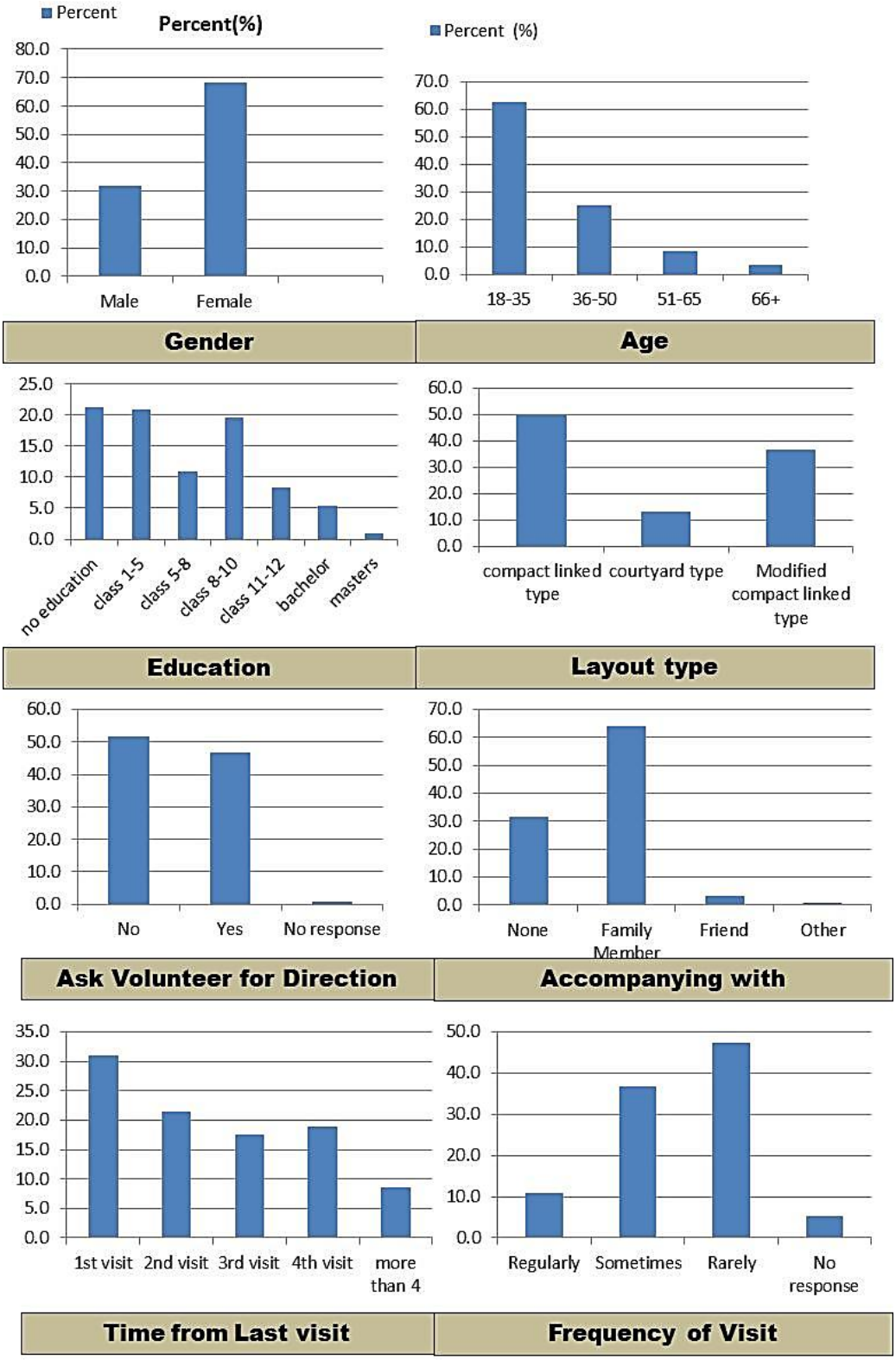

Figure 3-11 Description of Sample at Six District Hospital in Bangladesh

3.10 Data Analysis Plan

The analysis of the data was done in three stages. Firstly, the analysis looked at all the cases taken together to understand the overall patients' travel experience during wayfinding situations in the outpatient department of Bangladesh hospitals. Secondly, the analysis looked at patients' travel experience in wayfinding situations according to gender. Finally, the analysis looked at patients' travel experience in relation to the three layout types: courtyard, compact-linked-type and hybrid-linked-type. In each stage the analysis investigated the correlations between patients' satisfaction and various features of (1) signage systems; (2) layout complexity; (3) design quality; (4) axial maps (i.e., spatial syntax); and (5) wayfinding behavior as described below (Figure 3-12).

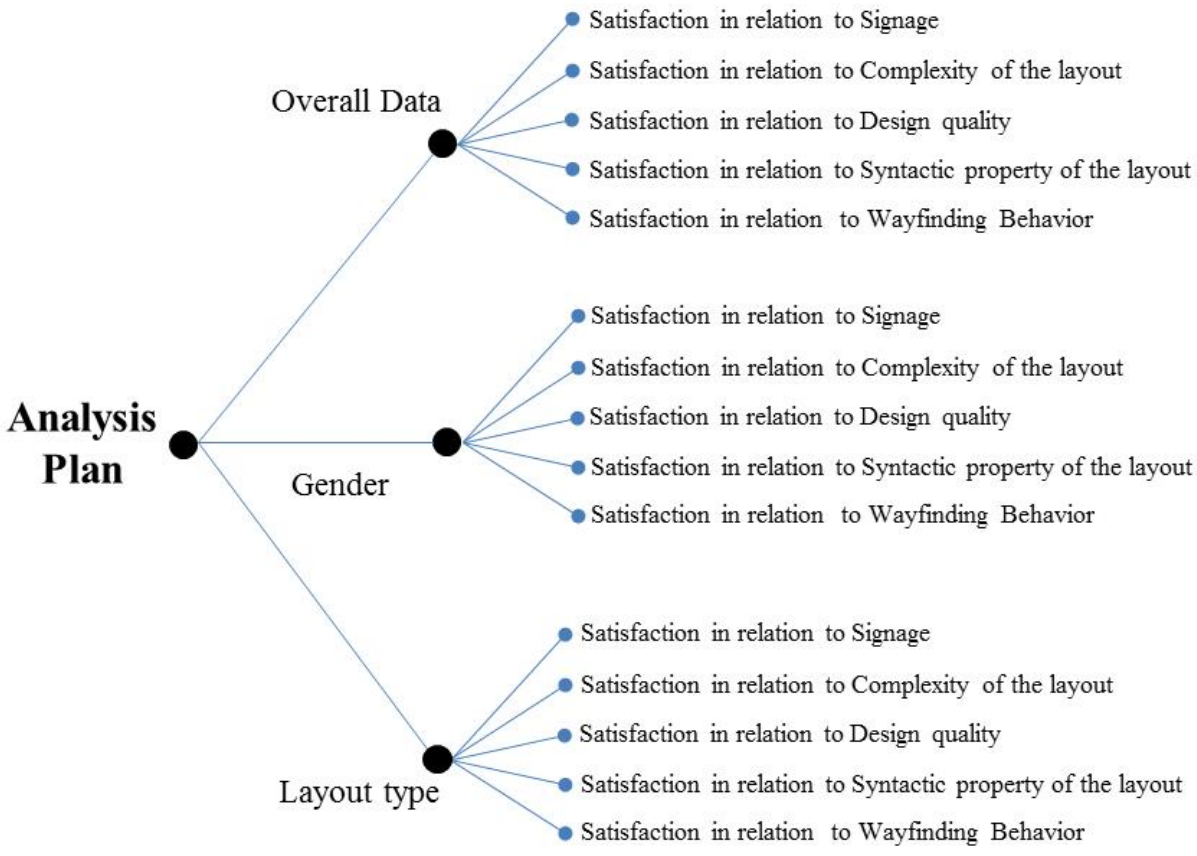

Figure 3-12 Diagram Showing Plan of Analysis

3.10.1 Patient Satisfaction and Signage System

To understand the effect of signage system on patients' satisfaction, the study looks at different sizes and different types of signage, such as identification signage, directional signage, orientation signage, in relation to patients' satisfaction in wayfinding situation.

In an outpatient department, the identification signage system provides the first impression of a destination as this type of signage displays the name and function of a department. The identity of a location allows the person to determine whether they are in the proper location or not. Proper placement of identification signage helps a patient to find his or her destination without getting lost in the outpatient departments. The directional signage systems are part of the circulation system as they provide information that patients need to move on after they entered an outpatient department. Orientation signage offers an overview of the whole hospital in the form of comprehensive building map and directories. According to Levine (1982), the orientation signage, "you are here" map significantly influences the ability of the people to complete successfully the wayfinding task. In addition, during wayfinding people face difficulties with illegible signage systems. Passini (1992) explains that illegible signs are those that are too small to be seen and recognized from the reading distance of the sign. Therefore, the study examined the correlation between patients' satisfaction and signage in the outpatient department of the six Bangladesh hospitals.

3.10.2 Patient Satisfaction and Layout Complexity

To understand how patients experience the outpatient department in relation to layout complexity, it is important to look at the journey that patients make in the hospitals of Bangladesh. Here layout complexity refers to the compound arrangement of clinical functions within outpatient departments in the hospitals of Bangladesh. As discussed earlier, upon entering

the hospital, patients usually try to find the information booth to buy tickets for the outpatient department. To purchase tickets, patients stand in lines. Often, patients standing in lines block movement in the lobby space. Therefore, it is important to know whether patients face any problems in finding the location of the information booth or the ticket counter and whether the congestion around the ticket counter has any effect on patients' satisfaction. Moreover, it is also important to know if the proximity of waiting room, staircase/ elevator and if spending more time in walking have any effect on patients' satisfaction with overall layout.

3.10.3 Patient Satisfaction and Design Quality

The design quality of an outpatient department gives "place" an identity and helps to distinguish one place from another. When different parts of the environment look the same in an environment, it is difficult to construct a cognitive map or to form an overall image of the layout. As a result, people face difficulty in recognizing an environment (Wiseman, 1981). According to Passini (1992), distinctiveness can be achieved by the form and volume of space and by the use of finish, color, lights and graphics. In hospitals, these interior design features (floor finish, lighting, wall color, furniture) help to differentiate the physical environment and help patients to find their way (Carpman et al., 1993; Weisman, 1981). Therefore, the analysis studied the correlations between interior design quality and patients' satisfaction when they are in wayfinding situations.

3.10.4 Patient Satisfaction and Syntactic Properties of the Layout

To understand the visual and physical accessibility of space, the study used the axial map analysis of space syntax to reveal the syntactic properties of the layout (Hiller and Hanson, 1984). Literature shows that the syntactic properties of the layout can predict patients'

wayfinding performance (Haq, 1999). In this analysis, route Integration, Integration-3, connectivity, Intelligibility and Intelligibility-3 were used to describe the properties of the layout in terms of visibility and accessibility (see Chapter 2 for definitions) in order to understand the effect of these syntactic properties on patient satisfaction.

3.10.5 Patient Satisfaction and Wayfinding Behavior

Wayfinding can be described as the process of problem- solving to reach a destination through a complex environment (Passini, 1992). During this process, people use different types of spatial or non-spatial strategies including movements of head and body. According to Alibali (2005), body movements or gestures, also called *searching behaviors*, play a great role during the early phase of wayfinding. In the next phase of wayfinding, people make a decision plan based on the visual and written clues of what they observe. To make a decision plan, people often stop their movement. This can be termed as *stopping behavior*. *Stopping behavior* helps people focus on spatial information and process that information. In the final phase, based on the decision plan, people move ahead in real time and repeat actions of the earlier phases until they find their destinations. When people do not find all the information in a consistent way they get lost. At that moment, they produce *help-seeking behavior* to get help from others to find their way.

The study tried to understand the relationships between wayfinding behaviors and patients' satisfaction, and between wayfinding behaviors and the syntactic properties of hospital layouts. Here, it is hypothesized that when patients produce more wayfinding behaviors they are more dissatisfied with the signage system, the overall layout, the quality of design, and with the perceived travel time.

Figure 3-13 Wayfinding Behavior: Searching, Stopping, and Help-Seeking in Bangladesh Hospital

3.10 Interpretation of Statistical Findings

During analysis to understand the correlations between patients' satisfaction and the above mentioned five sets of variables, the research used Pearson correlation coefficient (r) which quantifies a linear relation between two scales of variables using the SPSS20 software. In general, when the correlation coefficient or r = 0.7 - 0.9, the correlation is considered to be a strong correlation; when r = 0.4 - 0.6, the correlation is considered to be a moderate correlation; and when r = 0.1 - 0.3, the correlation is considered to be a weak correlation (Dancey & Reidy, 2004). However, research has shown that the correlation between two variables in social and behavioral science very rarely exceeds 0.4 in absolute value (Nolan, 2007). According to the often cited publication by Cohen (1988), the Pearson correlation value was considered r = ±0.5 as strong; r = ±0.3 as moderate and r = ±0.1 as weak correlation (Weinberg, 2001). Therefore, for the present study, the analysis considered (r= ±0.4 to ±0.5) as strong; (r = ±0.2 to ±0.4) as good or moderate, and (r= ±0.1 to ±0.2) as weak correlation .

3.11 Conclusion

The aim of this Chapter was to give an understanding about the environmental condition of the outpatient department where the research was conducted. These hospitals were selected based on their locations, similarities in functions in the outpatient departments, and their layout types. They represented three different types of layout: compact-linked type layout, courtyard type layout and Hybrid linked type layout. All the floor plans were collected from the architecture department of Bangladesh Public Works Department. Due to the limited availability of the hospital floor plans and a short data collection period, the present study did not include the same number of hospitals representing each layout type. Three were the compact-linked layout type, two the hybrid- linked layout type and one was the courtyard layout type. The intention was to understand whether patients' travel experience varies according to hospital layout type. At the same time the research tried to understand the importance of the spatial layout, the signage system, the design quality of the environment, and visual access for improving the patient's travel experience and satisfaction in wayfinding situation. The next three Chapters are designed to present the analysis of the data that was collected from the case study hospitals.

Chapter 4 : ANALYSIS OF ALL THE CASES TAKEN TOGETHER

4.1 Introduction

The aim of this Chapter is to look at the patients' overall satisfaction through analyzing all the case-study hospitals taken together. Correlational analysis is done here to understand the effects of signage systems, complexity of the spatial layout, and design quality on patients' satisfaction in relation to wayfinding. The main objective is to understand the correlation between wayfinding behavior and patients' satisfaction. In addition, this chapter looks at syntactic properties of the hospital layout and tries to understand how integration, connectivity, and the intelligibility value of the layout affect patients' satisfaction in wayfinding.

4.2 Patient Satisfaction and Signage Systems

In this research, the survey question "room numbering system following floor number is useful for me and large enough for me" is asked to understand the impact of identification signage on patients' satisfaction. For all the cases studies together, identification signage shows good and significant positive strong correlation (r = 0.475**) with patients' satisfaction (Table 4-1).

The question "Sign showing different parts are useful for me" is asked to achieve an understanding of the importance of the directional signage systems for patients' satisfaction. Again, the findings shows that the directional signage systems have a good and significant positive strong correlation (r = 0.437**) with patients' satisfaction in wayfinding situation (Table 4-1).

The question about orientation signage, "You are here map is useful for me," shows weak correlation (r = 0.171**) with patients' satisfaction (Table 4-1). Though the findings show weak correlation, the finding is highly significant at 1% level.

Satisfied with Signage System	Directional Signage	Orientation Signage	Identification Signage	Size of Signage
	Sign showing different parts are useful for me	You are here map is useful for me	Room numbering system follow floor number and large enough for me	Size of sign is appropriate and easy to read
All Building Analysis	**.437****	**.171****	**.475****	**.388****

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 4-1 Correlation between Patients' Satisfaction and Signage System for all Building Cases

The analysis shows a moderate positive correlation between patient satisfaction and size of signage (r = 0.388**), which indicates that the legibility of the signage has an effect on patients' satisfaction (Table 4-1). With an increase in the size of signage, it may be possible to increase patients' satisfaction.

4.3 Patient Satisfaction and Spatial Layout

4.3.1 Information Booth and its Surrounding Area

For all cases taken together, the analysis shows that 'information desk easy to find' (r = 0.204**) and 'circulation area not congested around the ticket counter' (r = 0.222**) are moderately correlated with patients' satisfaction (Table 4-2).

4.3.2 Walking Time

In this research it was hypothesized that spending more time walking due to poor spatial layout might give the patient a poor travel experience. Surprisingly, the analysis of all the cases taken together shows no significant correlation between "how much time patient spends on walking" and "patient's satisfaction with overall layout" (Table 4-2).

Patient Satisfaction with Complexity of the Layout		Information desk easy to find	Circulation area not congested around Info. Desk	Spend more time on Walking	Necessary function located in close proximity	Easy to locate waiting room	Elevator or stair are easy to find	Corridor are wide enough
All Building Analysis	Satisfied with amount of Time taken to Reach Service	**.168****	.105*	-.128	**.33****	**.388****	**.165****	**.125****
	Satisfied with Overall Layout	**.204****	**.222****	.047	**.153****	**.190****	.129*	**.375****

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 4-2 Correlation between Patients' Satisfaction and Complexity of the Layout for All Building Cases

4.3.3 Proximity of Necessary Functions, Waiting Room and Stair/ Elevator

The locations of different functions in outpatient departments are important to easily find one's destination during wayfinding. In wayfinding situations, if patients' destination departments are easily accessible, patients may find their destination without getting lost. Therefore, this research assumed that close proximity of outpatient functions and easy-to-locate waiting rooms, elevators, and staircases would have a positive effect on patients' satisfaction with the functional complexity of the layout.

For all cases taken together, the analysis shows weak but significant correlation at 1% level between patient satisfaction and proximity of necessary functions (r = 0.153**) and waiting room (r = 0.190**). The findings indicate that patients' satisfaction with the overall layout may tend to increase when outpatient department functions are locate in close proximity to the entry and when patients can locate their waiting rooms easily (Table 4-2). But "easy to locate elevator and staircase" did not show any correlation between patients' satisfaction and the overall layout.

For all cases taken together, patients' satisfaction with perceived travel time is moderately correlated with "necessary functions located in close proximity" (r=0.33**), with 'easy-to-locate

waiting room' (r = 0.388**), and with 'elevator or stair case easy to find' (r = 0.165**) (Table 4-2). These findings suggest that close proximity of outpatient functions and easy-to-locate waiting rooms, elevators, and staircases might help patients in wayfinding situations, and might also help increase patients' satisfaction with the perceived travel time.

4.3.4 Circulation Corridors

The circulation corridor is the key organization feature of a layout. Passini (1992) refers it as the bone structure that connects all building functions together. The primary function of the circulation corridor in a hospital is to carry patients to their destinations. In Bangladesh, most often the circulation corridor works as a place where patients and staff spend time waiting, gathering information, and talking. From the perspective of wayfinding corridors, like streets, are the place where people make decisions about wayfinding. In this research it is assumed that when patients are trying to reach their destinations the size of the corridor may have an effect on patients' satisfaction.

The analysis shows that the width of a circulation corridor has a positive significant correlation between patients' satisfaction with the overall layout (r = 0.375**) and perceived travel time (r = 0.125**). This suggests that we may be able to increase patients' satisfaction with the overall layout and the perceived travel time by increasing the width of the corridor.

4.4 Patient Satisfaction and Design quality

The correlational analysis shows that "patients' satisfaction with the overall quality of design" has significant positive strong correlation with comfortable floor finish (r = 0.454**), comfortable lighting (r = 0.440**), and with comfortable waiting room furniture (r = 0.447**) (Table 4-3). The analysis also shows moderate positive correlations between patients'

satisfaction and circulation space with windows (r = 0.355**) and seating arrangement (r = 0.365**) (Table 4-3). The findings indicate that increasing the quality of floor finish, lighting, and waiting room furniture can improve patients' satisfaction with design quality. At the same time, circulation space which has window and seating arrangements is a moderately significant factor that can improve patients' satisfaction.

Satisfied with Overall Quality of Design	Comfortable floor finish	Comfortable lighting	Circulation Space have windows to get outside view	Circulation Space have seating to take rest	Waiting room furniture is comfortable
All Building Analysis	**.454****	**.440****	**.355****	**.364****	**.447****

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 4-3 Correlation between Patients' Satisfaction and Design Quality for All Building Cases

4.5 Patient Satisfaction and Syntactic Properties of the Layout

For all buildings taken together, there is a weak but significant negative correlation (r = -0.187**) between patients' satisfaction and integration -3 properties of the layout. The finding suggests that, in the wayfinding situation, when the patient moves through a space which is highly integrated with other space at three steps away from it, the patient may become less satisfied. Two other syntactic variables – integration-n and connectivity – showed a similar trend at the level of 5% significance.

Pearson Correlation		Satisfied with overall signage system	Satisfied with amount of time taken to reach service	Satisfied with overall layout	Satisfied with overall quality of design
All Building Analysis	Route Integration as parts of the Whole Building	-.148*	-.024	-.090	-.031
	Route Integration-3 as parts of the Whole Building	**-.187****	-.073	-.054	-.034
	Route Connectivity as parts of the whole Building	-.126*	-.063	.014	-.032
	Route Depth as parts of the whole Building	.088	-.022	.079	.010
	Route Integration vs. Integration-3 as parts of the Whole building	-.035	.058	-.094	-.018
	Route Integration vs. Connectivity as parts of the Whole building	.010	.069	-.118*	-.028

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 4-4 Correlation between Patients' Satisfaction and Physical and Visual Accessibility for All Building Cases

4.6 Patient Satisfaction and Wayfinding Behavior

4.6.1 Searching Behavior

For all cases taken together, patients' searching behaviors show significant negative moderate correlation with patients' satisfaction with the signage system (r = -0.301**), and with the perceived travel time (r = -0.329**); and show negative weak correlation with patient satisfaction with the overall layout (-.190**) (Table 4-5). But the searching behaviors do not have any correlation with design quality (Table 4-5). In other words, patients' satisfaction with the signage system and the perceived travel time is somewhat related to how many times they look around to make a decision plan to reach their destination. In the outpatient environment when patients look around fewer times to find their destination, they become more satisfied with the signage system, overall layout and perceived travel time. In this case, orientation signage

(i.e., you are here map) (r = -0.195**) and the readability or the size of signage (r = -0.170**) may influence on patients' searching behavior (Table 4-6).

The analysis of the relationship between searching behavior and various attributes of layout complexity shows that spending more time in walking is positively correlated with patients' searching behavior (r = 0.222**) (Table: 4-7). The analysis also shows that close proximity of necessary functions (r = -0.219**) and easy-to-locate waiting room (r = -0.308**) were negatively correlated with patients' searching behavior (Table 4-7). In other words, patients executed less searching behavior when they found all the necessary functions in close proximity and when they were able to locate their waiting rooms easily. Additionally, the analysis shows that searching behavior was negatively correlated with patients' satisfaction with perceived travel time (r = -0.329**) (Table 4-7), indicating that patients' satisfaction with perceived travel time improves as searching behavior decreases.

The analysis shows that with an increase in the integration (r = 0.226**) and local integration -3 (r = 0.200**) value of the whole system, patients' searching behavior may increase as well in the outpatient departments (Table 4-8).

4.6.2 Stopping Behavior

In the outpatient departments of the six hospitals, patients' stopping behavior does not have any correlation with signage, overall layout, and design quality (Table 4-5). However, stopping behavior does show a moderate negative correlation with patients' satisfaction with the perceived travel time (r = -0.257**) at 1% significance level (Table 4-5). Spending more time on walking also shows positive correlation (r = 0.206**) with patients' stopping behavior, indicating that in a longer trip patients stopped more. In addition, the easy-to-locate waiting room also shows negative correlation (r = 0-.217**) with patients' stopping behavior (Table 4-7).

4.6.3 Help- seeking Behavior

Overall patients' help-seeking behavior has no correlation with patient's satisfaction with overall layout, signage system, and quality of design, but it does show significant correlation with satisfaction with the perceived travel time (r = -0.252**) (Table 4-5). In other words, the perceived time to reach destination increases when patients ask for directions more frequently.

4.6.4 Travel Time

For all cases taken together, patients' actual travel time shows significant moderate negative correlation with satisfaction with the overall signage system (r = -0.245**) (Table 4-5) and strong negative correlation with satisfaction with the perceived travel time (r = -0.408**) (Table 4-7). In other words, if patients are not satisfied with the overall signage systems, their satisfaction with perceived travel time may be negatively affected, or vice versa.

Pearson Correlation			Wayfinding Behavior			
			Patient travel time	Stopping behavior	Searching behavior	Help-seeking
All cases	All Building Cases	Satisfied with overall signage system	**-.245****	-.143*	**-.301****	-.147*
		Satisfied with amount of time taken to reach service	**-.408****	**-.257****	**-.329****	**-.252****
		Satisfied with overall layout	-.119	.031	**-.190****	-.017
		Satisfied with overall quality of design	-.102	.028	-.157*	-.012

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

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

Table 4-5 Correlation between Wayfinding Behavior and Overall Patients' Satisfaction

In addition, patients' travel time shows significant positive correlation with route integration (r = 0.268**), integration-3 (r = 0.323**), and route connectivity (r = 0.278**), indicating that if patients' routes to destination have higher integration and connectivity values, travel time may increase (Table 4-8). According to space syntax theory, spaces with higher integration values

generate more movement. Therefore, one wonders if more time needed to reach destinations along more integrated routes can be attributed to the distraction caused by more people on these routes.

Pearson Correlation			**Directional Signage**	**Size of Signage**	**Orientation Signage**	**Identification Signage**	**Satisfied with Overall Signage System**
			Sign showing different parts are useful for me	Size of sign is appropriat e and easy to read	You are here map is useful for me	Room numbering system follow floor number and large enough for me	Satisfied with overall signage system
All Cases	All Building Analysis	Travel time	**-.174****	**-.190****	-.038	-.101	**-.245****
		Stopping behavior	-.030	-.115	.024	-.055	-.143*
		Searching behavior	-.143*	**-.170****	**-.195****	-.154*	**-.301****
		Help-seeking behavior	-.045	-.083	-.065	-.131*	-.147*

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 4-6 Correlation between Wayfinding Behavior and Signage System

Pearson Correlation			Information desk easy to find	Circulation area not congested around Info. Desk	Spend more time on walking	Necessary function located in close proximity	Easy to locate waiting room	Elevator is easy to find	Corridor are wide enough	Satisfied with amount of time taken to reach service	Satisfied with overall layout
All Cases	All Building Analysis	Travel time	-.025	-.095	**.277****	**-.226****	**-.329****	-.059	.026	**-.408****	-.119
		Stopping behavior	.024	.063	**.206****	-.142*	**-.217****	-.127*	.099	**-.257****	.031
		Searching behavior	.016	.032	**.222****	**-.219****	**-.308****	-.093	.025	**-.329****	**-.190****
		Help-seeking behavior	.047	.007	.040	-.074	-.135*	.008	.089	**-.252****	-.017

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 4-7 Correlation between Wayfinding Behavior and complexity of the spatial layout

Pearson Correlation			Route Integration (whole building)	Route Integration -3 (whole building)	Route Connectivity (whole building)	Integration vs Integration-3 (whole building)	Integration vs Connectivity (whole building)
All Cases	All Building Analysis	Travel time	**.268****	**.323****	**.278****	.082	-.049
		Stopping behavior	-.027	.042	.108	-.105	-.134*
		Searching behavior	**.226****	**.200****	.108	.163*	.115
		Help-seeking behavior	.048	.117	.165*	-.061	-.105

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 4-8 Correlation between Wayfinding Behavior and Syntactic Properties of the Layout

4.7 Conclusion

In the hospitals of Bangladesh, patients' level of satisfaction in relation to wayfinding varies in regards to the signage system, interior layout, overall quality of design, and visibility of the outpatient departments. Analysis shows that identification signage, directional signage, and size of signage have greater impact on patients' satisfaction in the context of Bangladesh. In the outpatient department, when patients buy ticket, they get a room number written on the ticket. When the identification signage and directional signage are inadequate and the size of signage is not legible, patients' satisfaction and their travel experience in the wayfinding situation are negatively affected.

In the outpatient context, patients' travel experience depends on proximity of necessary functions, waiting room, and stair/ elevator, on the size of corridor, and on how much time patients spend on walking to their destination. Furthermore, the information booth and its surrounding area have an impact on patients' travel experience in the wayfinding situation. Since the outpatient department lobby area is always overcrowded, patients' movement in the lobby

space becomes difficult. As a result, patients' travel experience in the outpatient department is negatively affected. When patients are able to locate their destinations easily, spend less time walking, and find the registration area less crowded, they become more satisfied with hospital layouts and their travel experience in wayfinding situations improves.

According to this study of patients' wayfinding experience in the hospitals of Bangladesh, patients value the design quality of the hospital environment. A comfortable floor finish, comfortable lighting, a circulation space with windows and seating arrangement, and comfortable waiting room furniture may help improve patients' satisfaction with the quality of design.

The study also shows that integration, integration -3 and intelligibility of hospital layout may negatively affect patients' satisfaction in wayfinding situation. More visual and physical accessibility may attract more people (Hillier 1997). This may result in crowding, which affects patients' satisfaction negatively.

In Bangladesh, patients' searching behavior is a useful measure to predict patients' satisfaction with overall signage, perceived travel time, and with overall layout in wayfinding situations. Analysis shows that proper orientation signage and signs of appropriate size may reduce patients' searching behavior, and may improve their travel experience in wayfinding situations in the outpatient departments of the six hospitals in Bangladesh. When patients stop more on their way to locate the waiting room, their satisfaction with perceived travel time decreases. In addition, help-seeking behavior also affects patients' satisfaction with perceived travel, denoting that asking for directions gives patients a feeling of spending more time in wayfinding. As a result, their travel experiences worsen. Furthermore, the syntactic properties of hospital layouts may affect patients' wayfinding behavior. The study shows that higher integration and

connectivity values increase searching behavior, patients' travel time, and decrease patients' travel experience in wayfinding situations.

Chapter 5 ANALYSIS BASED ON GENDER

5.1 Introduction

The aim of this Chapter is to look at patients' satisfaction in the wayfinding situation according to gender. The correlational analysis has been done to understand the effect of the signage system, complexity of the spatial layout, design quality, syntactic properties of the layout, and wayfinding behavior on male and female patients' satisfaction separately.

5.2 Patient Satisfaction and Signage System

The analysis showed no correlation between male patients' satisfaction with the overall signage system and the orientation signage, and showed good correlation with the identification signage (r = 0.484**) and the directional signage (r = 0.412**) (Table 5-1). For female patients' satisfaction, the identification signage (r=.472**), the directional signage (r = 0.455**) and the orientation signage(r = 0.178**) were important (Table 5-1). The size of signage was more important to improve the satisfaction of male patients (r = 0.556**) than it was for female patients (r = 0.338**).

Satisfaction with Complexity of the Layout	**Directional Signage**	**Orientation Signage**	**Identification Signage**	**Size of Signage**
	Sign showing different parts are useful for me	You are here map is useful for me	Room numbering system follow floor number and large enough for me	Size of sign is appropriate and easy to read
Male	**.412****	.165	**.484****	**.556****
Female	**.455****	**.178****	**.472****	**.338****

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

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

Table 5-1 Correlation between Patient Satisfaction and Signage System By Gender

5.3 Patient Satisfaction and Spatial Layout

5.3.1 Information Booth and its Surrounding Area

In the hospitals of Bangladesh, male and female patients showed different correlations with various environmental design factors of *information desk and its surrounding area.* For male patients, "easy to locate the information desk" (r = 0.290**) is an important factor to increase their satisfaction with the time taken to reach service. Male patients are also more satisfied with the overall layout when they find less congestion around the ticket counter (r = -0.324**) (Table 5-2). For female patients, satisfaction with the amount of time to reach destination does not show any correlation with "easy to locate information desk" and "circulation area not congested around the ticket counter," but their satisfaction with the overall layout shows significant correlation with "easy to locate information desk" (r = 0.209**)(Table 5-2). The findings indicate that the amount of time and more space around information booth are important factors for male patients' satisfaction. In contrast, female patients' satisfaction depends on how easily they are able to locate the ticket counter from the entry.

5.3.2 Walking time

The analysis showed a significant negative correlation (r= -.324**) between male patients' walking time and male patients' perceived travel time (Table 5-2). This might indicate that when a male patient spent less time walking to reach his destination in a wayfinding condition, his satisfaction increased with the perceived travel time. The findings support a previous study that showed a long clinic visit could have a major impact on patients' satisfaction (Wanyenze et al., 2010)

For female patients, the analysis showed no correlations, suggesting that spending more time in walking was not an important factor for female patients' satisfaction with the overall layout and the perceived travel time.

Patient Satisfaction Based on Gender		Information desk easy to find	Circulation area not congested around Info. desk	Spend more time on walking	Necessary function located in close proximity	Easy to locate waiting room	Elevator or stair are easy to find	Corridor are wide enough
Male	Satisfied with amount of time taken to reach service	**.290****	.136	**-.324****	**.401****	**.650****	**.311****	.183
	Satisfied with overall layout	.008	**.413****	-.008	.107	.172	**.312****	**.628****
Female	Satisfied with amount of time taken to reach service	.106	.089	-.063	**.306****	**.280****	.130*	**.240****
	Satisfied with overall layout	**.209****	.083	.040	**.191****	**.185****	.097	**.177****

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

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

Table 5-2 Correlation between Patient Satisfaction and Spatial Layout by Gender

5.3.3 Proximity of Necessary Functions, Waiting Room and Stair/ Elevator

The analysis showed that male patients were satisfied with the overall layout when they easily located the stairs or the elevator (r = 0.312**) in the outpatient department (Table 5-2). Proximity of necessary functions and waiting room had no effect on male patients' satisfaction with the overall layout. In contrast, female patients' satisfaction showed weak positive associations with "necessary functions located in close proximity" (r = 0.191**), and with "easy-to-locate waiting room" (r = 0.185**) (Table 5-2).

5.3.4 Circulation Corridor

The analysis showed that male patients (r = 0.628**) were more satisfied than female patients (r = 0.177**) with the hospital layout in their wayfinding situations when the corridors were wide (Table 5-2). At the same time, the width of the corridor showed a significant correlation (r = 0.240**) with female patients' satisfaction with perceived travel time, but it did not show any correlation with male patients' satisfaction with the perceived travel time (Table 5-2). One

wonders if the findings can be explained by the fact that across cultures men have larger personal spaces than women as reported in the literature (Evans & Howard, 1973).

5.4 Patient Satisfaction and the Degree of Architectural Differentiation

The analysis showed that a comfortable floor finish is positively correlated with male (r = 0.270**) and female (r = 0.494**) patients' satisfaction with the overall quality of design. In addition, comfortable lighting was positively correlated with male (r = 0.355**) and female (r = 0.445**) patients' satisfaction with the overall quality of design (Table 5-3). For male patients, circulation spaces with windows did not have any correlation with their satisfaction with the overall quality of design in wayfinding situations. However, for female patients (r = 0.376**), circulation spaces with windows helped increase their satisfaction with the overall quality of design in wayfinding situations (Table 5-3).

Satisfied with Overall Quality of Design	Comfortable floor finish	Comfortable lighting	Circulation Space have windows to get outside view	Circulation Space have seating to take rest	Waiting room furniture is comfortable
Male	**.270****	**.355****	.241*	**.421****	**.452****
Female	**.494****	**.445****	**.376****	**.330****	**.450****

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

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

Table 5-3 Correlation between Patient Satisfaction and Design Quality by Gender

The analysis also showed that when waiting room furniture was comfortable and outpatient corridors had seating provisions, both male and female patients' satisfaction with the overall layout tended to increase (r = 0.452** and r = 0.450**), respectively (Table 5-3).

5.5 Patient Satisfaction and Syntactic Properties of the Layout

Female patients' satisfaction with the signage system is negatively correlated with integration-n (r = -0.192**) and integration-3 (r = -0.227**) (Table 5-4). These findings would indicate that

when female patients chose an integrated route they became dissatisfied. One wonders if female patients in Bangladesh are uncomfortable in more integrated spaces because more people use these spaces.

Satisfaction with Syntactic Properties of the Layout			Satisfaction			
			Satisfied with overall signage system	Satisfied with amount of time taken to reach service	Satisfied with overall layout	Satisfied with overall quality of design
Gender	Male	Route inte. as parts of the whole building	-.023	-.172	**-.211***	-.023
		Route inte.-3 as parts of the whole building	-.084	-.205	-.050	.031
		Route connectivity as parts of the whole building	-.060	-.126	.153	.090
		Route depth as parts of the whole building	-.016	.101	.245*	.033
		Route inte. vs. inte.-3 as parts of the whole building	.084	-.037	**-.305****	-.070
		Route inte. vs. connectivity as parts of the whole building	.118	.010	**-.366****	-.125
	Female	Route inte.as parts of the whole building	**-.192****	.027	-.028	-.039
		Route inte.-3 as parts of the whole building	**-.227****	-.026	-.092	-.098
		Route connectivity as parts of the whole building	-.155*	-.040	-.125	-.144*
		Route depth as parts of the whole building	.123	-.064	-.029	-.015
		Route inte. vs. inte.-3 as parts of the whole building	-.075	.092	.060	.038
		Route inte. vs. connectivity as parts of the whole building	-.029	.093	.088	.070

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

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

Table 5-4 Correlation between Patient Satisfaction and Syntactic Properties of the Layout by Gender

The analysis also showed that intelligibility (r = 0.366**) and intelligibility-3 (r = -0.305**) properties of the layout had greater negative effects on male patients' satisfaction (Table 5-3). Since the intelligibility value is related to the legibility of the environment, the finding of the study would suggest that a more legible outpatient department might help increase male patients' travel experience and satisfaction.

5.6 Patient Satisfaction and Wayfinding Behavior

5.6.1 Searching Behavior vs Patient Satisfaction

The analysis showed that male patients' searching behavior was negatively correlated with their satisfaction with signage (r = -0.423**) and perceived travel time (r = -0.348**) (Table 5-5). The analysis also showed that signage of appropriate size produced less searching behavior among male patients' (r = -0.337**) (Table 5-6). On the other hand, female patients' searching behavior showed significant negative correlation with signage (r= -.253**), perceived travel time (r= -.332**), and overall layout (r= -.260**) (Table 5-5). When the outpatient environment had no orientation signage system, female patients produced more searching behavior, decreasing their satisfaction with the signage system (Table 5-6).

Satisfaction and Wayfinding Behavior			**Wayfinding Behavior**			
			Patient travel time	Stopping behavior	Searching behavior	Help-seeking
Gender	**Male**	Satisfied with overall signage system	-.248*	**-.433****	**-.423****	-.256*
		Satisfied with amount of time taken to reach service	**-.484****	**-.439****	**-.348****	-.268*
		Satisfied with overall layout	-.070	-.022	-.185	.123
		Satisfied with overall quality of design	-.065	-.068	-.230*	.077
	Female	Satisfied with overall signage system	**-.247****	-.055	**-.253****	-.118
		Satisfied with amount of time taken to reach service	**-.384****	-.234**	**-.332****	**-.270****
		Satisfied with overall layout	**-.221****	-.060	**-.260****	-.151*
		Satisfied with overall quality of design	-.171*	-.016	-.156*	-.100

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

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

Table 5-5 Correlation between Wayfinding Behavior and Overall Patient Satisfaction

			Directional Signage	Size of signage	Orientation Signage	Identification Signage	Satisfied with overall signage system
			Sign showing different parts are useful for me	Size of sign is appropriate and easy to read	You are here map is useful for me	Room numbering system follow floor number and large enough for me	Satisfied with overall signage system
Gender	Male	Travel time	**-.287****	**-.313****	.027	-.098	-.248*
		Stopping behavior	**-.331****	**-.319****	-.124	-.143	**-.433****
		Searching behavior	-.194	**-.337****	-.174	-.154	**-.423****
		Help-seeking behavior	**-.334****	-.175	-.270*	-.102	-.256*
	Female	Travel time	-.150*	-.142	-.082	-.101	**-.247****
		Stopping behavior	.006	-.056	.027	-.023	-.055
		Searching behavior	-.144	-.112	**-.223****	-.153*	**-.253****
		Help-seeking behavior	.002	-.058	-.040	-.138	-.118
		Help-seeking behavior	-.191	-.242*	-.009	-.203	-.114

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

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

Table 5-6 Correlation between Wayfinding Behavior and Signage System of the Layout by Gender

In the case of spatial layout, when male patients in Bangladesh found that when all the necessary functions (r = -0.405**) and the waiting rooms (r = -0.531**) of outpatient department were located in close proximity, their searching behavior was reduced and their satisfaction with perceived travel time was increased. On the other hand, when female patients found the waiting room in close proximity to the entry (r = -0.218**) and when they spent less time walking (r = 0.200**), they executed less searching behavior, thereby increasing their satisfaction with spatial layout and perceived travel time (Table 5-7).

Pearson Correlation			Information desk easy to find	Circulation area not congested around Info. desk	Spend more time on walking	Necessary function located in close proximity	Easy to locate waiting room	Elevator are easy to find	Corridor are wide enough	Satisfied with amount of time taken to reach service	Satisfied with overall layout
Gender	**Male**	Travel time	-.167	-.127	**.401****	**-.392****	**-.582****	-.189	-.046	**-.484****	-.070
		Stopping behavior	-.245*	.045	**.364****	**-.447****	**-.504****	-.252*	.031	**-.439****	-.022
		Searching behavior	-.167	-.043	.261*	**-.405****	**-.531****	-.243*	-.042	**-.348****	-.185
		Help-seeking behavior	-.155	.146	.249*	-.095	**-.324****	-.040	.143	-.268*	.123
	Female	Travel time	.014	-.096	**.212****	-.156*	**-.206****	-.003	.042	**-.384****	**-.221****
		Stopping behavior	.026	.034	.139	-.059	-.149	-.084	.068	**-.234****	-.060
		Searching behavior	.068	.053	**.200****	-.151*	**-.218****	-.039	.037	**-.332****	**-.260****
		Help-seeking behavior	.064	-.054	-.031	-.072	-.092	.027	.042	**-.270****	-.151*

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

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

Table 5-7 Correlation between Wayfinding Behavior and Spatial Layout of the Layout by Gender

Male patients' searching behavior did not show any correlation with the syntactic properties of the layout (Table 5-8). But for female patients, the searching behavior showed positive correlation with route Integration-n (r = 0.242**), denoting that when female moved through the more integrated route their searching behavior increased (Table 5-8).

5.6.2 Stopping Behavior vs Patient Satisfaction

The analysis of patients' stopping behavior according to gender showed that male patients' stopping behavior was negatively correlated with their satisfaction with signage (-.433**) (Table -6) and perceived travel time (-.439**) (Table5-6). Therefore, increasing the number of identification signs and the size of signage should help reduce male patients' stopping behavior,

and increase their satisfaction level. In contrast, female patients' stopping behavior showed negative correlation with their satisfaction with perceived travel time (r= -.234**) (Table: 5-6), but showed no correlation with their satisfaction with signage and overall layout.

Pearson Correlation			Route Integration (whole building)	Route Integration -3 (whole building)	Route Connectivity (whole building)	Integration vs Integration-3 (whole building)	Integration vs Connectivity (whole building)
Gender	Male	Travel time	**.293****	**.393****	**.291****	-.031	-.160
		Stopping behavior	.005	.180	.222*	**-.284****	**-.347****
		Searching behavior	.189	.191	.071	.064	.041
		Help-seeking behavior	-.218*	-.032	.086	**-.416****	-.420
	Female	Travel time	**.259****	**.278****	**.266****	.154	.028
		Stopping behavior	-.036	-.009	.067	-.041	-.053
		Searching behavior	**.242****	.204*	.123	.207	.154
		Help-seeking behavior	.132	.165*	.193*	.052	.005

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

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

Table 5-8 Correlation between Wayfinding Behavior and Syntactic Properties of the Layout by Gender

Male patients' stopping behavior showed positive significant correlation with spending more time in walking (r=.364**) and negative strong significant correlation with close proximity of necessary functions (r= -.447**) and waiting room (r= -.507**) (Table 5-7). On the other hand, female patients' stopping behavior had no correction with the complexity of the layout (Table 5-7) or the syntactic properties of the layout (Table5-8). In addition, male patients' stopping behavior showed negative association with Intelligibility–n (r=-.347**) and Intelligibility-3 (r=-.284**) properties of the layout (Table: 5-8).

5.6.3 Help-Seeking Behavior vs Patient Satisfaction

Male patients' help-seeking behavior showed a significant positive correlation with directional signage (r=-.334**) (Table 5-6), and a significant negative correlation with easy to locate waiting room (r =-.324**) (Table 5-7). When the directional signage was useful to easily locate the waiting room, help-seeking behavior was reduced. On the other hand, female patients' help-seeking behavior showed significant negative correlation with the perceived travel time (r= -.270**) (Table 5-3). When female patients asked for directions more frequently, the increase in perceived travel time affected their satisfaction negatively.

5.6.4 Travel Time vs Patient Satisfaction

The analysis showed a significant negative correlation between male patients' actual travel time and male patients' satisfaction with perceived travel time (r=-.484**) (Table 5-5). For female patients, actual travel time was significantly correlated with their satisfaction with the overall signage system (r=-.247**), perceived travel time (r=-.384**), and overall layout (r=-.221**) (Table 5-5). These findings would indicate that in wayfinding situations, when female patients' actual travel time increased, their satisfaction with overall signage, overall layout, and perceived travel time decreased.

The analysis showed positive correlations between male patients' actual travel time and integration (r=.293**), integration-3 (r=.393**), and connectivity (r=.291**) of the layout. It also showed positive correlations between female patients' actual travel time and integration (r= .259**), integartion-3 (r= .278**), and connectivity (r= .266**) (Table 5-8).

5.7 Conclusion

The analysis of patients' satisfaction in wayfinding situations according to gender shows that for both male and female patients, identification signage and directional signage are important

factors for improving patients' satisfaction in wayfinding. The male patients show more satisfaction with the overall layout when they find less congestion around the ticket counter, when they find the staircase and elevator in close proximity, when the corridors of the outpatient department are wide. On the other hand, female patients' satisfaction with layout depends on how easily they are able to locate the ticket counter waiting room and other functions from the entry in the outpatient departments. The findings also show that the design quality of the outpatient departments has effects on both male and female patients' satisfaction in wayfinding situation. In addition, a higher integration value of the layout helps male patients to understand the whole system from the local information and to execute the wayfinding task. However, more people in integrated spaces may decrease male patients' satisfaction. Similarly, more people in integrated space may also decrease female patients' satisfaction.

Chapter 6 ANALYSIS BASED ON HOSPITAL LAYOUT TYPES

6.1 Introduction

The aim of this Chapter is to look at how patient satisfaction is associated with features of the signage system, layout complexity, design quality, spatial syntax and wayfinding behavior based on hospital layout type. In this study, the three types of layout described in chapter 3 are used here for analysis. 6.2 Patient Satisfaction and Signage Systems

Satisfaction with the overall signage system according to hospital layout types shows that in the courtyard-type layout, the identification signage, directional signage, and the orientation signage have no correlation with "patients' satisfaction with the signage system". In other words, signage may not be an important factor for patients in Bangladesh in the courtyard- type hospital layout, which is a rather simple layout in which to move around due to openness. However, the analysis shows significant positive correlation between the size of signage and "patients' satisfaction with signage system" in the courtyard-type layout (r=.385**) (Table 6-1).

Satisfaction with Layout Type	**Directional Signage**	**Orientation Signage**	**Identification Signage**	**Size of Signage**
	Sign showing different parts are useful for me	You are here map is useful for me	Room numbering system follow floor number and large enough for me	Size of sign is appropriate and easy to read
Courtyard-type	.170	.087	.265	**.385****
Compact-linked-type	**.418****	**.233****	**.498****	**.388****
Hybrid –linked-type	**.494****	.060	**.453****	**.379****

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 6-1 Correlation between Patient Satisfaction and Signage System based on Layout Type

In contrast, in the Compact-linked-type layout where clinical functions are laid in a sequential order, patients' satisfaction shows correlations with identification signage (r = 0.498**),

directional signage (r = 0.418**), orientation signage (r = 0.233**), and the size of the signs (r = 0.388**) (Table 6-1).

In the Hybrid-linked-type layout, the orientation signage shows no correlation with patients' satisfaction. But in this type of layout, patients' satisfaction shows positive correlations with identification signage (r = 0.453**), and directional signage (r = 0.493**). In addition, patients' satisfaction shows positive moderate correlation with the size of signage (r = 0.379**) (Table 6-1). These findings indicate that due to complex functional distribution in hybrid-linked-type layout patients depend more on identification and directional signage. When patients find signs showing different parts of the outpatient department and the room numbering system to be useful, they become more satisfied with the wayfinding system of outpatient departments.

6.3 Patient Satisfaction and Spatial Layout

6.3.1 Information Booth and its Surrounding Area

Patients' satisfaction with overall layout shows significant positive strong correlation with "circulation area not congested around the ticket counter" in courtyard-type layout (r=.555**) (Table 6-2). In the compact-linked type, satisfaction with the overall layout shows significant positive correlation with "easy-to-locate information desk" in the compact-linked-type layout (r=.285**). More importantly, the analysis of patients' satisfaction in different layout types shows that patients' satisfaction with perceived travel time is not affected by the location of the ticket counter and congestion in the lobby area in both the compact-link-type and the courtyard - type layouts. But for the hybrid-linked type layout "easy-to-locate information desk" has a significant correlation with patients' satisfaction with perceived travel time (r=.239**) (Table 6-2). These findings indicate that in the compact-linked type and the courtyard-type layout, patients' perceived travel time is not an important factor, but in the hybrid-linked type layout

people actually take note of how much time they need to reach their destinations (r=.319**) (Table 6-2).

Pearson Correlation			Information desk easy to find	Circulation area not congested around Info. Desk	Spend more time on walking	Necessary function located in close proximity	Easy to locate waiting room	Elevator or stair are easy to find	Corridor are wide enough
Layout Type	Compact – linked-type	Satisfied with amount of time taken to reach service	.112	.134	-.020	**.378****	**.427****	**.303****	**.329****
		Satisfied with overall layout	**.285****	.156*	.047	**.340****	**.350****	.154*	**.366****
	Courtyard-type	Satisfied with amount of time taken to reach service	-.018	.333*	**-.483****	**.389****	.366*	-.274	.271
		Satisfied with overall layout	.208	**.555****	.066	.006	-.211	-.106	**.694****
	Hybrid-linked-type	Satisfied with amount of time taken to reach service	**.239****	.080	-.175*	.214*	**.319****	.082	.113
		Satisfied with overall layout	.138	.094	-.058	-.008	.157	.196*	.108

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 6-2 Correlation between Patients' Satisfaction and Complexity of the Layout based on Layout Type.

6.3.2 Walking Time

The analysis of patients' satisfaction with the overall layout shows no correlation with the amount of time they spent walking in different hospital types. Only for the courtyard-type layout did the analysis show that if patients spent more time on walking, their satisfaction with the perceived travel time decreases their satisfaction (r = 0.-483**) (Table 6-2). The finding suggests that less walking time to locate their destination can improve patients' travel experience in the courtyard-type layout. However, the reason for this remains unknown.

6.3.3 Proximity of Necessary Functions, Waiting Room and Stair/ Elevator

The analysis of patients' satisfaction according to layout type shows that in the courtyard-type and the hybrid-linked-type layout, patients' satisfaction with overall layout did not show any correlation with proximity of necessary functions, waiting room and stair/elevator (Table 6-2). In contrast, in the compact-linked-type layout, patients' satisfaction show a good positive associations with 'necessary functions located in close proximity' (r = 0.340**) (Table 6-2).

6.3.4 Circulation Corridors

The analysis of patients' satisfaction with spatial layout and perceived travel time shows that when the corridors are wide, patients are more satisfied with spatial layout in the courtyard-type (r = 0.366**) and the compact-linked-type layouts (r = 0.694**). But the hybrid-linked-type layouts do not show any correlation with the width of the corridor (Table 6-2).

6.4 Patient Satisfaction and the Degree of Architectural Differentiation

The analysis of patients' satisfaction in relation to spatial layout according to layout type shows that design quality defining architectural differentiation has greater effect on patient's travel experience in the compact-linked-type and hybrid-linked-type layout in this study (Table 6-3). In this case, patients in compact-linked-type layout are more concerned with design quality than are patients in the hybrid-type-layout. In the courtyard-layout, it's comfortable floor finishes (r=.499**) have an impact on patients' satisfaction. The other design variables related to architectural differentiation have no correlation with patients' satisfaction in the courtyard-type layout (Table 6-3).

Satisfied with Overall Quality of Design		Comfortable floor finish	Comfortable lighting	Circulation space have windows to get outside view	Circulation space have seating to take rest	Waiting room furniture is comfortable
Layout Type	Compact-linked-type	**.529****	**.607****	**.443****	**.431****	**.483****
	Courtyard-type	.328*	.119	.161	.364*	**.490****
	Hybrid–linked-type	**.388****	**.273****	**.321****	**.257****	**.384****

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 6-3 Correlation between Patient Satisfaction and Design Quality Based on Layout Type

6.5 Patient Satisfaction and Syntactic Properties of the Layout

The analysis shows that patients' satisfaction with signage has significant negative correlations with the integration-n (r = -0.218**), and integration-3 (r = -0.197**) properties of the layout in the compact-linked-type layout (Table 6-4). The findings suggest that visibility and accessibility of the layout is important for the compact-linked-type layout and may have an impact on patients' satisfaction. For the courtyard-type layouts and hybrid-linked-type layout, patient satisfaction does not show any correlation with visibility and accessibility properties of the layout. It is possible that there is an association between patient satisfaction and the syntactic properties of the layout in courtyard-type and hybrid-linked type layout, but that this association has been suppressed by some other factors.

Pearson Correlation			Satisfied with overall signage system	Satisfied with amount of time taken to reach service	Satisfied with overall layout	Satisfied with overall quality of design
Layout type	Compact –linked-type	Route Inte. as parts of the whole building	**-.218****	-.138	-.155*	-.096
		Route Inte.-3 as parts of the whole building	**-.197****	-.116	-.142	-.110
		Route connectivity as parts of the whole building	-.098	-.040	-.075	-.107
		Route Inte. vs. inte.-3 as parts of the whole building	-.168*	-.128	-.114	-.012
		Route inte. vs. connectivity as parts of the whole building	-.079	-.077	-.050	.044
	Courtyard -type	Route Inte. as parts of the whole building	.c	.c	.c	.c
		Route Inte.-3 as parts of the whole building	.c	.c	.c	.c
		Route connectivity as parts of the whole building	.c	.c	.c	.c
		Route Inte. vs. inte.-3 as parts of the whole building	.c	.c	.c	.c
		Route Inte. vs. connectivity as parts of the whole building	.c	.c	.c	.c
	Hybrid -linked -type	Route Inte. as parts of the whole building	.c	.c	.c	.c
		Route Inte.-3 as parts of the whole building	.c	.c	.c	.c
		Route connectivity as parts of the whole building	.c	.c	.c	.c
		Route Inte. vs. inte.-3 as parts of the whole building	.c	.c	.c	.c
		Route Inte.vs. connectivity as parts of the whole building	.c	.c	.c	.c

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 6-4 Correlation between Patient Satisfaction and Syntactic Properties of the Layout Based on Layout Type.

6.6 Patient Satisfaction and Wayfinding Behavior

6.6.1 Searching Behavior vs Patient Satisfaction

Patients' searching behavior show negative good correlation with signage system (r = -0.273**), spatial layout (r = -0.244**), and negative strong correlation with perceived travel time (r= -.404**) in the compact-linked-type layout (Table 6-5). In the courtyard-type, searching behavior does not have any correlation with the signage system and spatial layout, but does have a good correlation with satisfaction with perceived travel time (r = -0.424**). In hybrid-linked-type,

patients' searching behavior has good negative correlation with patients' satisfaction with signage (r = -.378**). In this case, appropriate orientation signage is negatively correlated with patients' searching behavior (r = -0.318**) (Table 6-6). This may help improve patients' satisfaction.

Pearson Correlation			Wayfinding Behavior			
			Patient travel time	Stopping behavior	Searching behavior	Help-seeking
Layout Type	Compact - linked-type	Satisfied with overall signage system	**-.255****	-.112	**-.273****	-.168*
		Satisfied with time taken to reach service	**-.423****	-.202*	**-.404****	-.189*
		Satisfied with overall layout	**-.219****	-.007	**-.244****	-.051
		Satisfied with overall quality of design	-.149	.097	-.183*	-.043
	Courtyard-type	Satisfied with overall signage system	.034	.039	-.008	-.030
		Satisfied with time taken to reach service	**-.424****	-.272	**-.395****	-.249
		Satisfied with overall layout	.241	.302*	.050	.258
		Satisfied with overall quality of design	.185	.227	.008	.231
	Hybrid – linked-type	Satisfied with overall signage system	-.209	-.186	**-.378****	-.114
		Satisfied with time taken to reach service	**-.348****	**-.301****	-.165	**-.363****
		Satisfied with overall layout	-.145	-.146	-.275*	-.161
		Satisfied with overall quality of design	-.147	-.215	-.189	-.079

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 6-5 Correlation between Patients' Wayfinding Behavior and Overall Patients' Satisfaction Based on Layout Type

When patients are able to locate the waiting room more easily in the compact-linked-type(r= -.302**) and courtyard-type layouts (r=-.421**), their searching behavior may be reduced and their satisfaction with layout and with perceived travel time may be increased. In hybrid-linked-type layout, patients' searching behavior shows negative good correlation (r= -.314**) with proximity of necessary functions.

Pearson Correlation			**Directional Signage**	**Size of Signage**	**Orientation Signage**	**Identification Signage**	**Satisfied with Overall Signage System**
			Sign showing different parts are useful for me	Size of sign is appropria te and easy to read	You are here map is useful for me	Room numbering system follow floor number and large enough for me	Satisfied with overall signage system
Layout Type	Compact-linked- type	Travel time	-.172*	**-.218****	.043	-.090	**-.255****
		Stopping behavior	.014	-.086	.111	-.013	-.112
		Searching behavior	-.060	-.128	-.064	-.143	**-.273****
		Help-seeking behavior	.066	.031	-.085	-.094	-.168*
	Courtyard-type	Travel time	.039	.048	.128	.116	.034
		Stopping behavior	-.009	-.075	.174	-.045	.039
		Searching behavior	-.062	-.013	-.159	-.016	-.008
		Help-seeking behavior	-.118	-.175	.095	-.112	-.030
	Hybrid - linked -type	Travel time	-.240*	-.158	-.121	-.120	-.209
		Stopping behavior	-.069	-.143	.099	-.059	-.186
		Searching behavior	-.251*	-.261*	**-.318****	-.182	**-.378****
		Help-seeking behavior	-.191	-.242*	-.009	-.203	-.114

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 6-6 Correlation between Patients' Wayfinding Behavior and Signage System Based on Layout Type

In compact-linked type layout, the searching behavior shows weak but significant positive correlation (r=199**) with integration properties of the layout, denoting that when patientsmove through the more integrated route, they execute more searching behavior due to the presence of more people.

Pearson Correlation			Information desk easy to find	Circulation area not congested around Info. Desk	Spend more time on walking	Necessary function located in close proximity	Easy to locate waiting room	Elevator are easy to find	Corridor are wide enough	Satisfied with amount of time taken to reach service	Satisfied with overall layout
Layout type	Compact –linked-type	Travel time	.062	-.192*	.209*	-.208*	**-.381****	-.067	-.069	**-.423****	**-.219****
		Stopping behavior	.162	-.063	.112	.031	-.108	-.107	.005	-.202*	-.007
		Searching behavior	.099	-.089	.206*	-.101	**-.302****	-.005	-.049	**-.404****	**-.244****
		Help-seeking behavior	.162	-.035	-.076	-.061	-.041	.042	.100	-.189*	-.051
	Courtyard -type	Travel time	.059	.215	.357*	-.224	**-.458****	-.103	.212	**-.424****	.241
		Stopping behavior	.151	.343*	.301*	-.146	**-.443****	-.279	.362*	-.272	.302*
		Searching behavior	.045	.136	.139	-.234	**-.421****	-.094	.074	**-.395****	.050
		Help-seeking behavior	.169	.305*	.172	-.106	**-.480****	-.248	.322*	-.249	.258
	Hybrid -linked -type	Travel time	-.184	-.119	.294*	-.283*	-.195	-.072	.085	**-.348****	-.145
		Stopping behavior	-.219	-.070	.262*	-.261*	-.215	-.087	.078	**-.301****	-.146
		Searching behavior	-.104	.114	.247*	**-.314****	-.232*	-.234*	.109	-.165	-.275*
		Help-seeking behavior	-.194	-.193	.185	-.037	-.131	.072	-.110	**-.363****	-.161

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

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

Table 6-7 Correlation between Patients' Wayfinding Behavior and Spatial Layout Based on Layout Type.

6.6.2 Stopping Behavior vs Patient Satisfaction

The analysis of patients' stopping behavior according to hospital layout type shows that patients' stopping behavior does not have any effect on patients' satisfaction with signage, layout type, or design quality. Only in the hybrid-linked-type layout, stopping behavior shows a negative correlation with patients' satisfaction with perceived travel time (r = -0.301**) (Table 6-7), denoting that when patients stop more frequently in the wayfinding situation, they become less

satisfied with their perceived travel time. When patients are easily able to locate their waiting rooms, they stop less (r = -0.443**) in wayfinding situation.

Pearson Correlation			Route integration (whole building)	Route integration -3 (whole building)	Route Connectivity (whole building)	Integration vs Integration-3 (whole building)	Integration vs Connectivity (whole building)
Layout Type	Compact-linked -type	Travel time	**.328****	**.319****	**.230****	.170*	.011
		Stopping behavior	-.006	.043	.079	-.085	-.102
		Searching behavior	**.199****	.156*	.097	.173*	.108
		Help-seeking behavior	**.206****	**.210****	.197*	.107	.005
	Courtyard - type	Travel time	.[c]	.[c]	.[c]	.[c]	.[c]
		Stopping behavior	.[c]	.[c]	.[c]	.[c]	.[c]
		Searching behavior	.[c]	.[c]	.[c]	.[c]	.[c]
		Help-seeking behavior	.[c]	.[c]	.[c]	.[c]	.[c]
	Hybrid – linked-type	Travel time	.[c]	.[c]	.[c]	.[c]	.[c]
		Stopping behavior	.[c]	.[c]	.[c]	.[c]	.[c]
		Searching behavior	.[c]	.[c]	.[c]	.[c]	.[c]
		Help-seeking behavior	.[c]	.[c]	.[c]	.[c]	.[c]

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 6-8 Correlation between Patients' Wayfinding Behavior and Syntactic Properties Of The Layout Based on Layout Type.

6.6.3 Help-seeking Behavior vs Patient Satisfaction

Analysis of help-seeking behavior according to layout type shows that patients' satisfaction in the courtyard-type and the compact-linked-type layout do not show any correlation with help-seeking behavior. In other words, these two types of layouts have no effects on patients' help-seeking behavior and satisfaction with overall layout, signage, and quality of design. In case of hybrid-linked-type layout, patients' satisfaction with perceived travel time showed significant negative correlation (r = -0.363**) with help-seeking behavior. According to the morphological study of hybrid-linked-type layout in Chapter 3, this type of layout shows a more complex functional distribution where new outpatient departments are segregated from the main structure.

In addition, the multilevel complexities often found in this type also lead patients to choose help-seeking behavior more often to reach their destination quickly. When patients ask for directions more frequently, their satisfaction with perceived travel time is affected. Wiener, Büchner, & Hölscher (2009) defined this type of wayfinding task as an uninformed task.

On the other hand, in compact-linked-type layout, patients' help-seeking behavior shows positive correlation with Integration-n (r = 0.206**) and Integration-3 (r = 0.210**), denoting that when patients move though the integrated route they need more help to find their way. In this case, due to the presence of more people in the more integrated route, patients cannot process environmental information easily and therefore execute more help-seeking behavior.

6.6.4 Travel Time vs Patient Satisfaction

In compact-linked-type layout, patients' actual travel time shows good correlation with patients' satisfaction in relation to signage system (r = -0.255**) and spatial layout (r = -0.219**) (Table 6-7). Furthermore, patients' travel time shows strong correlation with patients' satisfaction in relation to perceived travel time in compact-linked-type layout (r = -0.423**), courtyard type layout(r = -0.424**) and hybrid-linked-type layout(r = -0.348**) (Table 6-7). The findings suggest that increasing the size of signage may reduce the actual travel time in wayfinding situations in the compact-linked-type layout (r = -0.218**) (Table 6-7). In addition, when patients find their waiting room and all the functions are in close proximity, it reduces travel time in all layout types (Table 6-7). Moreover, in the compact-linked-type layout, patients' travel times shows positive good correlation with integration-n (r = 0.328**), Integration-3 (r = 0.319**) and connectivity(r = 0.230**) (Table: 6-8).

6.7 Conclusion

In the outpatient department, patient satisfaction varies due to different layout types. The findings show that in courtyard-type, where all the functions are arranged around the courtyard, the signage is not important for improving patients' travel experience in wayfinding situations. In this type of layout, patients' satisfaction depends on whether or not there is crowding around the information desk. Design quality has little effect on patient satisfaction in the courtyard-type layout. Only comfortable waiting room furniture helps to improve patient travel experience in wayfinding situations. In addition, the syntactic properties of the layout do not have any relation to patient satisfaction in wayfinding situations. In this type of layout, when patients use less travel time and produce less searching behavior, their satisfaction with perceived travel time improves. An easy-to-locate waiting room and proximity to necessary functions help reduce patients' searching behavior, stopping behavior, and travel time in the courtyard type hospitals in Bangladesh.

In the compact-linked-type layout, patients' travel experience and satisfaction depend on directional signage, identification signage, orientation signage, and the size of signage. When patients can easily find the information booth, waiting room, and necessary functions in the layout and when corridors are wide, then patients become more satisfied with the layout in wayfinding situations. The findings show that design quality has an effect on patients' satisfaction in the compact-linked -type layout. The findings also show that in compact-linked type-layout when patients move through the more integrated route, their satisfaction with signage decreases. In addition, in this type of layout if patients' travel time and searching behavior decrease, then their satisfaction in wayfinding situation may improve. Furthermore, bigger signage and waiting room in close proximity may reduce their travel time and searching

behavior. Moreover, in compact linked type layout, a more integrated route increases patients' travel time, searching behavior, and help-seeking behavior because of the presence of more people in the outpatient department.

In the hybrid-linked-type layout, patients' satisfaction depends on directional signage, identification signage, and the size of signage in the outpatient department of the studied hospital in Bangladesh. In this type of layout, when patients can easily locate the information desk and waiting room, their satisfaction improves. Like the compact-linked-type layout, design quality plays a greater role to improve patients' satisfaction in wayfinding situations. The findings show that patients' travel time, stopping behavior, and help-seeking behavior negatively affect patients' satisfaction with perceived travel time. However, patients' wayfinding behavior has no correlation with the signage system, layout complexity, and the syntactic properties of layouts.

Chapter 7 DISCUSSION

7.1 Introduction

Understanding patients' satisfaction is fundamental for designing a patient-centered healthcare environment. Several studies on patients' satisfaction have reported that the physical design of the hospital has directly or indirectly impact patients' experience and perceived quality of care (Arneill and Devlin ,2002; Becker & Douglass, 2008; Becker, Sweeney, & Parsons, 2008; Fottler et al., 2000; Harris, McBride, Ross, & Curtis, 2002). Studies have also shown that difficulties in wayfinding can lead to a loss of time and a decrease in safety, and an increase in environmental stress (Carpman, Grant, & Simmons 1993) and, as a result, may lower patients' satisfaction level. In most cases, personal and cultural differences in spatial behavior, proximity to other people and objects, body posture and movement within hospital settings also generate stress and reduce the performance of wayfinding. Therefore, the aim of this chapter is to discuss the potential determinants of patients' satisfaction in wayfinding situations in relation to the findings of this dissertation research.

7.2 Potential Determinants of Patient Satisfaction in Wayfinding Situations

Patient satisfaction is a useful measure in assessing patient's experience in health care. This study suggests that patients' interaction with environmental variables, their individual differences, and their interaction with other people play a role in wayfinding and travel experience. Therefore, understanding the environmental, personal, and social variables (social interaction and privacy issues) that control the interaction between patients and the healthcare environment is important to improve patients' experience.

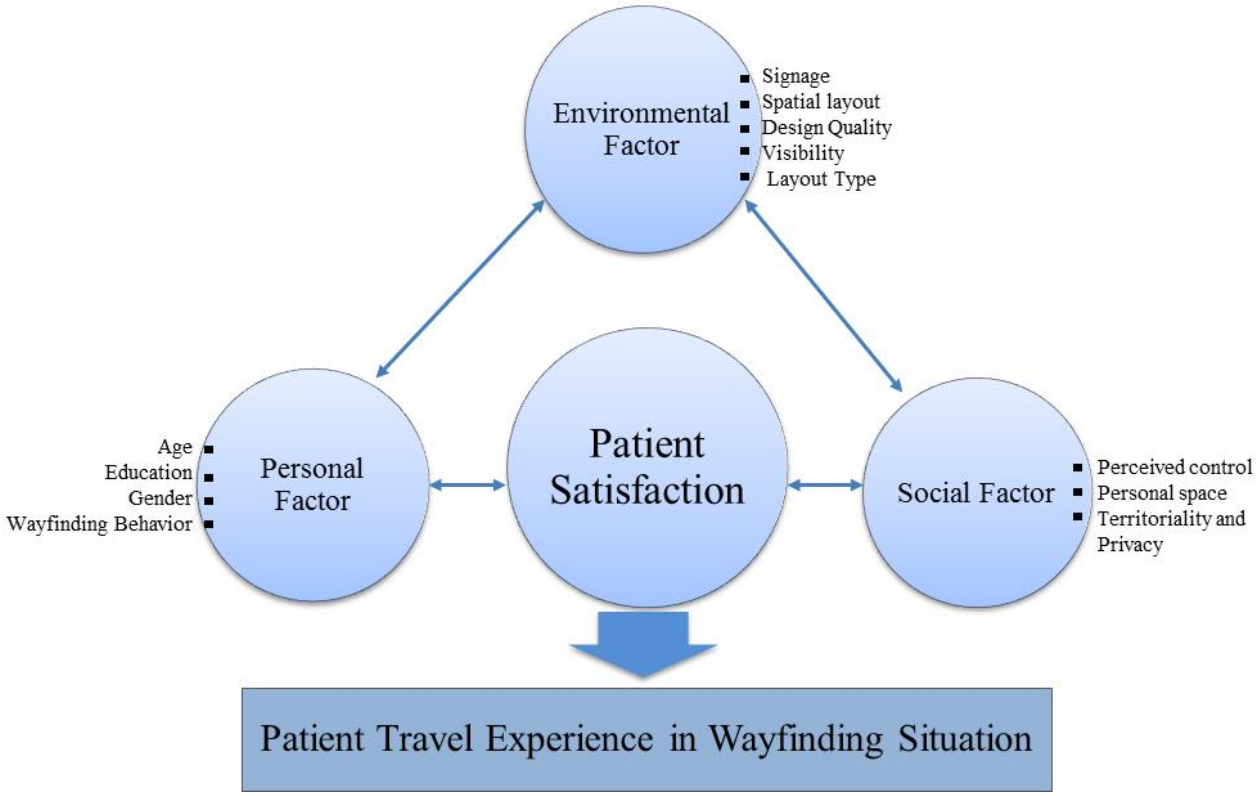

Figure 7-1 Potential Determinants of Patient Satisfaction in Wayfinding Situations

7.2.1 Environmental Factors

The research findings show that signage system, layout complexity, design quality, and visual and physical accessibility are four environmental factors that help improve patients' satisfaction in wayfinding situations in hospitals. This is in accord with Wiseman (1981), who found that these environmental components can influence the ease with which one can comprehend the overall layout of the building. According to this study, when these environmental factors help patients find their destinations, patients' satisfaction in wayfinding situations improves.

7.2.1.1 Signage System and Patients' Satisfaction

It is widely accepted in the literature that hospital environments, assisted by a proper signage system, can help patients find destinations and can maximize their performance in wayfinding

situations (Peponis et al. ,1990, Passini, 1992, Wiseman,1981, Carpman et al., 1993). An inefficient signage system can make patientsfeel lost in hospitals and can increase their stress and discomfort (Carpman et al., 1993, Passini, 1992). However, most existing wayfinding studies try to understand how signage can improve wayfinding performance without showing how signage can impact patient's satisfaction. This study fills in that gap by showing that among the three types of signage systems–the identification, directional, and orientation signage systems–identification signage is very important for patients' satisfaction in the outpatient department, indicating that patients find the identity of a location to be important in wayfinding situations. The legibility of the signage also has an effect on patients' satisfaction. In wayfinding situations, people face difficulties with illegible signage systems–signs that are too small to be seen and recognized from the reading distance of the sign (Passini (1992). According to this study, when appropriately sized signs help patients reach their destination, their satisfaction improves.

7.2.1.2 Spatial layout and Patients' Satisfaction

A number of previous studies suggest that layout complexity has primary influence on Patients' wayfinding performance (Dogu & Erkip, 2000; Weisman, 1981; O'Neill, 1991). It has also been suggested that people depend more on spatial layout and other architectural features than on signage in wayfinding situations (Carpman et al.1993; Weisman 1981). As floor plan complexity increases, wayfinding performance decreases (O'Neill, 1991). The main assumption behind floor-plan complexity is that it conveys information about a building that cannot be mentally represented until the building is repeatedly navigated, or until the paths gets familiar to the people (Weisman, 1981). In addition, a simple and regular spatial system makes the building easy to understand in wayfinding situations (O'Neill 1991; Weisman 1981). Moreover, complexity of the hospital layout makes patients feel lost and frustrated in wayfinding situations

(Carpman et al., 1993; Weisman, 1981; O'Neill, 1991). However, it is not fully acknowledged in the literature if layout complexity has any effect on patient's satisfaction in wayfinding situations in hospitals. According to this research, the spatial layout of the hospital is highly salient to the patients, because it affects their comfort and hospital experience. This research shows that patients become more satisfied with layout type and hospital environment when they easily find the information desk, waiting room, and stair and elevator, when they find necessary functions in close proximity, when the corridor is wide, and when it takes less time to reach their destination.

Concerning spatial layout, the circulation corridor is a key organization feature. Passini (1992) refers to it as the bone structure that connects all building functions all together. The primary function of the circulation corridor is to carry patients to their destination. But in Bangladesh, most often the circulation corridor works as a place where patients and staff spend time waiting, gathering information, and talking. From the perspective of wayfinding, it is the place where people have to make wayfinding decisions. According to this research, overcrowding in corridors may affect patients' wayfinding performance and satisfaction level.

7.2.1.3 Design Quality and Patient's Satisfaction

Design quality defines the degree of architectural differentiation that gives a place an identity. When different parts of the environment look the same, it is difficult to construct a cognitive map or to form an overall image of the layout. According to Passini (1992), distinctiveness can be achieved by the form and volume of space and by the use of finish, color, lights, and graphics. In hospitals, these interior design features (floor finish, lighting, wall color, furniture) help to distinguish the physical environment and help patients to find their way (Carpman et al., 1993; Weisman, 1981).

According to this research, design qualities of the environment of a hospital can affect patients' perception and experience. The research shows that interior design features like floor finish, color, artwork, and the layout of the furniture can affect patients' experience and satisfaction in the wayfinding situation. These findings support previous research (Arneill & Devlin, 2002; Becker & Douglass, 2008; Harris et al., 2002) where environmental quality was shown to affect patient satisfaction.

Lighting can significantly improve one's walking experience along a corridor. It can also improve how wayfinding elements are used. Further, it can help define destination departments, and reveal important information along the way. It can signal a change such as the beginning of a ramp or a level change along one's way. As a result, lighting can facilitate safe and comfortable movement in wayfinding situations (Carpman etal., 1993). The current study finds that when lighting conditions of the outpatient department help patients recognize destinations, and help them find important wayfinding information along the way, patients are more satisfied.

The current study also finds that when patients find floor finish more comfortable, their satisfaction with design quality improves. Additionally, it also finds that having seating arrangements along the corridor may help to improve patients' travel experience and satisfaction with overall quality of design regardless of gender and layout type. Furthermore, the study finds that comfortable waiting room furniture can improve patients' satisfaction with overall spatial layout regardless of gender and layout type.

7.2.1.4 Syntactic Properties of the Layout and Patients' Satisfaction

Literature shows that the syntactic properties of the layout produced by space syntax analyses have the ability to predict the deliberate use of space in wayfinding situation (Haq, 1999, 2003; Haq & Girotto, 2003; Haq & Zimring, 2003; Penn, 2003; Peponis, Zimring, & Choi, 1990;

Montello, 2007). Haq (1999) suggests that space syntax provides the necessary environmental understandings to study the relationship between the mental structure and the environmental structure. Space syntax also examines the relationship between behavior and space by examining behavior not only with respect to its local setting, but also with respect to the global setting (Bafna, 2003). When there is a poor relationship between local and global features of the environment, people have difficulty figuring out the configuration of an area. In space syntax terms, this relationship between the local and the global measure of spatial structure is referred to as intelligibility.

Literature also shows that integration-n is a good predictor of wayfinding behavior. In wayfinding situations people tend to move toward those spaces which have more visual and physical connections or higher integration (Haq & Zimring, 2003; Kim & Penn, 2004). The present study shows that spaces with higher integration value do not have any effects on patients' overall satisfaction and travel experience. However, when patients use routes that are more integrated at the local level, their satisfaction with signage in wayfinding situations may decrease due to crowding. The research findings support the previous environmental psychological studies (Evans et al., 1987, Evans & Wener, 2007; Sinha et al., 1995) that suggest negative consequences of excessive social interaction, that spatial density has adverse effects on the wellbeing and healing process of patients.

7.2.1.5 Layout type and Patients' Satisfaction

This study shows that hospital layouts can affect patients' satisfaction. In a courtyard-type hospital layout that is ringy and therefore provides more choice of movement, the signage system has no effect on patients' satisfaction, but the size of signage does have an effect on patients' satisfaction. It also shows that when signs are readable from an appropriate distance and are

helpful in wayfinding situations, patients' travel experience and satisfaction improve. However, it should be noted here that more choice of movement may make corridors overcrowded in a ringy layout, and this may negatively affect patients' satisfaction in wayfinding situations. In this case, a wider corridor may help improve their satisfaction.

In contrast to a ringy courtyard-type layout, a compact-linked-type layout with local rings and bush like sub-complexes provides less choice of movement from the exterior to the interior complex. In this type of layout, all clinical functions are linked in a bush-like layout and the circulation spaces are connected with each other through the local ring. The current research finds that in this type of layout, patients depend more on the signage system to find their destinations. During wayfinding, when patients easily find the directional signage, orientation signage, and the identification signage, their satisfaction improves. As this type of layout provides some degree of controlled movement in the outpatient department, the factors of an easy-to-locate registration area and waiting room and proximity to necessary functions have greater effects on patients' satisfaction.

In the hybrid-linked-type layout where all functions are laid on both the local and the global ring due to complex functional distribution patients' travel experience depends more on identification and directional signage. At the same time, when patients can easily locate the registration area and waiting room during their visit in the outpatient department of this type of layout, their satisfaction may improve.

Summarizing all the findings, it is evident that depth of space and choice of movement play an important role when patient satisfaction is considered in relation to the three layout types.

7.2.2 Personal Factors

Patients' characteristics or personal factors are important determinants of patient satisfactions in wayfinding situations. Understanding patient characteristics helps us to explain patients' perceptions and attitudes towardthe hospital environment. A number of studies have found substantial associations between patient satisfaction and socio-demographic characteristics of patients such as age, education , gender, social class, and race (Cleary and McNeil 1988; Sitzia and Wood 1997). However, among several personal factors this research has studied the effects of gender only.

7.2.2.1 Gender

The literature shows an inconsistent correlation between gender and patients' satisfaction. Some studies reported that gender difference has an impact on patient satisfaction (Rahmqvist, 2001; Schoenfelder, Klewer, & Kugler, 2011; Wiseman et al., 2000). Others studies, such as Sitzia & Wood (1997), argued that patient's gender does not have any effect on patients' satisfaction. (Weisman, Rich et al. 2000) found that women's satisfaction score was much lower than men's for the accessing care and amenities factor, that women are always less satisfied with the length of time between making an appointment and the day of visit, the length of waiting time at the visit before seeing the doctor, and the ease of parking. However, these studies did not find significant difference between males and females in overall rating of care received (Weisman, Rich et al. 2000).The present research shows that gender has significant effect on patients' satisfactions in wayfinding situation. The next following section will show how patients' satisfaction with the signage system, spatial layout and the syntactic properties of the layout differs according to gender.

Gender and Signage System

The findings of this research suggest that in wayfinding situations, both male and female patients depend on identification signage and directional signage. When room numbering systems and signs showing different parts of the layout are useful in wayfinding situations, male and female patients are satisfied with the signage system of layout. The orientation signage is important for female patients' satisfaction but not for men patients' satisfaction. Wayfinding literature has already reported that men are significantly more confident than women in locating the direction of destination, and women are significantly more uncertain about giving direction to the destination (Lawton, Charleston & Zieles, 1996). The findings of the current study and other research may suggest that proper placement of you-are-here maps can be useful for improving female patients' satisfaction in wayfinding situation.

Gender and Spatial Layout

The findings of this research suggest that travel time and the spaciousness of information booths are important factors for male patients' satisfaction. In contrast, female patients' satisfaction depends on how easily they are able to locate their destination from the entry. In this case spending more time in walking is not an important factor for female patients' satisfaction with the overall layout and the perceived travel time. On the other hand, when male patients' spend less time walking to reach destinations, they are more satisfied with the perceived travel time and spatial layout, denoting that travel time is an important factor for male patients. One explanation for the observed differences may be that in Bangladesh men spend a lot more time on paid work, while women spend substantially more time on family. So, when male patients visit the hospital for any sickness they actually lose their paid time. As a consequence, when they spend more time walking in the building they become more dissatisfied with the environment.

Corridor width is also an important determinant of patients' satisfaction in wayfinding situations in the hospitals of Bangladesh. The findings of this study show that male patients are more satisfied with the layout than female patients are when corridors are wide. It is reported in literature that across cultures men have larger personal space than woman (Evans and Howard 1973). Larger personal space makes male patients uncomfortable when they move through a narrow corridor. When male patients move through a narrow corridor, they get a feeling of loss of control over their personal space. Sommer (1969) defines this personal space as "the emotionally charged bubble of space which surrounds each individual". Hall (1969) elaborates this concept, which he terms as "proxemics," to define the distance between people and their sensory zones. Research shows that invasion of personal space produces stress and discomfort (Betchtel, 1997). Therefore, corridor width should be considered carefully in relation to male patients' overall satisfaction with spatial layout.

Gender and Syntactic Properties of the Layout

The study shows that in wayfinding situations male patients' satisfaction with layout complexity depends on the intelligibility properties of the layout. Intelligibility is a mathematical way of describing spatial configuration and is an important measure of environmental cognition in wayfinding situations. It does not just represent the physical environment, but also represents the process by which the mind acquires spatial knowledge ((Kim, 2001). There are two approaches to measure the intelligibility of a space. The psychological approach always tries to understand the way people experience and perceive the physical environment at the cognitive level. The syntactic approach suggests that spatial cognition is linked to the spatial configuration of individual areas and to the way the spatial properties of an area interact with the surrounding area.

Hillier (1996) argues that intelligible layout can contribute to the intuitive understanding of spatial configuration. In this context syntactic intelligibility supports Lynch's idea that defines the legibility of the environment from the perspective of spatial cognition. The concept of intelligibility is most similar to what Lynch (1960) proposes in his research as "imageability," Rashid (2012) proposes that buildings become intelligible in two ways. In one of the two ways, people get the idea of whole building layout from bird's eye view or in the form of a floor plan diagram. In the other way, people understand the building through experiencing the indoor environment over time. He suggests that to make the building intelligible in the second way, "the structure of experience of architecture" is important. In wayfinding situations, the variation in the perceived local properties of the building, which is related to the global form, determine the structure of male patients' travel experience in wayfinding situation.

In contrast, female patients' satisfaction depends on the global and local syntactic properties, such as integration and connectivity, of the layout. Literature shows that integration is associated with various aspects of human behavior in the built environment (Haq & Zimring, 2003; Kim & Penn, 2004). Haq & Zimring (2003) suggests integration as a strong predictor of wayfinding performance inside large buildings like hospitals. Their findings show that as people become more familiar with the environment, their wayfinding performance depends more on global integration than on local syntactic properties when they are asked to find specific destinations. The links between acquisition of spatial knowledge and integration are more profound in the study of Kim & Penn (2004).

7.2.2.2 Wayfinding Behavior

In wayfinding situations, patients produce different types of body moment or gesture to help them process information. According to (Alibali 2005), body gestures influence problem-solving

strategy and, at the same time, help in expressing, communicating, and thinking about spatial information. McNeill (1992) supports the contribution of gesture in spatial cognition. According to his theory, gesture or body movement plays an important role in spatial thinking and helps produce more mental images to incorporate spatial information. In wayfinding situations, patients' searching behavior helps collect and store spatial information in memory. When environments fail to provide enough information, people retrieve information from their past experience and execute searching behavior. In this case, proper use of the orientation signage and proper size of signage systems may reduce their searching behavior and improve their satisfaction in wayfinding situations. According to this study, a well-organized outpatient department, where necessary functions are in close proximity and where patients easily find their waiting room and spend less time in walking, can reduce searching behavior and increase patients' satisfaction with layout.

This study shows that in integrated spatial layouts patients execute more wayfinding behavior, and in more intelligible layouts male patients show less stopping behavior in the outpatient department. Therefore, when the signage system and the configuration of spatial layout support healthy wayfinding behavior, male patients' satisfaction may improve.

7.2.3 Social Factors

Social factors affecting patients' social interaction within the outpatient environment may also affect patients' travel experience in wayfinding situations. In most cases, the size of space determines the individual's interaction levels. In this research, social factor is discussed only in terms of perceived control and privacy.

7.2.3.1 Perceived Control

Perception of control over situations is an important psychological determinant of patients' satisfaction in wayfinding. Literature shows that the perception of loss of control can increase stress and adversely affect wellbeing (Ulrich, 1991; Devlin & Arneill, 2003). Disorientation, noise, lack of privacy, and the absence of a view are environmental factors that contribute to the loss of control. Literature also shows that a crowding experience leads to lower perceived control, which, in turn, leads to more psychological distress (Baum, Aiello, & Calesnick, 1978; Hui & Bateson, 1991). Averill (1973) conceptualizes control in three different ways: behavioral control, cognitive control, and decisional control. Behavioral control refers to the "availability of a response which may directly influence or modify the objective characteristics of an event" (Averill 1973, p. 293). Cognitive control refers to the information available to the subject and the way in which an event is interpreted, appraised, or incorporated into a cognitive plan. Finally, decisional control refers to "choice in the selection of outcomes or goal" (Averill 1973, p. 289). Among these three sources of personal control, cognitive (or informational) control is the most efficient (Dion, 2004) to handle a crowding situation. According to Gärling, Lindberg, & Mäntylä, (1983), visual access facilitates the processing of information in wayfinding situation. In crowding situations, people lose their control over information received from the environment due to less visual access.

According to the findings of this research when patients move through the more integrated route, which is more visually and physically accessible, they interact with more people and experience crowding. Due to the crowding effect, patients fail to process signage information, and become dissatisfied with the signage system in the course of their wayfinding. Also according to this research, when patients find the signage system less helpful, or find that functions are not laid

out in close proximity and are difficult to find, and the environment lack in sufficient lighting, a comfortable floor finish, and a view of outside, they usually get lost in the buildings. As a result, they become less satisfied. Similar findings have been reported in the literature (Evans & McCoy, 1998).

Summarizing, the research shows that patients' loss of perceived control to orient them in the environment has a negative effect on patients' satisfaction level. Therefore, increasing patients' control or influence is, in fact, an important element in patient-oriented healthcare. This respects the autonomy and self-determination of patients and patients feel valued in that environment, and that is essential for patient satisfaction in wayfinding situation.

7.2.3.2 Privacy and Territory

In the wayfinding situation, privacy that promotes a sense of territory plays a role in patients' satisfaction. The findings of this study suggest that when patients use narrow corridors, they become less satisfied with layout complexity. One possible reason may be that when patients use narrow corridors they come in close contacts with other patients. As a result, they get a feeling of loss of control over their personal territory. Research shows that invasion of personal territory may produce stress and discomfort (Betchtel, 1997) and decrease satisfaction with spatial layout. In this case, following the rule of spatial hierarchy, the distribution of clinical function may promotes privacy in the healthcare environment (Evans & McCoy, 1998) and may create more positive feelings and satisfaction towards the spatial environment in wayfinding situations.

7.3 Conclusion

From the above discussion it is clear that patients' satisfaction in wayfinding situations is a multidimensional concept that deals with various social, personal and environmental aspects of a

particular situation. The findings support the definition of patient satisfaction as provided by Pascoe (1983, p.189): "Patients' emotional reaction to salient aspects of the context, process, and result of their experience." In wayfinding situation, when the physical environments of hospital provide cognitive and emotional support, it helps to increase patients' travel experience. Research findings show that legibility of the environment has a greater effect on patients' satisfaction. During wayfinding when patients face difficulties in finding their way because of the inadequacy of orientation signage and the improper size of signage system, they produce more searching behavior, and that this affects their satisfaction with signage negatively. On the other hand, due to layout complexity, patients may face difficulty in finding their destination, may spend more time in walking, and may produce more searching behavior, all of which may decrease their satisfaction with the hospital layout. The findings also suggest that when a patient's perceived travel time is lower than the actual travel time, then the patient is more satisfied with the signage system, the overall layout, and the design quality of the environment in the outpatient department of Bangladeshi hospitals. The findings support previous reported studies that explain patients' expectation as the best determinants of patient satisfactions (Thompson and Sunol 1995; Williams, Weinman et al. 1995; Sitzia and Wood 1997; Staniszewska and Ahmed 1999). In contrast, the findings suggest that the negative emotions due to crowding effect may lead dissatisfaction in wayfinding situation. In this case, perceived control over environment and privacy play a great role over patient travel experience in wayfinding situation.

Chapter 8 CONCLUSION

According to this study, patients' travel experience is a product of their cumulative experience acting in a network of interconnected wayfinding situations defined partly by signage, layout complexity, and interior design quality. The Beryl Institute defines patient experience (Wolf, 2013) as "the sum of all interactions, shaped by an organization's culture, that influence patients' perception across continuum of care." According to their definition, interaction, culture, perception, and continuum of care are the four core concepts that define patient experience. In wayfinding situation, patients' travel experiences begin from the moment they enter the lobby area in a hospital. From entry to destination, patients get their first impressions of the healthcare experience when they interact with the environment, even before receiving any services. The present research shows that a positive interaction with signage systems, spatial layouts, and interior design features helps to improve patient experience in the wayfinding situation. The research also shows that the factor of the layout type of the hospital as well as that of patient demography may play a role in shaping patients' wayfinding experiences. In addition, patients' personal interpretations of a situation based on their perceived control over environmental situations and privacy affect their travel experience during wayfinding.

Understanding patients' travel experience is important for designing a patient-centered healthcare environment. The US Agency for International Development (USAID) define patient–centered healthcare as "an approach to care that consciously adopts a patients' perspective. This perspective can be characterized around dimensions such as respect for patients' values, preferences, and expressed needs in regard to coordination and integration of care, information, communication and education, physical comfort, emotional support and alleviation of fear and

anxiety, involvement of family and friends, transition and continuity " (IAPO, 2007). The Picker Institute identified eight domains to use in evaluating patient-centered care in healthcare: respect for patient preferences and values; emotional support; physical comfort; information, communication and education; continuity and transition; co-ordination of care; involvement of the family and friends; and access to care (Gerteis et al., 1993). According to Laine & Davidoff, (1996), healthcare that is closely congruent with and responsive to patients' wants, needs and preferences may help to promote patient centered care in healthcare environment. Therefore, if an outpatient environment respects patients' values and preferences, provides sufficient information on wayfinding, helps to reduce travel time, and ensures easy access to care, and then this environment will promote patient-centered care.

The research presented in this dissertation is significant from the perspective of patient -centered design perspective which supports the practice of patient-centered care by creating supportive environmental conditions. The research recognizes the four principles identified above that support the goal of patient-centered design as a means to improve the outpatient environment when patients are in wayfinding situations. More specifically, the research findings demonstrate that when the environment supports patients' needs and expectations, provides adequate information for them to find their destinations, promotes healthy behavior, and protects patients' personal moments during their visits in the outpatient department, then that environment improves patients' travel experience in wayfinding situations and promotes patient-centered care in healthcare environment. Below, the findings with regards to each of the four principles are summarized.

Respect:

In wayfinding situations, patients feel valued as unique individuals when the outpatient environments are easily understandable, welcoming and helpful in processing the information patients need to reach their destinations. This research shows that a well-designed directional signage, sufficient space around the ticket counter, well-designed outpatient functions, waiting rooms that are easily accessible and have comfortable furniture, sufficient lighting, and outside window on the corridor, and appropriate floor finishes can improve patients' travel experience. Such an environment, therefore, can be considered more respectful to patients.

Communication:

Providing patients with sufficient information is not enough when people need to reach a destination within a limited time frame. In wayfinding situations, patients seem satisfied with an outpatient environment which provides them a clear non-verbal communication for executing the task of wayfinding. The findings of this research show that to promote patient -centered care in wayfinding, information should be legible, readable, and clear with appropriate size and language from an appropriate distance. When the environment provides information in a way that is sensitive to patients' expectations, it helps to increase their travel experience and satisfaction.

Behavior:

Patients, who feel valued and safe while trying to find their destinations experience healthy wayfinding behavior. In wayfinding situations, when patients face difficulties in finding their way because of signage system or complexity of the layout, they engage in more help-seeking, searching, and stopping behaviors. When patients execute more help-seeking behaviors, their perceived travel time increases, and their satisfaction in wayfinding situation decreases.

Therefore, inciting healthy wayfinding behavior may help promote safety in the outpatient department, and may also help create a more patient-friendly the hospital environment.

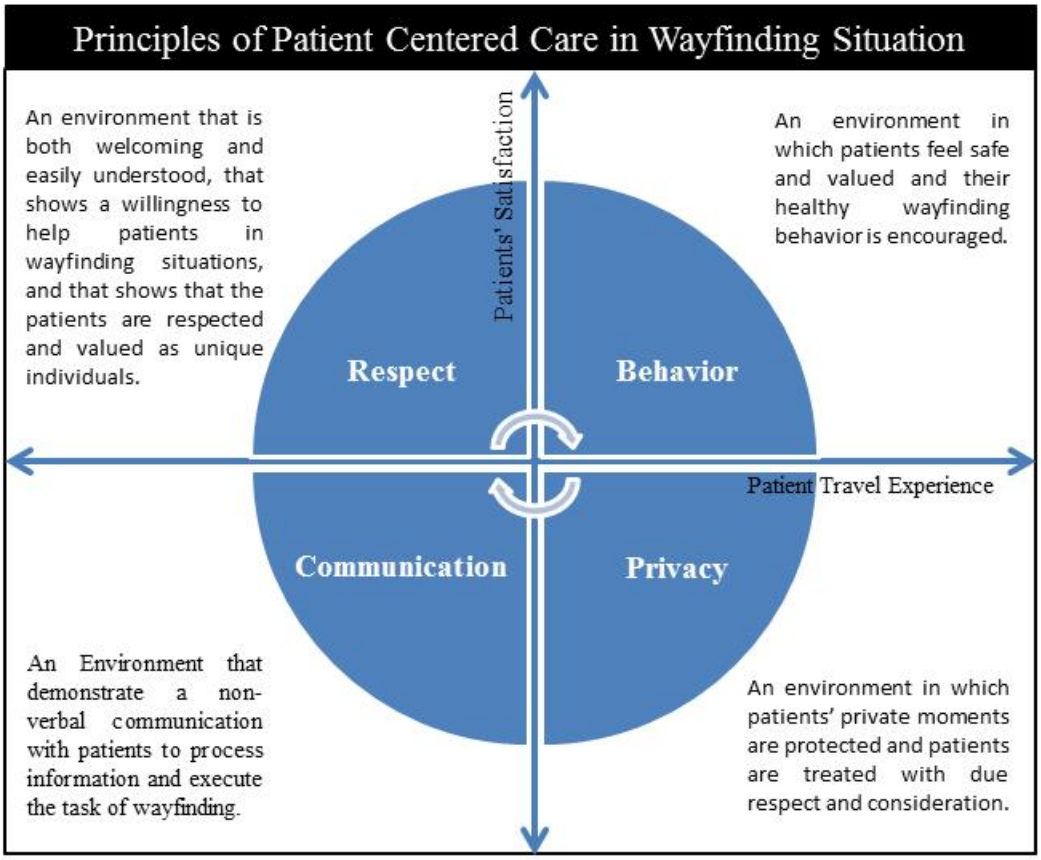

Figure 8-1: Patient-Centered Care in Wayfinding Situations

Privacy:

Design that respects patients' private moments in wayfinding situations promotes patient-centered design in the healthcare environment. According to this study, when the outpatient department is highly integrated with the whole hospital system, perceived crowding may lead to a sense of lack of control over the processing of information in wayfinding situations. Similarly, in crowding situations, intimate interaction with others gives patients a reduced sense of privacy due to a loss of control over their personal territory. Therefore, in outpatient environments,

patient's privacy needs to be protected by reducing crowding effects in integrated corridors for improved travel experiences.

In summary, the present research shows that to improve patients' travel experience and satisfaction in wayfinding situations, the design of outpatient departments should demonstrate respect of the patient, establish effective communication with the patient, encourage healthy wayfinding behavior by the patient, and provide privacy for the patient. In this regard, the concept of situation awareness may be important in promoting patient-centered care in the healthcare design process. Endley (1988) defines situation awareness as "the perception of the elements in the environment within a volume of space and time, the comprehension of their meaning and the projection of their status in the near future (p.5)." During wayfinding, situation awareness may help patients process information, plan, and make and execute decisions.

Situation awareness requires a perception of environmental variables and attributes. This research shows that in an unfamiliar environment, when patients understand the signage system, the spatial layout, and the quality of design, they find their way easily and have a better travel experience from entry to destination in the outpatient department. In addition, when patients' perceived travel time is less than their actual travel time, patients seem more satisfied with their travel experience.

Situation awareness also requires an understanding of the meaning of perceived environmental information in relation to the perceiver's relative objectives. Flach (1995, p.3) points out that during the construction of situation awareness, "meaning must be considered both in the sense of subjective interpretation (awareness) and in the sense of objectives significance or importance (situations)." In wayfinding situations, patients comprehend the surrounding environment and their position in it through processing the available environmental information (Passini, 1992).

This research shows that when patients understand the meaning of environmental information, they produce less searching, stopping and help-seeking behaviors and, as a result, they are more satisfied.

Finally, understanding the meaning of environmental information helps patients anticipate the future state of the environment, and this advance understanding is valuable for executing wayfinding task In wayfinding situations, being able to retrieve information from the environment or from past experiences and understand the meaning of the information helps patients feel safe in their existing situation and feel confident in deciding what future steps to take to achieve their objectives, thereby improving their travel experience .

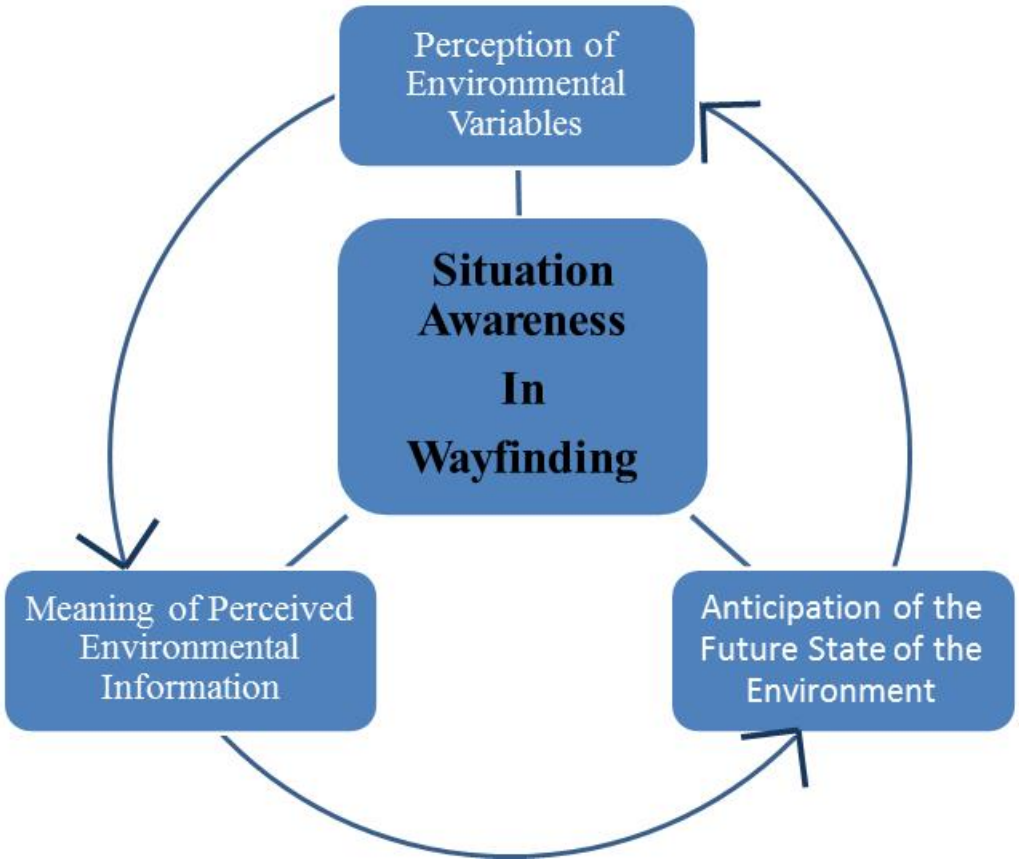

Figure 8-2 Stage of Situation Awareness during Wayfinding

From the above discussion it is clear that situation awareness relates to how patients orient themselves in an environment. Having full control over their wayfinding situations improves patients' travel experience and satisfaction. In addition, an awareness of the wayfinding situation is also important for decision-making in the healthcare design process. In this process, situation awareness may provide the healthcare designer with a sense of understanding of the environmental variables he or she need to focus on, and how these variables can help or hinder patients in finding their destinations.

This present research shows that systematic behavioral observation may be used as a powerful tool for promoting situation awareness during the design phase of a hospital outpatient department. This research also shows that a systematic patient survey can help designers understand the meaning of environmental variables related to patients' travel experience. According to this research, the best way to understand the environmental meaning is by asking patients about their interaction with the signage system, the complexity of the layout, and the design quality in wayfinding situations. Once designers have knowledge about the meaning of environmental variables that affect patients' travel experience in wayfinding situations, they may be better able to change the existing condition of the hospital to improve patients' travel experience.

Finally, according to this study, the analysis of the floor plans using space syntax techniques can be important in promoting situation awareness in the design phase. During design, space syntax can work as a visual representation tool to estimate the future state of patient movement in the hospital environment. By predicting patient movement, space syntax has the ability to inform the

designer of the potential crowding effect that may adversely affect a patient's sense of privacy and personal control in wayfinding situations.

In summary, the present research suggests patients' travel experience in wayfinding situations is a product of patients' interpretation of and interaction with a situation based on the cultural, social, and physical conditions of the environment. In designing for wayfinding, respect, communication, behavior, and privacy are four concepts that can promote patient-centered care in the outpatient environment. In this regard, awareness of wayfinding situations is important both for patients and also healthcare designers in order to improve patients' travel experience in these situations.

Limitations of the study and directions of future research

The study has several limitations indicating future research directions. Some of which are described below:

- For the selection of case-study hospitals, a convenience sampling method based on the availability of the floor plans at the time of data collection was used. As a result, the study included three compact-linked-type layouts, one courtyard-type layout and two hybrid-linked-type layouts. For better comparisons among different types of hospital layouts, an equal number of hospitals for each type of layout is necessary. Future studies should use equal and more hospitals for improved generalizability.
- Since many patients who participated in the questionnaire survey were illiterate the researcher needed to read and fill out the questionnaire on behalf of these patients. In the future, a qualitative research using patient interviews may be a better way to overcome the limitation.

- In this research, data analysis is focused on patients' satisfaction based on gender and layout type only. Further analysis focusing on individual background descriptive such as age, level of education, individual differences in cognitive abilities, visiting with others or not, and the number of prior visits to hospitals may provide additional interpretation of patients' travel experience in wayfinding situations.
- In this exploratory research, correlational analysis was used to reveal the degree of association between environmental, personal, and social factors and patients' travel experience in wayfinding situations. The analysis helped identify bivariate relationships, but it did not help establish any causal links. For example, correlational analysis showed a negative correlation between the size of corridor and patients' satisfaction with spatial layout. It remains unknown if the relationship was due to a third variable, such as the number of people in the corridor. To overcome this limitation, future studies should consider regression analysis to learn more about the relationships between predictor variables and patients' satisfaction in wayfinding situations.
- For floor plan analysis, the study used the axial map analysis of space syntax. Research has shown that other techniques of analysis like isovist (or visual fields) and visibility graph analysis also have the ability to predict certain experiential qualities of architecture (Franz and Wiener, 2005). Further analysis based on isovist and visibility techniques may help explain better the relationships among spatial variables, behaviors, and patient experience in wayfinding situations.

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APPENDIX 1: Understanding Patient Satisfaction (Literature Review)

1.1 Introduction:

Understanding patients' experience is fundamental for designing a patient-centered healthcare environment. Several studies on patients' satisfaction have reported that the physical design of the hospital has direct or indirect impact patients' experience and perceived quality of care .Direct impact refers the environment that directly affect patients' health condition, such as hygiene and safety. On the other hand, indirect impact refers to the psychological processes, which may be cognitive or emotional in nature, and which indirectly affect patients' experience and behavior and at the same time, affect patients' satisfaction. Therefore, the aim of this section is to understand the conceptual and theoretical construct of patients' satisfaction and their relation to the physical environment of hospital settings.

1.2 Patient Satisfaction:

Patient satisfaction is a useful measure in assessing a patient's experience in health care. Pascoe (1983, p.189) defines patient satisfaction as the "patients' emotional reaction to salient aspects of the context, process, and result of their experience." It is a multidimensional concept that deals with aspects such as the technical and interpersonal aspects of care, accessibility, and the outcome of the health intervention (Sitzia & Wood, 1997). The purpose of measuring patients' satisfaction is to understand patients' experiences of health care, to promote co-operation with treatment, to identify problems in health care, and to evaluate health care (Fitzpatrick, 1984).

Linder-Pelz (1982, p. 580) defines patient satisfaction as "the individual's positive evaluations of distinct dimensions of health care." In her study, she refers to satisfaction as an expression of an attitude which is related to one's belief about different aspects of care process. Her study points out that the personal preferences of patients, the patient's expectations, perceived quality of care, interpersonal comparisons of the healthcare experience, and an individual's belief in seeking or claiming a particular service are the important variables of patients' satisfaction (Linder-Pelz, 1982). In 1983, Ware et.al developed eight dimensions of patients' satisfaction: interpersonal manner, technical quality of care, accessibility/convenience,

finance, efficacy, continuity of care, physical environment, and availability of service (Ware, Snyder, Wright, & Davies, 1983).

From Fitzpatrick's (1984) perspective, satisfaction cannot be viewed as a single concept made up of several determinants. Instead, he develops three satisfaction models, each of which is associated with one determinant. According to his first model, socially created expectations are the primary determinant of the degree of satisfaction, and he terms this model as "the need for the familiar." In this case, cultural differences directly influence satisfaction. The second model, "the goals of help seeking," proposes that patients' satisfaction depends on their primary goal related to their health problem. The third model focuses on "the importance of emotional needs," uncertainty and anxiety that patients experience due to health problems and non-technical aspects of care. His models provide understanding that familiarity, quality of care, and emotional well-being are the main determinants of patients' satisfaction.

1.3 Determinants of Patient Satisfaction:

1.3.1 Expectations:

Patients' expectations can be defined as the anticipation of patients' experience in healthcare. It is the needs, requests or desires of the patient prior to seeking a doctor (Staniszewska & Ahmed, 1999; Williams, Weinman, Dale, & Newman, 1995). Various studies reported patients' expectations as the best determinants of patient satisfactions (Sitzia & Wood, 1997; Staniszewska & Ahmed, 1999; Thompson & Sunol, 1995; Williams et al., 1995). An understanding of patients' expectations gives us a sense what people expected to receive from their healthcare, compared with what they received in practice. If a patient's perception of his or her hospital experience meets or exceeds his or her expectations, there will be a corresponding degree of satisfaction. However, if the perception does not meet the expectation, dissatisfaction results (Staniszewska & Ahmed, 1999; Williams et al., 1995). Thus, patients' satisfaction results from healthcare that meets or exceeds patients' expectations.

1.3.2 Patients' Characteristics:

Patients' characteristics are another determinant of patient satisfaction. Understanding patient characteristics helps us to explain patients' perceptions of, and attitudes toward, the quality of care. A number of studies have found substantial associations between patient satisfaction and socio-demographic characteristics of patients such as age, education, gender,

social class, and race (Cleary & McNeil, 1988; Sitzia & Wood, 1997). Among them, age is the most consistent determinant of patient satisfaction. Evidence shows that older people have been found more satisfied with their healthcare services than the younger people (Rahmqvist, 2001; Schoenfelder, Klewer, & Kugler, 2011; Sitzia & Wood, 1997). Various studies also reported that the patient's level of education was significantly related to patient satisfaction (J. A. Hall & Dornan, 1990; Johansson, Oleni, & Fridlund, 2002; Sitzia & Wood, 1997). In this case a higher level of education is associated with a lower level of satisfaction. Literature shows an inconsistent correlation between gender and patients' satisfaction. (Sitzia & Wood, 1997) reported that patients' gender had no effect on patients' satisfaction. But evidence shows that gender difference has an impact on patient satisfaction (Rahmqvist, 2001; Schoenfelder, Klewer, & Kugler, 2011). (Weisman et al., 2000), in their study found women's satisfaction score was much lower than men's for accessing care and for an amenities factor. Their findings show that women are always less satisfied with the length of time between making an appointment and the day of visit, the length of waiting time at the visit before seeing the doctor, and the ease of parking. However, the study did not find significant difference between males and females in overall rating of care received (Weisman et al., 2000).

1.3.3Psychosocial Determinants of Satisfaction:

Literature shows that a number of "social-psychological artefacts" may indirectly affect patients' satisfaction (Sitzia & Wood, 1997). Psychological processes and social factors along with the physical environment which may affect health and wellbeing are stress, perceived control or impact on the environment, social interaction and social support, privacy, negative emotions (such as crowding, aggression, fear) that the physical environment can arouse, health- promoting behavior (the physical environment can promote "healthy" behavior or a healthy way of life, or break negative habits), and restorative effects (relaxation, relaxing, or restorative effects of, among other things, nature).

1.3.3.1 Stress:

One of the key factors affecting people's health and wellbeing as well as patients' satisfaction is stress. Literature shows that the physical environment is only one of the possible sources of stress, in addition to, for example, personal stressors (dismissal, divorce, etc.) or specific events (sickness). The ambient of the environment (such as noise and temperature), lack of privacy, and crowding are the main sources of stress in the built environment. In healthcare, the stress levels are often high as a result of concern, fear and complexity of the environment, or because of dealing with patients that are extremely sensitive to stress, such as psychiatric patients. It is, therefore, highly important to eliminate stress-creating factors from the physical care environment and to promote stress-remedying factors.

According to Evans & McCoy (1998), there are three general spatial principles that are associated with stress: stimulation, coherence, and affordances (Evans & McCoy, 1998) . Stimulation means the amount of information and stimuli that people face as a challenge in a built environment. Loud noise, bright light, unusual or strong smells, crowding, and inappropriately close interpersonal distances all are environmental properties that intensify the level of stimulation. Literature shows that the layout, circulation systems, individual position in space, and the shape and orientation of interior space have greater influence on visual and acoustic stimulation.

Coherence refers to the transparency and understandability of building elements and shape. This relates to how easily the spatial configuration of an interior can be recognized. The complexity of the physical environment, conflicting information, disorganization, and ambiguous cues disrupt spatial coherence. In this case the legibility of environment is an important factor in making a building coherent. Literature shows that the signage system spatial layout, differentiation of architectural space, visual access, landmark, and the way the circulation spaces are connected with each other all contribute to make the building legible (Weisman, 1981; Evans, 1980; Garling et al., 1986; Passini, 1984; Carpman et al., 1986.) The term "affordance" relates to the properties of an environment that tell us what actions are possible in that environment and what are the consequences of those actions (Heft, 1989). According to Gibson (1969), the concept of affordance refers to the perceivable functional meaning of objects and events that are carried out in the structure of ambient light. When a building user cannot understand the functional properties of building layout, and fails to understand the functional

meaning of interior design element due to vague and ambiguous information of the environment, mis affordances occur, producing stress on the user (Evans & McCoy, (1998).

1.3.3.2 Perceived Control:

Perception of control over situations is an important psychological determinant of patient satisfaction. Literature shows that the perception of loss of control can increase stress and adversely affect wellbeing (Ulrich, 1991(E. T. Hall, 1976); Devlin & Arneill, 2003). Disorientation, noise, lack of privacy, and the absence of a view are environmental factors that contribute to the sense of loss of control. If patients have control over their physical environment, they are better able to defend themselves against the stimuli and stressors of the hospital environment. It is, therefore, highly important to give patients maximum control over their situation by providing them with decision-making authority, choices, and/or information. Increasing patients' control or influence is, in fact, an important element in patient-oriented healthcare. Doing so respects the autonomy and self-determination of patients, which is essential for their wellbeing and satisfaction about the quality of the care. Insufficient spatial resources, inflexible spatial arrangements, lack of climatic or lighting controls, limited visual exposure, and increased structural depth of the layout are important factors that result in patients' lack of control over their environment (Evans & McCoy, 1998).

1.3.3.3 Social Interaction:

Generally, social interaction offers people relaxation and distraction and gives people support. Social support is considered an important coping strategy for people to deal with stressful situations like sickness and to promote recovery (Ulrich et al., 2004). There are strong indications that variation in the types of rooms and facilities will create options and offer the possibility for various types of social interaction. In environment-behavior literature, socio-petal configuration and socio-fugal configuration describe the physical characteristics of space that promote the social interaction. A socio-petal layout provides opportunity to adjust the personal space and make it more easily accessible and facilitates communication about a person's intentions (Lang, 1987). On the other hand, a socio-fugal layout separates people, reduces social interaction and leads to withdrawal and isolation (Hall, 1974). According to Ziesel (1981), the permeability of visual and acoustical barriers influence social interaction. The functional distance between spaces, the directness of door openings, the intersection of circulation paths, a well

designed focal point and visual access promote social interaction in the environment that directly affect patients' health condition the healthcare environment (Evans & McCoy, 1998).

1.3.3.4 ***Privacy and Territory:*** The importance of a built environment that respects the patients' privacy and encourages patients' satisfaction is critical. Lack of privacy leads to loss of control and autonomy and adversely affects the quality of communication between patients and staff (Ulrich et al., 2004). Privacy perception plays a role in the patient's wellbeing. Privacy proves important for a positive perception of the room. Both the extent of visual access (quantity of view of the room) and the extent of visual exposure (the extent to which a person is visible to others) turn out to affect the privacy perception (Archea, 1977). Research shows that the experience of lack of privacy and dissatisfaction with the environment leads to deterioration of one's health (Fuller et al., 2000). Privacy that promotes a sense of territory plays a role in organizing social interactions, in expressing one's identity and sense of association with the hospital environment. Generally, territory gives people a sense of safety and offers protection against stressors in the environment. The spatial hierarchy of hospital functions promotes privacy and effectiveness in the healthcare environment (Evans & McCoy, 1998). All these aspects suggest that the design of a care environment should accommodate a patient in personalizing the hospital environment and identifying his territory. This will create more positive feelings and satisfaction towards the spatial environment.

1.3.3.5 ***Negative Emotions (Crowding):*** Various environmental psychological studies show that one of the negative emotions that the environment can arouse comes from crowding. This refers to the negative consequences of excessive social interaction or spatial density (too many people in a room), which creates the sensation that there is not enough room available. Research shows that the associated sense of crowding may lead to a variety of psychological symptoms, such as arousal, overload, loss of control, stress, and aggression (Bell et al., 2001; (Prestopnik & ROSKOS–EWOLDSEN, 2000)). Particularly are hospitals places where, by definition, many different people come together who usually do not know one another. Research shows that excessive density can have adverse effects on the wellbeing and healing process of patients (Evans et al., 1992; Sinha et al., 2000). Literature shows that personal factors (for example, personality, attitude, expectation, and gender), social factors (for example, the number

and type of actions of others and attitude similarity), and physical factors (for example, architectural features and spatial arrangements) accentuate or ameliorate the effect of crowding. Individuals in some cultures seem to cope with high density. However, sensory overload and lack of personal control lead to many negative outcomes. Careful environmental design such as partitioning and behavioral zoning can ease crowding within a limited space (Gifford, Steg & Reser, 2011).

1.3.3.6 Restorative Effects:

Restorative qualities define the potential of design elements to function therapeutically, to reduce cognitive fatigue and other sources of stress. Restorative design elements function as a coping resource that can reduce stress by producing the balance between environmental demands and personal resources. In healthcare, the restorative design elements that stimulate fascination and exposure to nature draw patients' attention and reduce mental fatigue and stress. Fascination can be designed through providing a window view, a burning fireplace or various displays like moving water or an aquarium (Coss, 1973). Additionally, direct contacts with natural elements as well as views of nature enable restoration (Hartig & Evans, 1993; Kaplan & Kaplan, 1989; Ulrich, 1993). Restorative design elements supporting the healing effect should have as little distraction as possible and a certain extent of isolation.

1.4 Patient Satisfaction in the Context of Inpatient and Outpatient Departments:

Several studies on patients' satisfaction as well as research on the physical and social dimensions of the perception of healthcare quality have been carried out with different environmental conditions in both outpatient and inpatient settings. The outpatients spend much less time in the healthcare setting, and have less contact with doctors, nurses and administrative staff than do the inpatients. Therefore, perceptions of the hospital's physical and social environments have different significance for inpatients' and outpatients' satisfaction (Andrade et al., 2013).

In the inpatient context, patients' satisfaction depends on nursing care, medical care, communication, ward management, ward environment, and discharge procedures (Rubin, 1990). Abramowitz, Cote, & Berry (1987) identified 10 key areas of hospital care that have an effect on inpatients' satisfaction. These were medical care, housekeeping, nursing care, nurses' aides, staff explanations of procedures and treatments, noise level, food, cleanliness, and overall quality. In

the primary care setting, the continuity of care, accessibility of the surgery, quality of medical care, physical environment, and availability of doctors are the important components of patients' satisfaction (Baker, 1991). Harris et al. (2002) in their study tried to understand the relative contribution of environmental satisfaction to overall inpatients' satisfaction with the hospital experience. The findings show that satisfaction with interior design, architecture, housekeeping, privacy, and the ambient environment was perceived as a source of overall inpatients' satisfaction. Rowlands and Noble's (2008) study pointed out that attitude, competence, and helpfulness of the staff are important determinants of inpatient satisfaction rather than layout, furnishings, equipment, and decor of the ward. Fornara (2005) found that spatial-physical comfort and relations with staff were the best predictors of inpatient satisfaction, whereas outpatient satisfaction was predicted only by spatial-physical comfort. All studies show that patients' satisfaction depends on the physical environment of the facility as well as on the social environment such as customer service and staff interactions.

In the outpatient context, the environment in which the service is experienced can significantly improve patients' satisfaction and the perceived quality of care (Becker & Douglass, 2008; Becker, Sweeney, & Parsons, 2008; Fottler et al., 2000; Harris, McBride, Ross, & Curtis, 2002). Sitzia and Wood (1997) in their study propose that accessibility, waiting times, waiting environment, attitude of staff, and patient information are critical components of patients' satisfaction (Sitzia & Wood, 1997). The study by Becker et al. (2008) shows that a patient's perception of overall quality of care and experience depends on the physical attractiveness of the waiting room environment. His study compared patients' perception of quality of care in old and new settings of a dermatology department. The findings show that patients are more satisfied with the new waiting room area because of the pleasantness of the environment, more privacy, and less crowded conditions than the old waiting room. The Arneill and Devlin (2002) study showed that a nicely furnished, well-lighted waiting room that contained art work and was warm in appearance can increase patients' perceived quality of care as well as patients' overall satisfaction. Ware et al. point out different features of healthcare settings such as the clarity of signs and directions, orderly facilities, and equipment, and the pleasantness of the atmosphere are all important determinants of outpatient patients' satisfaction (Ware et al., 1983).

In order to understand the relationship between the healthcare physical environment and patients' satisfaction in both outpatient and inpatient setting, Andrade et.al. (2013) investigated the impact of patients' perception of the physical environment and social environment on patients' satisfaction with the care unit. The main objective was to explore how patient satisfaction differs in inpatient and outpatient units. The findings showed that patients' satisfaction with unit of care depends on the perception of the quality of the physical environment (e.g. spatial-physical comfort, orientation, quietness, views, and lighting) and of the social environment (e.g. social and organizational relationships, and privacy). More specifically, inpatients' satisfaction was affected by the way they perceived privacy and relationships with staff and organization of the care unit, whereas outpatients' satisfaction was affected by the quality of the physical environment. That means perceptions of the social environment are an important factor for inpatients' satisfaction but not for outpatients' satisfaction.

Most of the studies on patients' satisfaction in outpatient departments focus on the environmental qualities of the waiting area. However, less effort has been made to understand patients' satisfaction and travel experience when they are trying to find a destination. Literature shows that difficulties in wayfinding may cause delays in patients' movements through the hospital along with loss of time, decrease in safety, and increase in environmental stress, and at the same time, patients may feel a poor experience of care. In such a situation, understanding the environmental variables that have an effect on wayfinding problems may lead to a more satisfying healthcare experience.

1.5 Determinants of Patients' Satisfaction in Wayfinding Situations:

Patients' experience in the healthcare environment is an important factor in overall patients' satisfaction and care outcomes. According to Fottler et al. (2000), patients respond to the environment physiologically, cognitively, and emotionally. Physiological responses not only depend on the body's reaction to heat, cold, and other sensory effects but also depend on environmental effects on the patient's ability for processing information. In the wayfinding situation, a physiological response to processing information may cause the patients to become frustrated, confused, and lost in the environment due to too much or too little information (Carpman, Grant, & Simmons, 1993).

Cognitive response rests on a patient's expectation related to his or her prior experience with the environment. When patients enter a hospital, they try to make a non-verbal communication with the environment by the physical clues that are framed by their knowledge of a previous experience. When all environmental clues are located in appropriate positions and are consistent with their expected experience, patients can more easily reach their destinations and maximize their experience. In this situation, familiarity with the environment may play a large role in patients' wayfinding experiences (Dogu & Erkip, 2000; Iachini, Ruotolo, & Ruggiero, 2009; Prestopnik & Roskos-Ewoldsen, 2000). That means that when patients are more familiar with the environment, they become less confused and frustrated. At the same time, this familiarity helps to improve patients' experience. Finally, the positive emotional response to the environment can promote patients' satisfaction. In this case any experience that creates pleasure could increase satisfaction.

In healthcare, the patient gets his or her first impression of the healthcare experience from the environment, which mainly influences his or her expectations before he or she experiences any services. Ambient conditions, spatial conditions, and the signage system are three environmental components that patients usually perceive as a hospital customers when they first enter the hospital setting (Fottler et al., 2000). Ambient conditions have a subconscious effect on patients' perception and experience when they enter the hospital. Research shows that unpredictable and uncontrollable ambient environmental conditions like temperature, humidity, air quality, smells, sounds, physical comfort, and light can result in stress, and control over this ambient environment might enhance patients' satisfaction (Harris et al., 2002, Fottler et al., 2000). In wayfinding situations, lighting, measured as an environmental quality of space, can significantly influence the overall ambience of a corridor and the effectiveness of this wayfinding element (Carpman, Grant, & Simmons, 1993Carpman, Grant, & Simmons, 1993). When patients are trying to find their destination, lighting conditions of the outpatient department can help to define the areas along the hallways and to highlight meaningful level changes and important wayfinding information along the way. Similarly, a comfortable floor finish facilitates safe and comfortable movement. Different textures on a floor help to distinguish different departments. Moreover, seating arrangements along the route, comfortable waiting room furniture, and an outside view from the circulation corridor are all related to physical comfort.

The spatial layout of the hospital is highly salient to the patient. Efficiency of the physical layout facilitates the functional needs of patients and affects their comfort and hospital experience. Therefore, the functional congruence of environmental elements is an important consideration to maximize patient's experience in hospital (Fottler et al., 2000). From the perspective of wayfinding, functional congruence depends on how well a space with functional purpose fits into the environment of hospital. During their visit in a hospital, when patients find all functional space congruent with what they expect to find in that environment, their experience is improved. This research assumes that, in wayfinding situations, if patients find that the location of information desk, the waiting room, stairs and elevator, proximity of different functions, the size of the corridor and walking time to reach their destinations meet their expectations, their wayfinding experience will be maximized and at the same time their satisfaction will be increased..

Finally, signage, symbols, and artifacts that help to communicate information to patients in hospital environments improve experience. When patients find that the sign and symbol are in appropriate size, shape and color that help them to read easily, and that these are located in appropriate places where they can direct and teach the patient how to use the service easily, their satisfaction improves.

APPENDIX 2: Understanding the Wayfinding Situation (Literature Review)

2.1 Introduction:

Wayfinding is an interdisciplinary term. It has been extensively studied in environmental psychology, but other fields like cognitive psychology, architecture, interior design, behavior study, urban design and planning, and facilities management have also used wayfinding theories for research. In general, wayfinding refers to the process of finding ones' destination by following a route between an origin and a destination. The main intent of wayfinding research in healthcare facilities is to help design the environment that would assist patients in making decisions regarding how to reach a destination. Literature shows that wayfinding difficulties may cause problems such as loss of time, decreased safety, stress, or discomfort (Dogu & Erkip, 2000; Ulrich,et al., 2004, 2008; Cooper & Smith, 2004). But less effort has been made to show that wayfinding difficulties may adversely affect patients' satisfaction and travel experience. Therefore the goal of this Appendix is to provide an overview of the concepts and theories of wayfinding, to discuss the physical environmental characteristics and social characteristics that influence wayfinding and wayfinding behavior. Finally, this Appendix discusses the importance of wayfinding to improve patient travel experience.

2.2 Definition of Wayfinding:

In general the term "wayfinding" represents the cognitive processes of using spatial and environmental information to find one's way through the built environment. According to Lynch (1960, p. 3), wayfinding is based on "consistent use and organization of definite sensory clues from the external environment." Lynch's work provided the foundation for wayfinding research. He argued that when people move through an environment, the structure and characteristics of physical objects of that environment could help create an image of the environment in people's mind and could help people orient themselves in the environment. He proposed five environmental elements--path, edge, district, node, and landmark--that could support the acquisition of spatial knowledge during wayfinding situations. Lack of recognition and poor understanding of these environmental elements might make people become disoriented, lost, and frustrated in wayfinding situations (Passini, 1996).

Later, Heft's (1983) works gave a new dimension to wayfinding research by extending the work of Gibson (1979). Heft defines wayfinding as the perception of environmental information over time. According to him, in wayfinding situations, people cannot see their destination from the starting point, so they make a visual angle with an object as they move through a vista. During movement through a space, their visual angle changes in relation to their rigid layout of space and reveals the edge of the visual barrier. In this way people find their way by making connections from one vista to another. His study used vista (vision lines) and transition (nodes) to describe the wayfinding problem. According to his concept, in wayfinding situations, people perceive the information through a sequence of vistas and a sequence of transitions between these vistas. According to Lynch's (1960) work, this vista can be defined as vision line or path and transition between vistas as nodes. During wayfinding, when people move through a corridor or path, nodes are the location of pause where people usually stop to get new information about making decisions to reach their destination.

Montello (2001) refers to wayfinding as the planning and decision-making process used to reach a destination. He proposed that exploration of environmental knowledge and spatial ability helps people to make decisions in finding their way. According to Siegel & White (1975), when people acquire knowledge from the environment, they usually follow a three-stage sequence. In the first stage, people identify a place based on their knowledge of landmarks and places. With increasing experience, in the second stage, people link their knowledge of landmarks and build their route knowledge. In third stage, they organize and develop a mental map of that setting with the support of spatial clues. When a person becomes familiar with all interconnections among different routes, that person's survey knowledge helps him or her to develop a two dimensional cognitive map of that environment. With time this cognitive map creates an accurate and complete spatial representation of that area. The capacity to acquire each type of knowledge depends on the individual's experience and familiarity of the environment (Medyckyj-Scott & Blades, 1992).

Passini (1996) defines wayfinding as a spatial problem-solving activity. He conceptualizes it as "a person's ability to mentally represent the spatial characteristics of a setting and the ability to situate him or herself within that representation." That means a person's ability to comprehend the surrounding environment and his position in it is the main criterion for

solving the wayfinding problem. When a person in an unfamiliar environment successfully reaches a destination, the process of wayfinding activity mainly depends on information-processing activity, decision-making or planning activity, and decision- execution activity. Information-processing activity relies on the person's cognitive ability and is responsible for understanding the surrounding environment and the world. For wayfinding, Passini mentions three type of environmental information: memory, sensory, and inferred information. Sensory information generates through direct sensory contact with a setting; memory information is evoked from past experience; and any combination of sensory and memory information can generate inferred information. Based on this processed information, in the next stage the wayfinder makes a decision-plan to complete his or her wayfinding. The decision-plan can be combination of several decisions, depending on how many decision are needed to execute a wayfinding task. The development of decison plan is a solution-generating activity or task-generating activity. In the final stage, a person transforms his decision into behavior-action. The sequence of behavior-action helps a person to reach from an origin to a destination. These three types of activity constitute a person's problem-solving activity in wayfinding situations..

2.3 Environmental and Social Factors Affecting Wayfinding Difficulties:

The aim of wayfinding research is to understand how people find their ways in the physical world, what they need to do so, how they communicate directional information, and how their verbal and visual abilities influence wayfinding (Raubal, Egenhofer &Tryfona, 1997). According to Weisman (1981), there are four groups of environmental variables that are thought to be influential in wayfinding: (a) visual access to familiar cues or landmarks within or exterior to a building, (b) the degree of architectural differentiation between different areas of a building that can aid recall, and hence orientation, (c) the use of signs and room numbers to provide identification or directional information, and (d) building configuration, which can influence the ease with which one can comprehend the overall layout of the building. Passini et al. (1998), point out that the layout of the setting and the quality of the environmental information are two major physical factors that may affect the wayfinding task. To define the layout of the setting he mentions its spatial content, its form, its organization, and its circulation. A number of studies suggest that the complexity of the spatial layout of a setting has primary influence on wayfinding performance (Dogu & Erkip, 2000; Weisman (1981); O'Neill, 1991). O'Neill (1991) found that

with incremental increases in floor plan complexity, people have significantly greater problems with understanding spatial layout and suffer reduced wayfinding performance. The main assumption behind floor-plan complexity is that it conveys information about the layout of a building that cannot be mentally represented until the building is repeatedly navigated, or until the wayfinder beomes familiar with the built environment (Weisman, 1981).

Although it is widely agreed that putting up signs is an acceptable effort to solve the problem of wayfinding, doing so does not always yield the desired result (Dogu & Erkip, 2000). Especially when the buildings are larger and more complex, people experience more difficulty in finding their way with signs and other cues. In various literature it has already been demonstrated that wayfinding problems are strongly influenced by the nature of the intersections and major characteristics of branching points, where decisions have to be taken when seeking a destination (Hillier et al., 1984; O'Neill, 1991a, 1991b; Peponis et al., 1990; Weisman, 1981). In various studies, factors such as age, gender, occupation, individual psychology, familiarity with the environment, and so forth have been found to affect the way people find their way and orient themselves in the environment and the way chosen may differ from one individual to another (O'Neill, 1991; Peponis, Zimring, & Choi, 1990; Weisman, 1981, Lawton, Charleston & Zieles, 1996; Hurts, 2006; Lawton & Kallai, 2002). Cultural norms and traditions also influence an individual's wayfinding abilities ((Dogu & Erkip, 2000)). Ulrich et al. (2004) find the way-finding problem is stressful and costly and has particular impact on outpatients and visitors. But less effort has been made to show what factors may improve patients' satisfaction and travel experience in wayfinding situations.

2.3.1 Gender Difference in Wayfinding:

Wayfinding efficiency depends on a person's orientation skills and spatial abilities which help to find the destination and to acquire information about the surroundings. In the wayfinding literature, it has already been reported that gender differences affect wayfinding efficiency and directional accuracy (Coluccia & Louse, 2004). Lawton, Charleston & Zieles (1996) used a variety of behavioral and self-report measures to examine gender differences in wayfinding behavior following incidental learning in an unfamiliar indoor environment. Their findings showed that although there was no gender difference in the choice of route, men were

significantly more accurate in locating destinations than women were. Also, women reported significantly more uncertainty about giving directions to the destination. Hurts (2006) studied the effects of spatial intelligence and gender on wayfinding strategy and the amount of configurational wayfinding knowledge. Results showed that men tended to report more route-based directions, relative to landmark-based directions, than women did; and also men had better configurational knowledge than woman. Lawton & Kallai (2002) showed that men in both Hungary and United States were better in orienting themselves in wayfinding situation than women were; and women showed more wayfinding anxiety than did men in both countries.

In wayfinding literature, different theories try to interpret reason of gender difference in spatial ability. According to biological theory, sexual hormoned influence the cognitive development of a person (Williams et al., 1990). Research shows that in spatial ability tests, women perform well when hormone levels are low, while males perform well when hormone levels are high (Moffat & Hampson, 1996).

Environmental theory explains the gender differences from the perspective of environmental factors (experienced-based learning). Research shows that males are naturally interested in involving themselves in different kind of spatial activities, actively search for high-spatial experiences from their childhood, and spend much more time in such experiences than females. Such spatial experiences enhance spatial abilities and increase the initial differences between males and females. (Lawton & Morrin, 1999) Gaulin and Hoffman (1988).

Evolutionistic theories explain the gender differences in spatial orientation (Silverman and Eals, 1992) according to this theory: the male performs better than the female in wayfinding situations because of his hunting nature from the prehistoric age. When searching for food, the male always had to move in an unfamiliar environment following the Euclidian and configurational properties of hunting area. During hunting males always maintained a sense of their own position according to compass directions, keeping in mind the position of the sun, cardinal points, etc. Therefore in wayfinding situations males follow configurational or ‘‘survey strategies’’ to main their spatial orientation in the built environment. On the other hand, from the primitive period females have fewer navigational experiences than males as they spent long time in caves taking care of their children. So they have always had fewer opportunities to increase their spatial orientation skills. When they moved around their cave they always followed the

surrounding landmarks to keep their orientation. Therefore, in wayfinding situations females apply procedural or ‘‘route strategies,” instructions on how to get from place to place (Lawton, 1994; Galea & Kimura, 1993; Lawton, 1996; Lawton et al. 1996; O’Laughlin & Brubaker, 1998).

Psychological theory explains the difference between males and females from the perspective of individual personality. Research shows that spatial anxiety reduces the ability to focus on cues essential to maintain spatial orientation. In wayfinding situations, females show more spatial anxiety and fear of getting lost than do males, and this prevents the exploration of unfamiliar places due to negative impact on self-confidence and on motivation to navigate in new environments (Lawton, 1994, 1996; Kozloswki & Bryant, 1977). Research show that when people have a high level of spatial anxiety, they are not able to maintain a sense of direction and/or self-position with respect to the surrounding environment (survey strategy) and most often tend to get lost, confused, and anxious in wayfinding situations.

2.3.2 Familiarity and Wayfinding:

Research shows that the degree of familiarity with the environment has a great influence on the wayfinding problem. The spatial information about the layout of a building cannot be mentally represented until the building is repeatedly navigated and the wayfinder becomes familiar with the built environment (Dogu & Erkip, 2000). That means that with the increase of familiarity with the environment the wayfinder’s spatial orientation improves, the wayfinding problem is reduced (Baskaya, Wilson, & Özcan, 2004; O'Neill, 1991)), and the degree of complexity of the layout of the environment becomes less important. According to (Iachini, Ruotolo, & Ruggiero, (2009), people become familiar with the environment through making abframe of reference with the environment. In wayfinding situations these frames of reference help people to process spatial information from their surroundings (Iachini et al., 2009). They argue that these frames of reference are selected on the basis of various cues, such as egocentric experience and properties of the environment itself. Egocentric frames of reference are determined by the position of the viewer in space (McNamara, Rump, & Werner, 2003). These frames of reference mainly depend on viewers’ positions and the way viewers make visual relation with external environmental features and objects, that is,the way they make orientation-

specific or orientation-dependent frames of reference. On the other hand, allocentric frames of reference are orientation-independent or orientation-free. Research suggests that in unfamiliar environment people maintain spatial orientation in terms of egocentric frames of reference; at the same time, allocentric frames of reference defined by the environment were used when the environment was familiar (Iachini et al., 2009; McNamara, Rump, & Werner, 2003). When people move through an environment which was not experienced before, they follow different types of environmental information to find their way. According to Wiseman (1981), plan configuration, spatial landmarks, spatial differentiation, and finally signage and room numbers are important environmental elements that influence the wayfinding problem. But in familiar environments, peoples' experience with the environment leads to a transition from an egocentric to a more allocentric representation (Evans & Pezdek, 1980; Iachini et al., 2009). Therefore, to find their destination in wayfinding situations they more depend on their own cognitive map that they produced from their prior experience.

2.4 Importance of Wayfinding from a Patient-Experience Perspective:

The "patient experience" is emerging as an important factor in overall patient satisfaction and care outcomes. The patient experience begins from the moment a car enters the parking lot, continues as the patient arrives at the lobby, and includes the atmosphere in the waiting area. This experience continues as the patient moves through the corridors and smaller waiting areas to the exam and support service rooms. There are numerous design decisions that impact this experience: traffic circulation and parking patterns, wayfinding within the facility, the aesthetic environment within the lobby, access circulation throughout the corridors, and the experience within exam and testing rooms, just to name a few. As a result, the emphasis on the patient experience requires a holistic approach to space planning, corridor management, management of the signage system, and specifications of environmental quality. Each element is important for creating a comfortable, non-threatening and efficient healthcare environment.

Design responsiveness to patient's needs is an important factor to improve patient outcome. Research shows that the environment that provides psychological supports to patients helps to foster the process of healing and recovery (Urlich, Zimring, Quan, Joseph, & Choudhary, 2004; Zimring et al., 2008). In most cases, reducing environmental stress through design can improve

patients' outcome. Literature shows that when patients are moving through the hospital corridor to reach a destination, poor wayfinding systems confuse them and and increase their stress level. Sometimes personal and cultural differences in spatial behavior, proximity to other people and objects, body posture and movement within the hospital setting also generate stress and reduce the performance of wayfinding. Therefore, understanding the environmental and social variables that control the interaction between patients and the healthcare environment is important to improve patients' experience.

Northwestern Memorial Hospital's eight-floor patient experience project is an example of how designing a wayfinding system in a healthcare facility can increase patients' satisfaction through understanding patients' needs and expectations (Rave et al., 2003). This research project focuses on measuring patients' satisfaction in the outpatient department of a new hospital building. To improve patient flow, Northwestern focuses on navigation problems and on improvement of signage and simplification of the parking process. The results show a significant increase in patients' satisfaction in the outpatient department. However, this research does not discuss improvement of spatial layout to improve patients' travel experience and satisfaction by reducing wayfinding problems.

APPENDIX 3: Spatial Cognition and Space Syntax (Literature Review)

3.1 Introduction:

The aim of wayfinding research is to investigate the process that takes place when people try to orient themselves in the environment and navigate through the space .The main focus is to understand how people find their way in the physical world, what they need to find it, how they communicate directional information, and how peoples' verbal and visual abilities influence wayfinding. Their acquisition and communication of spatial knowledge from the environment mainly depend on the spatial configuration of the environment (Kim, 2001). Space syntax is an analytic theory and technique for analyzing the spatial configuration in the built environment. In the early 1970's, an active research group, led by Professor Bill Hillier at University College London, developed the theoretical framework of space syntax. Space syntax quantitatively evaluates the configurational properties of the layout for understanding how people interact with space and how they make and use spatial configuration. The observed relationship between behavior and spatial structure has led to the development of recent interest in spatial cognition among space syntax researchers. Space syntax theories study spatial configuration from the perspective of the environmental psychology of places. It explains how people experience the place, where they will likely move within the place, and what they will come to notice and remember about the place. Haq (1999) suggests that space syntax provides the necessary environmental understandings to study the relationship between the mental structure and the environmental structure. It examines the relationship between behavior and space by examining behavior not only with respect to its local setting, but also with respect to the global setting (Bafna, 2003). Therefore the aim of this Appendix is to focus on the contribution of space syntax in the field of spatial cognition

3.2 Spatial Cognition:

Spatial cognition studies human capabilities to understand how people acquire, process, and store information and use knowledge about their environment to find their way (Waller & Nadel, 2012).The concept emerges from the field of cognitive psychology, and it deals with human mental structures and processes which allow an individual to think, imagine, interact with, and communicate about space (Medyckyj-Scott & Blades, 1992). The human brain and nervous system of the human body help to build this mental structure and process information from the

social and physical world (Montello, D. R., 2001). Rashid (2012) proposes four theoretical perspectives to explain how people acquire knowledge in a large scale space. Firstly, he suggests that our mental representation of large scale space depends on the arrangement of environmental elements. This representation process, which he terms as physical perspective, is related to Lynch's work (1960). Second is the development of perspective, which illustrates an understanding that mostly constructs the mental image of large scale spaces from the acquired data. Third is the psychological perspective which examines how the human brain manages, organizes, utilizes and revises the knowledge in large scale space. Finally, the computation and information processing perspective includes a formal model that simulates the processes of knowledge acquisition and creates the mental representation of large scale spaces.

Spatial cognition represents space through a cognitive map and spatial structure (Long, Baran, & Moore, 2007). A cognitive map is "the mental representations that store a person's spatial knowledge of an environment" (Dara-Abrams, 2005). In the process of cognitive mapping, an individual stores spatial knowledge through experiencing the built and natural environment directly or indirectly. The literature on human cognition suggests that the configurational properties of the built environment have an effect on spatial cognition (Kim, 2001; O'Neill, 1991). The characteristics of the built and natural environments in which people live have a great influence on human cognitive psychology (Montello, 2007).

3.3 Space Syntax:

Space syntax is an analytic approach that quantitatively evaluates the configurational properties of the layout. In the first stage of research, space syntax focuses more on the society as a whole and tries to build the relationship between space and society rather than between space and individual subjects (Dalton and Zimring, 2003; Hillier and Hanson, 1984; Hillier and Iida, 2005). Later, space syntax research groups shifted their emphasis to environmental psychology. They characterize places that are potentially relevant to a variety of psychological responses such as behavioral affordance, orientation and disorientation, spatial knowledge acquisition, emotional responses like stress and fear, privacy and social interaction, and quality of design judgments (Montello, 2007). Space syntax analysis does not deal with metric distances, but with topological values. It tries to explain various mental and behavioral responses (Montello, 2007).

Space syntax analysis uses two approaches to understand the spatial configuration in the built environment: the graph-based approach and the geometry-based approach. The graph-based approach examines the patterns of connections (graph-based), and the geometry-based approach analyzes the perceived spatial relations. In graph-based analysis, a graph consists of nodes, or vertices, and a set of lines, or edges. Each line makes a link between two of the nodes of the graph (Peponis and Wineman, 2000). The graph-based analysis represents the spatial configuration as a purely relational pattern of connected graphs. The analysis does not take into account the area of nodes, the length of lines or the directions between any two nodes. The geometry-based, perception-based, approach includes axial maps, convexity, and visibility polygons. Axial maps or linear representations describe how people move around a spatial layout to reach other spaces, and the darker lines are more integrated or central to the system. The analysis of spatial convexity uses "isovists" or visibility polygons within visual fields that address the relationship between the viewers and their immediate spatial environment (Benedikt, 1979; Turner et al., 2001). Visibility diagonals represent the potential lines of movement across space (Peponis et al, 1998). Isovist and visibility graph analysis provide generic descriptions of architectural spaces that have predictive power of spatial experience and behavior.

3.4 Space Syntax and Spatial Cognition:

Space syntax research tried to understand the built environment through understanding the relational characteristic of local and global features of the environment. The observed relationship between behavior and spatial structure has led to the development of recent interest in spatial cognition among space syntax researchers. When people are involved in the process of spatial learning in everyday experience, they acquire two types of configurational knowledge. The first one is the intuitive knowledge which is the spatial knowledge of the immediate environment at perception level. The second one is the global configurational knowledge, which results from the long term experience of the environment at cognitive level (Kim, 2001). The acquisition and communication of spatial knowledge from the environment mainly depends on the spatial configuration of the environment. When there is a poor relationship between local and global features of the environment, people seems struggle with figuring out the configuration of an area. Space syntax terms this relationship between local and global measures of spatial structure as intelligibility.

Hillier argues that intelligible layout can contribute to the intuitive understanding of spatial configuration (Hillier, 1996). Intelligibility is a mathematical way of describing spatial configuration. It does not just represent the physical environment, but also represents the process by which the mind acquires spatial knowledge. There are two approaches to measure the intelligibility of a space. The psychological approach always tries to understand the way people experience and perceive the physical environment at the cognitive level. The syntactic approach suggests that spatial cognition is linked to the spatial configuration of individual areas and to the way the spatial properties of an area interact with surrounding areas. In this context syntactic intelligibility supports Lynch's idea that defines the legibility of the environment from the perspective of spatial cognition. The concept of intelligibility is most similar to what Lynch (1960) proposed in his research as "imageability," "the ease with which its parts can be reorganized and can be organized in to a coherent pattern. Just as this printed page, if it is legible, can be visually grasped as a related pattern of recognizable symbols, so a legible city would be one whose districts or landmarks or pathways are easily identifiable and are easily grouped into an over-all pattern." (Rashid, 2012) proposes that buildings become intelligible in two ways. One way occurs when people get the idea of whole building layout from bird's eye view or in the form of floor plan diagram which has an ordered repetitive spatial layout. The second way is to understand the building through experiencing the indoor environment over time. He suggests that to make the building intelligible by second way, "the structure of experience of architecture" is important. In most cases, variation in the perceived local properties of the building, which is related to the global form, determine the structure of experience.

According to Siegel and White (1975), when people build their route knowledge through linking their knowledge of landmarks, they organize and develop a mental map of that setting with the support of spatial clues. The route knowledge develops the image of interconnected paths of the system and helps people to decide which route to take to reach their destination. In space syntax, the configuration of spatial layouts is also described in terms of the pattern of connections. Each "unit" of space is analyzed and described regarding how it relates to other units in a configurational system and how all of the units are articulated into interconnected pieces. The analysis generates the properties of interconnected paths that provide information as to how people use theses spaces when they move through them.

3.5 Methods of Space Syntax to Study Spatial Cognition:

Space syntax has the ability to bring spatial and cognitive dimensions into a single research framework in investigating the intelligibility of the built environment. It could provide a useful method to understand how humans actually perceive and use in their surroundings (Dara-Abrams, 2005). In this section we will review popular methods that have been used formally to describe spatial cognition. The most popularly used constructs of space syntax in wayfinding research include integration, depth, intelligibility, isovists, and visibility graph analysis (VGA). Most recently Peponis (2012) developed the concept of "purview" to understand the legibility of layout and spatial cognition.

In space syntax research, the "axial map" is similar to "cognitive map" that people use to describe spatial cognition (Kim & Penn, 2004; Penn, 2003; Zimring & Dalton, 2003). Montello (2001) refers to cognitive maps as internally represented spatial models of the environment that store the knowledge of landmarks, route connections, distance-directional relations, non-spatial attributes, and emotional attributes. The "axial map" or "linear representation" (Hillier and Hanson, 1984) consists of the fewest and longest sight lines represented as a graph in which each line is represented by a node and each intersection as an edge. An axial map constitutes a continuous web of axial lines that cover all convex spaces in the setting under investigation. Axial maps also reflect the effective visibility structure for people navigating through the building (Long, Baran, & Moore, 2007). Kim (2001) suggests that the axial map not only represents the syntactic view of the physical environment but also reflects our memories of experience as well. It provides a linkage between the way people perceive their physical environment and the ways in which they communicate about it.

In space analysis, integration is a measure that helps to understand how easily one can reach to a specific location. It is a measure of syntactic accessibility. Global integration calculates the average number of steps required to reach each node from each other node in the graph. Local integration reflects the connection among the nodes in the context of their immediate surroundings. Literature shows that integration has the ability to compute various aspects of human behavior in the built environment (Haq & Zimring, 2003; Kim & Penn, 2004). Haq & Zimring (2003) suggest integration as a strong predictor of wayfinding behavior inside large buildings like hospitals. Their findings show that in directed search, when people become familiar with the environment, their wayfinding behavior depends on global integration value. The links between acquisition of spatial knowledge and integration are more profound in the

study of Kim & Penn (2004). Their findings show that the integration value of sketch maps drawn by people correlate with actual integration values of the streets. All these denote that the integration measure has the ability to predict the spatial knowledge of people who experience that environment.

Hillier et al. (?) suggest that depth also has an effect on spatial cognition and human behavior. Depth is a change in direction occurring when people move from one specific place to another. Yun & Kim (2007) propose that using a path with few depths provides higher accessibility, spatial cognition, and availability than using a path which has many depths. Their study investigates the interrelationship between spatial cognition and spatial configuration and the effects of depth and the metric distance in forming spatial cognition. They performed structured interview surveys and observations on local users of a university area. The findings confirm that there is a strong interrelation between the syntactic properties and spatial cognition, and that depth has more influence than distance on spatial cognition. Haq (1999) shows that mean depth can predict the space use pattern during open exploration in the wayfinding situation.

Several theorists have proposed that the "isovist" measure has the ability to relate psychological responses such as ease of orientation, sense of privacy, stressfulness, and aesthetic judgment (Montello, 2007; Wiener & Franz, 2005) to spatial properties of the layout. In the recent work of Wiener & Franz (2005), the isovist measure is used to predict spatial behavior and spatial experience. They correlated 16 virtual indoor scenes with behavioral data from two experiments. The findings suggest a strong correlation between isovist measures and the way people experience spaces. Researchers also suggest that the isovist measure has the ability to predict the environment with regards to wayfinding (Davies et al., 2006; Meilinger et al., 2009). Meilinger et al. (2009) use isovist measures to address the interrelations between wayfinding performance, mental representation of route, and the geometrical layout of path intersections. The findings show that the geometric properties of the layout defined by the isovist measure are not only connected with observable wayfinding behavior, but they are also connected with the mental representations of the environment like route knowledge and landmark.

Later visibility graph analysis (VGA) has been developed by Turner and others (Turner, Doxa, O'Sullivan, & Penn, 2001). In this method researchers extended the representation of isovist equally to all visible locations of the environment and correlated the visual access of an environment with human preferences of spatial experiences. In his doctoral work, Danton used

the VGA technique to test people's navigation in six virtual environments (Davies et al., 2006). His findings show that pauses do not occur in a random manner in wayfinding situations but instead occur in those spaces where more visual information is available. HoĞlscher, BroĞsamle, & Vrachliotis (2012) use visibility graph analysis to experiment on wayfinding in complex multi-level buildings. The study makes a comparison between the wayfinding abilities of an experienced and an inexperienced participant. The study shows that connectivity, integration, and step-depth of VGA have the ability to predict the novice user's decision in wayfinding situation.

More recently, Peponis (2012) proposed a direct purview measure that describes the relationship of a position to all others according to the mean number of turns that are required to reach a destination. He suggested that the directional turns involved in movement affected the legibility of layout and navigation. He tried to determine how layouts vary based on the spatial properties that are associated with cognitive and organizational performance, and he concluded that purview has the ability to judge the space as a potential field of access, movement, search, encounter, and co-presence. Purview refers to path distance from any potentially occupied position to all other available positions in metric distance. Local direct purview provides immediate environmental perception. Global purview refers to our ability to survey available space through sight. Global purview gives us an objective property of cognitive schemata that generate through repeated paths of perception overtime. Global direct purview is measured in terms of mean turn.

All the above studies suggest that space syntax has the ability to bring spatial and cognitive dimensions into a single research framework in investigating the intelligibility of the built environment. It could provide a useful method to understand how humans actually perceive and use in their surroundings when they are in wayfinding situations.

3.6 Space Syntax Studies Focus on Spatial Cognition in Healthcare

Understanding patient behavior and experience is an important factor for understanding patient satisfaction and care outcomes. To determine how the environment causes behavioral change, it is important to understand how people perceive their environment. In most cases, variation in the perceived local properties of the building, which variation is related to the global form, determines the structure of experience. Space syntax studies this experience through making the

relationship between the local and the global measure of the spatial properties. Few studies have been done in space syntax research to understand patient behavior and experience in the healthcare setting and most of these studies focused on understanding patient behavior in wayfinding situation.

The first research on wayfinding using the space syntax technique was done by Peponis, Zimring, & Choi in 1990. This research used space syntax methodology to examine spatial search behavior. The researchers asked 15 students to explore a small hospital in both open exploration and directed search. The findings show that open search behavior could be strongly predicted by integration measure. In addition, during open exploration, the subjects who failed to develop locational knowledge seemed to experience more surprise along integrated nodes. The study suggests that exploration in an unfamiliar setting and error in search can be predictable by greater integration .

In 1999, Haq replicated and extended Peponis' studies (1990) by analyzing behavior and environmental variables and exploring the more local and relational value of space syntax. Haq's study was carried out on the ground floor of a 21-storey hospital building. Three entrances out of six were used for open exploration and four locations were chosen for directed search. In this research, Haq tried to understand the properties of spatial layout as a predictor of wayfinding performance. In total, 12 male and 19 female students participated in this study. The study showed that when people are trying to understanding the layout, their use of space is best predicted by a local quality, public connectivity. The findings also reported that during open exploration, wayfinding behavior can be predicted by the number of choice points that can be seen from a node. In directed search, the use of space can be predicted by public integration. In addition, people who entered the space with lesser mean depth have a better opportunity to explore the layout.

Haq & Girotto (2003) compared a sketch-up map and an axial map of space syntax to explore the setting, perform wayfinding tasks, point to unseen destinations, and estimate the difference between them. The study was conducted in two hospital complexes with 96 volunteer students who were totally unfamiliar with the environment. The study shows that intelligibility of the setting is an important measure of environmental cognition in wayfinding situations.

In 2003, Haq studied three large hospitals in the US to understand the relationship between various configurational properties (integration, integration-3, and connectivity) and the

wayfinding problem. In this study, 62 male and 65 female participants carried out the following task: open exploration, directed search, pointing to unseen area, and sketch mapping of hospital layout. The study analyzed a conventional axial map and a newly proposed segmented version of an axial map. The findings show that although the use of space is best predicted by local measures (connectivity), the distribution of people can be best predicted by integration-3. The conventional axial map that has uninterrupted visual lines has more predictive power for analyzing spatial cognition than a segmented axial map. Also this study supports the previous finding that the intelligibility measure can predict space use and that the mean depth of the entry has an effect on how people will explore the building.

A subsequent study by Haq and Zimring (2003) tried to determine how people's topological knowledge changes when they become familiar with a setting. Their study was carried out in three large hospitals in the US with 62 male and 65 female participants. Their findings show that during open exploration in a wayfinding situation, a person depends on local topological knowledge meaning how many additional nodes can be seen from a given node. As they become familiar with the settings, their wayfinding behaviors can be better predicted by more global properties, meaning the integration measure of node. In addition the study suggested that the space syntax measure can predict the pointing out-of-sight location and sketch map.

Most recently, in 2009, wayfinding research using a space syntax construct was done by Tzeng & Huang (2009). Using axial map analysis and isovist analysis, this research for the first time studied the influence of the wayfinding decision point, spatial form, and signage on wayfinding behavior. The study conducted a wayfinding experiment with 24 participants, 15 male and 9 female, in two medical centers with single level, hallway-type outpatient departments. All the participants were college students and had previous experience with this hospital but no experience with the two departments being studied. Participants performed the directed search by wearing cameras on their heads to record the signage that they observed during exploration. The findings show that orientation signage is an important factor in wayfinding design. In the outpatient department, while the closed-form space and open-form space most often produce wayfinding behavior, stop behavior most often occurs in closed-form space. Visual content received in wayfinding most often appears in open L- shaped spaces.

3.7 Strengths and Weaknesses of Space Syntax Studies Involving Patients' Behavior, Wayfinding and Experience in Hospitals

The strength of space syntax studies that involve patient behavior, wayfinding and experience was that they proposed space syntax analysis as a method to predict human wayfinding behavior in healthcare settings. Their main focus was to understand how people behave when they move through an unfamiliar environment and also through a familiar environment. However, concerning space syntax analysis for understanding patients' behavior and experience in healthcare settings, the early studies had a number of shortcomings.

In the healthcare setting, the direct observation of patients in wayfinding research is rare (Peponis et al., 1990). In space syntax literature, researchers tried to understand wayfinding problems through tracking people (Beaumont, Gray, Moore, & Robinson, 1984; Haq, 1999, 2003; Haq & Girotto, 2003; Haq & Zimring, 2003; Moeser, 1988). In all cases, they used students who were not actual users of the building to execute open search and directed search. Tzeng & Huang (2009) in their study used actual patients of a hospital who have experience with other departments but not with the studied department. These patients were asked to do the open search with a video camera. On that day, they did not come to this hospital for a checkup but only to participate in this research. In all cases the researches totally ignored the health condition of patients although that condition may have had an effect on their wayfinding behavior.

Individual difference or individual group difference (age, gender) is always ignored in the space syntax literature in healthcare setting. Wayfinding studies have established that gender and age have an effect on wayfinding performance (Lawton, Charleston, & Zieles, 1996; Lawton & Kallai, 2002). All research in space syntax took two groups of participants but they did not focus on how the different sexes behave and experience the spatial layout differently in wayfinding situations.

Less effort has been made to understand individual wayfinding travel behavior like "stop," "search," "ask for direction," "travel time," etc. All research that has been done by Haq (1999, 2003, 2003a, 2003b) focuses mainly on understanding the environment as a predictor variable for wayfinding performance. Tzeng & Huang (2009) studied some aspect of travel behavior and

pointed out the frequency of travel behavior on specific department routes but they did not relate the travel behavior to the space syntax properties of the route.

In addition, multilevel analysis of hospital buildings has always been ignored in healthcare wayfinding research. All research that has been done on healthcare settings using space syntax focused only on the ground floor. How the properties of the layout may differ in multilevel analyses of the hospital building still needs to be explored.

Moreover, the reported studies show how people behave when they move through a space, but fail to relate how people feel when they move and interact with the local and global properties of the layout in the wayfinding situation. This understanding is important to enhance the healthcare experience and patient satisfaction in wayfinding situation.

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APPENDIX: 5 Sample of Questionair Survey (English)

Questionnaire Survey: Patient's Travel Experience and Satisfaction Study

Part I: General Information

1.	Your destination department :	A_____	B._____	C._____	
2.	Did you ask the volunteer for direction?	☐ Yes	☐ No		
3.	Gender	☐ Male		☐ Female	
4.	Age	☐ 18-35	☐ 36-50	☐ 51-65	☐ 66+
5.	I am accompanying with	☐ None	☐ Family member	☐ Friend	☐ Other
6.	This is my	☐ 1st Visit	☐ 2nd Visit	☐ 3rd Visit	☐ 4th Visit
7.	How often do you visit the building?	☐ Regularly	☐ Sometimes	☐ Rarely	
8.	When was the last time you visited this building?	☐ Less than a week	☐ Between a week and a month	☐ More than a month	

Part II: User characteristic	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. It is difficult for me to understand the direction I am facing in the building.	☐	☐	☐	☐	☐
2. I could keep in mind which direction of the building I enter from	☐	☐	☐	☐	☐
3. I am confident about giving direction within this building	☐	☐	☐	☐	☐
4. The presence of someone to give direction is easy for me	☐	☐	☐	☐	☐
5. I notice whether the corridors meet at right angle or not while walking in a building	☐	☐	☐	☐	☐
6. I pay attention to "landmarks" while walking in a building	☐	☐	☐	☐	☐
7. I pay attention to changes in the lighting system of a building while walking	☐	☐	☐	☐	☐

Part III - Information and way finding: These statements refer to patient satisfaction and travel experience regarding Information and way finding of the outpatient department

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. Sign showing different parts of the building are useful for me	☐	☐	☐	☐	☐
2. Signs pointing out different paths and/or directions are useful for me	☐	☐	☐	☐	☐
3. The size of signs is appropriate and easy to read	☐	☐	☐	☐	☐
4. You are here map showing my location within the building with an arrow is useful for me	☐	☐	☐	☐	☐
5. The floor numbering system is easy enough for me to get to a destination on a particular floor	☐	☐	☐	☐	☐
6. The room numbering system follows the floor number and large enough for me to find my destination easily.	☐	☐	☐	☐	☐
7. I am satisfied with the overall signage system of the building	☐	☐	☐	☐	☐

Questionnaire Survey: Patient's Travel Experience and Satisfaction Study

Part IV - Layout: These statements refer to patient satisfaction and travel experience regarding the spatial layout of the outpatient department

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Upon entering, it is easy for me to find the information desk	☐	☐	☐	☐	☐
2. The circulation area is not congested around the information desk	☐	☐	☐	☐	☐
3. I have to spend more time walking to and from different activities in the outpatient department	☐	☐	☐	☐	☐
4. Elevator and staircases are easy to find	☐	☐	☐	☐	☐
5. I do not get lost on my way to a destination in this building	☐	☐	☐	☐	☐
6. Corridors are free of obstruction.	☐	☐	☐	☐	☐
7. Corridors are wide enough to move easily and comfortably	☐	☐	☐	☐	☐
8. Necessary functions are located in close proximity to one another	☐	☐	☐	☐	☐
9. It is easy to locate waiting area for each unit within the department.	☐	☐	☐	☐	☐
10. I am satisfied with the amount of time it took me to get my destination	☐	☐	☐	☐	☐
11. I am satisfied with overall layout of the outpatient department	☐	☐	☐	☐	☐

Part V -Design quality: These statements refer to patient satisfaction and travel experience regarding the quality of design.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. The entry door is well designed for easy access	☐	☐	☐	☐	☐
2. I put much strength to open the entry door	☐	☐	☐	☐	☐
3. Circulation spaces have comfortable floor finish	☐	☐	☐	☐	☐
4. Circulation spaces have comfortable lighting.	☐	☐	☐	☐	☐
5. Circulation spaces have windows to get outside views	☐	☐	☐	☐	☐
6. Artworks on the wall help relieve stress during journey.	☐	☐	☐	☐	☐
7. Circulation spaces have seating's to take rest during journey	☐	☐	☐	☐	☐
8. In waiting room all the furniture is easily accessible	☐	☐	☐	☐	☐
9. In waiting room all the furniture are comfortable	☐	☐	☐	☐	☐
10. I am satisfied with overall quality of design	☐	☐	☐	☐	☐

Thank you for completing this questionnaire

If you have any questions about your rights as a research participant, you may call 785-505-6442 or e-mail IRB Chair at jeff.pierce@lmh.org

APPENDIX 6: Sample of Questioanair survey (Bangla)

রোগীর যাতায়াত অভিজ্ঞতা ও সন্তুষ্টি নির্ধারক গবেষণাঃ

কোডঃ_____ তারিখঃ _____ সময়ঃ সকাল/দুপুর/বিকাল

ক। সাধারণ তথ্যঃ

১। আপনার গন্তব্য স্থানঃ ক)----------খ)----------গ)----------

২। আপনি কি কারো কাছ থেকে দিকনির্দেশনা নিয়েছেন? ------হ্যাঁ ----------না।

৩। লিঙ্গঃ ----------পুরুষ ----------মহিলা।

৪। বয়সঃ ------১৮-৩৫ -------৩৬-৫০--------৫১-৬৫ --------৬৫+

৫। আপনি কার সাথে হাসপাতালে এসেছেন ?

-------কারো সাথে না ---------পরিবারের সদস্যের সাথে ----------বন্ধুর সাথে ----------অন্যান্য।

৬। এটা আপনার ------১ম আগমন ------২য় আগমন -------৩য় আগমন --------৪র্থ আগমন।

৭। আপনি কি প্রায়ই এই হাসপাতালে আসেন?

----------সবসময় ---------মাঝেমাঝে ---------- খুবই কম।

৮। শেষ কবে এই হাসপাতালে এসেছেন ?

---------এক সপ্তাহের কম সময় ----------এক সপ্তাহ ও এক মাসের মধ্যে ---------- এক মাসের বেশী সময় আগে

খ। রোগীর চারিত্রিক বৈশিষ্ট্যঃ	খুবই সম্মত	সম্মত	নিরপেক্ষ	অসম্মত	খুবই অসম্মত	প্রযোজ্য নয়
১। আমি কোন দিকে মুখ করে দাড়িয়ে আছি এটা আমার পক্ষে নির্ধারন করা কষ্টকর ।	☐	☐	☐	☐	☐	☐
২। হাসপাতালের কোন দিক দিয়ে আমি অভ্যন্তরে প্রবেশ করেছি এটা আমার পক্ষে মনে রাখা সম্ভব।	☐	☐	☐	☐	☐	☐
৩। আমি বিশ্বাস করি যে হাসপাতালের ভিতরে আমি অন্যকে দিকনির্দেশনা দিতে পারব।	☐	☐	☐	☐	☐	☐
৪। দিকনির্দেশনার জন্য অন্যের সাহায্য পেলে গন্তব্য স্থান খুজে পাওয়া আমার জন্য সহজ হয়।	☐	☐	☐	☐	☐	☐
৫। হাসপাতালের ভিতর দিয়ে চলাফেরার সময় করিডোর গুলো সমকোণে বাক নিয়েছে কিনা আমি লক্ষ্য করি।	☐	☐	☐	☐	☐	☐
৬। হাসপাতালের ভিতর দিয়ে চলাফেরার সময় আমি বৈশিষ্ট্য পূর্ণ জিনিস লক্ষ্য করি।	☐	☐	☐	☐	☐	☐
৭। হাসপাতালের ভিতর দিয়ে চলাফেরার সময় আমি আলোর পরিবর্তন লক্ষ্য করি।	☐	☐	☐	☐	☐	☐

গ। তথ্য ও পথ নির্দেশণা বিষয়ক প্রশ্ন	খুবই সম্মত	সম্মত	নিরপেক্ষ	অসম্মত	খুবই অসম্মত	প্রযোজ্য নয়
১। হাসপাতালের বিভিন্ন অংশের দিকনির্দেশক প্রতীক গূলো গন্তব্যস্থান খুজে পাওয়ার জন্য উপযোগী।	☐	☐	☐	☐	☐	☐
২। হাসপাতালের দিকনির্দেশক প্রতীক গূলোর আকার (সাইজ) যথাযথ এবং সহজবোধ্য।	☐	☐	☐	☐	☐	☐
৩। হাসপাতালের "তোমার বর্তমান অবস্থান" নির্দেশক ম্যাপের ভিতর আমার বর্তমান অবস্থান সূচক তীর চিন্হ আমার জন্য উপযোগী।	☐	☐	☐	☐	☐	☐
৪। হাসপাতালের তলা নির্দেশক ক্রমিক সংখ্যা/চিন্হ গন্তব্য স্থানে পৌঁছানোর জন্য উপযোগী।	☐	☐	☐	☐	☐	☐
৫। রুম নির্দেশক প্রতীক গুলো হাসপাতালের তলার নম্বরের অনুগামী এবং যথাযথ আকারের।	☐	☐	☐	☐	☐	☐
৬। আমি হাসপাতালের দিকনির্দেশনা ব্যবস্থাপনার ব্যাপারে সন্তুষ্ট।	☐	☐	☐	☐	☐	☐

ঘ। হাসপাতালের জায়গা বিন্যাস বিষয়ক প্রশ্নঃ	খুবই সম্মত	সম্মত	নিরপেক্ষ	অসম্মত	খুবই অসম্মত	প্রযোজ্য নয়
১। হাসপাতালের ঢোকার পরে তথ্যকেন্দ্র সহজে খুজে পাওয়া সম্ভব।	☐	☐	☐	☐	☐	☐
২। তথ্য কেন্দ্রের চারপাশে চলাফেরার জন্য পর্যপ্ত জায়েগা আছে।	☐	☐	☐	☐	☐	☐
৩। হাসপাতালের বিভিন্ন বহির্বিভাগে যাওয়ার জন্য যথেষ্ঠ সময় হাটাচলায় ব্যয় করতে হয়।	☐	☐	☐	☐	☐	☐
৪। হাসপাতালের ভিতরের বিভিন্ন বিভাগ একে অন্যের নিকটবর্তী।	☐	☐	☐	☐	☐	☐
৫। হাসপাতালের বিভিন্ন বহির্বিভাগের অপেক্ষা কক্ষ সহজে খুজে পাওয়া সম্ভব।	☐	☐	☐	☐	☐	☐
৬। হাসপাতালের লিফট ও সিঁড়ির অবস্থান সহজে খুজে পাওয়া সম্ভব।	☐	☐	☐	☐	☐	☐
৭। হাসপাতালের করিডোর গুলো প্রশস্ত এবং বাধা মুক্ত।	☐	☐	☐	☐	☐	☐
৮। হাসপাতালের ভিতরে গন্তব্য স্থান খুজে পেতে যে সময় ব্যয় করতে হয় তাতে আমি সন্তুষ্ট।	☐	☐	☐	☐	☐	☐
৯। হাসপাতালের বর্হিবিভাগের সামগ্রিক জায়গা বিন্যাস-এ আমি সন্তুষ্ট।	☐	☐	☐	☐	☐	☐

ঙ। হাসপাতালের অভ্যন্তারীন বিন্যাস-এর গুণগত মান বিষয়ক প্রশ্ন	খুবই সম্মত	সম্মত	নিরপেক্ষ	অসম্মত	খুবই অসম্মত	প্রযোজ্য নয়
১। হাসপাতালের ফ্লোরে ব্যবহৃত নির্মান সামগ্রী চলাফেরার জন্য উপযোগী।	☐	☐	☐	☐	☐	☐
২। হাসপাতালে চলাফেরার জায়গায় আলোর ব্যবস্থা আরামদায়ক এবং চলাফেরার জন্য উপযোগী।	☐	☐	☐	☐	☐	☐
৩। হাসপাতালের চলাফেরার জায়গায় বাহিরের পরিবেশ দেখার জন্য পর্যাপ্ত জানালা আছে।	☐	☐	☐	☐	☐	☐
৪। হাসপাতালের দেয়ালের শিল্পকর্ম মানসিক চাপ দূর করতে সাহায্য করে।	☐	☐	☐	☐	☐	☐
৫। হাসপাতালের চলাফেরার জায়গায় বিশ্রাম নেয়ার জন্য বসার জায়গা আছে।	☐	☐	☐	☐	☐	☐
৬। অপেক্ষা কক্ষ-এর সকল আসবাবপাত্র আরামদায়ক এবং ব্যাবহারের উপযোগী।	☐	☐	☐	☐	☐	☐
৭। হাসপাতালের সামগ্রিক অভ্যন্তারীন বিন্যাস-এর গুনগতমানে আমি সন্তুষ্ট।	☐	☐	☐	☐	☐	☐

---------- ধন্যবাদ ----------

যদি আপনার এই গবেষনার ব্যাপারে কোন প্রশ্ন থাকে তবে আপনি ৭৮৫-৫০৫-৬৪৪২ নম্বরে ফোন করতে পারেন অথবা আই আর বি এর প্রধানকে jeff.pierce@lmh.org ইমেইল করতে পারেন।

APPENDIX: 7 Sample of Field Observation Sheet