BUILDING EVALUATION TOOLS TO ASSESS THE USABILITY OF PRIMARY CARE CLINICS

A Thesis

by

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

MASTER OF SCIENCE

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December 2012

Major Subject: Architecture

ABSTRACT

Primary care clinics play a vital role in the US healthcare system, providing preventative and cost-effective care. New trends in healthcare such as the development of the medical home model for care, the application of electronic medical records (EMRs), the effort to increase access to care, and the need to adhere to the Health Insurance Portability and Accountability Act (HIPAA) will have direct impacts on the work flow and spatial delineation of primary care clinics. To ensure the success of primary care practices, the architectural design of primary care clinics needs to address these changes to satisfy both patients and staff, and to improve efficiency and outcomes of care. There is limited literature on the design usability (efficiency, effectiveness, and user satisfaction) of primary care clinics.

This study developed a set of building usability evaluation tools to collect, analyze and interpret the "usability" of a primary care facility. The study used previous literature as well as a case study primary care clinic in Maryland as a basis to develop these tools.

In the clinic, data were collected through an initial interview with the head nurse, a forty-hour behavioral observation, and a staff survey. A behavioral observation tool and a survey questionnaire were developed for the data collection. For data analysis, JMP Pro 9 software was used to analyze the data collected through behavioral observation and the staff survey.

The literature review developed a "Building Usability Framework" specifically for healthcare design. A data analysis tool, the "Usability Matrix" was created to integrate and understand the analyzed data within the Building Usability Framework.

Integrating the analyzed data from the case study within the Usability Matrix, a primary care clinic usability evaluation survey was developed at the end of the study. This survey along with the behavioral observation tool and design analysis tools were compiled together to produce the "Building Usability Evaluation Tool-Kit for Primary Care Clinics." This tool-kit can be used by architects and researchers interested in designing and analyzing "usable" primary care clinics.

DEDICATION

To my parents, my grandparents, and my husband:

"The dignity of the artist lies in his duty of keeping awake the sense of wonder in the world." —G.K. Chesterton

By the Grace of God, I have been blessed with some wonderful people in my life who were able to provide me the love, support, and resources to follow my interests and nurture a love of appreciating and examining the world around me. My parents, my grandparents, and my husband have encouraged me to always keep alive this sense of wonder.

I hope to instill the same love of appreciating and examining the built environment with the work I have produced in this thesis to those whom I come across. The art and science of studying architecture have the potential to inspire, heal, and move the world.

ACKNOWLEDGEMENTS

I would like to thank a number of individuals who have helped me along the way in producing this thesis. Professor George Mann encouraged me to look into primary care clinics as my study topic. Knowing a number of individuals who work in a primary care clinic, it was easy to find a case study.

My chair, Dr. Xuemei Zhu, played a crucial role in helping me develop a study plan and research methodology. She encouraged me to think rigorously about what I was interested in and develop the appropriate research techniques for the investigation. I also received valuable feedback from her and my committee members, Dr. Mardelle Shepley and Dr. James Varni, to help me build my conceptual framework and evaluation tools.

I also would like to thank the entire clinic staff where I conducted my research for their encouragement and willingness to answer any questions I had. During the summer I did my clinic observation, I also had the opportunity to work at Cannon Design in St. Louis. Working with the Cannon Design research team also inspired developments in my thesis.

I also would like to acknowledge the feedback and encouragement from my mother, father, and husband as well as support from my grandmother, siblings, in-laws, and friends throughout the entire process of writing this thesis. Thank you all!

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1. INTRODUCTION AND PROBLEM STATEMENT

1.1 Significance of and New Trends in Primary Care

On March 25, 2010, the Affordable Care Act became the law in the United States, dramatically changing the scope and dynamics of the US healthcare system. Under the act, tens of millions of Americans were given access to healthcare through the establishment of policies that emphasize making preventative care more affordable to all. More than $600 million was set aside for this initiative in 2010 (New York Times, 2011).

Such a drastic expansion of medical insurance coverage also requires changes in delivery models of healthcare. US healthcare reform is focusing on creating a patient-centered model of care (Joseph & Keller, 2009). The healthcare system is shifting from an inpatient focus to an outpatient focus, delivering care and monitoring a patient's health through a more holistic approach. Treatment is being undertaken more rigorously as a continuum of care instead of a quick-fix episodic solution. The medical home model for care is establishing "a regular source of care in a familiar, comprehensive, and coordinated system," which will be directly influencing the delivery of primary care (Joseph & Keller, 2009). With the use of medical technology such as electronic medical records (EMRs), a patient's health and treatments are being tracked and recorded to gain a more comprehensive understanding of the health and wellness of each patient. In a patient-centered model, privacy and adherence to the Health Insurance Portability and Accountability Act (HIPAA) will need even more careful consideration as the

effectiveness of the healthcare environment depends on how comfortable the patient feels sharing information.

The primary care clinic becomes a crucial establishment in this refined system because it is a gateway into the complex network of healthcare and is used for preventing and treating illness. As discussed above, the new trends in healthcare, such as the development of the medical home model for care, the application of EMRs, the effort to increase access to care, and the need to adhere to HIPAA, will have direct impacts on the work flow and spatial delineation of primary care clinics. To ensure the success of primary care practices, the architectural design of primary care clinics needs to address these changes to satisfy both patients and staff, and to improve efficiency and effectiveness of care. Designers need to address these changes and take on the responsibility of providing primary care environments that are usable by patients and staff. They are obligated to assess the success and failure of their clinic design through practice and research to meet the demands of healthcare delivery.

1.2. Overview of Research Goals and Objectives

How can a usability assessment of a primary care clinic design address current developments in healthcare? Healthcare architecture demands both rigorous research and creativity to improve the design of "healing spaces." There is a growing body of literature on healing spaces that can help designers to create effective and efficient spaces to satisfy the needs of users.

The goal of this thesis is to develop appropriate design evaluation tools to assess the usability of a primary care clinic. These evaluation tools are intended 1) to help evaluate existing buildings using the provided usability criteria, 2) to provide a checklist that a designer can use to develop a clinic design, and 3) to provide a sample methodology for the development of similar evaluation tools for other building types.

In order to develop such tools, a case study clinic will be analyzed to provide practical design problems and current healthcare concerns to integrate into a literature-based theoretical framework. The study hopes to bridge an essential gap that exists between theoretical works and architectural design practice.

2. LITERATURE REVIEW

2.1 Design Guidelines for Primary Care Clinics

In order to design efficient, effective, and user-satisfying clinics, all programmatic elements of a clinic must be analyzed and understood in terms of the clinic operations. The current literature provides a basic evaluation methodology for medical clinic programming and design. Two of the most useful sources are *The Medical and Dental Space Planning: A Comprehensive Guide to Design, Equipment, and Clinical Procedures* by Jane Malkin (2002) and *The Guidelines for Design and Construction of Healthcare Facilities* (2010 edition) by the Facilities Guideline Institute (FGI). The typical programmatic elements in a primary care clinic include a waiting area, check-in/reception, examination room, procedure room, lab area, nurses' station, staff lounge, consultation room, and storage areas. Design guidelines available for each programmatic element in a typical primary care clinic were reviewed for this study and are summarized in the following sections.

2.1.1 Waiting Room

Figure 1. Waiting Room Design

When designing a waiting room (Figure 1), it is important to conceptualize the flow of incoming patients as this experience gives patients the first impression about the facility and the quality of care (Malkin, 2002). “A clean, well-lit, flexible, and comfortable environment can create a good first perception among patients, and can even impact the perceived quality of care received at the clinic” (Douglas & Douglas, 2005).

The reception area should be immediately apparent upon entrance (Facilities Guidelines Institute (FGI), 2010). The reception area design needs to emphasize patient privacy. If personal matters need to be discussed at the reception desk, other public seating must be placed away from this area to protect the patient’s privacy and avoid

embarrassment. Privacy screens, frosted glass, and sound absorptive acoustical treatments are common features that can be used around the reception and check-out areas to protect patients' privacy.

Privacy must be addressed together with patient security in the design. Depending on the location, varying degrees of security measures may be needed. As a general requirement, the staff in the reception area should be able to see anyone entering and leaving the facility. The reception area design and location should provide a visual surveillance over the waiting area (FGI, 2010). The seating arrangement in the waiting area must not hinder visibility and must allow for efficient patient flow from the reception/sign-in desk back to the seating area. A children's desk or play area is an additional feature in the waiting area that should be accommodated when possible.

Additionally, the front office personnel need a direct connection to communicate with other office and staff members.

The size of the waiting room is dependent on the organizational system in which the facility operates. The appointment scheduling system must allow for sick patients to walk in when necessary and maintain a flow of scheduled visits at the same time. The FGI suggests that at least two seats per examination room be provided in the waiting area.

An additional feature of the waiting room in a typical primary care clinic is the patient education room, which also reflects the growing emphasis of preventive care. This education room may be an 8 feet–by–10 feet space with Internet access and

reference books, where patients can inquire about a particular drug, disease, or treatment. The space should include partitions for additional privacy for the patient (Malkin, 2002).

2.1.2 Examination Room

According to Malkin (2002), the design of examination rooms needs to reflect consideration of three factors. First, the examination rooms needs to be placed in close proximity to the nursing station. This will enable nurses to show patients into the exam rooms and travel back and forth between the exam room and the nursing station to clean medical instruments and prepare items needed for examinations. Second, exam rooms need to be placed close to consultation rooms so that the physician can easily navigate back and forth when needed. The exam room corridor should be designed in a way that the patients will pass the business office on exiting the facility for easy check-out, consulting, and medicine distribution.

Third, the design of the exam room needs to accommodate the examination flow. The physician should have easy physical access to the sink on entering the room to quickly wash his/her hands and be able to pivot around to speak to the patient as well as reach any necessary medical equipment for examination. The examination table should be angled away from the door and wall so that all sides of the table are accessible (see Figure 2). The door of the examination rooms should be hinged so that it opens away from the wall; in case the door opens, it can provide the patient privacy from corridor traffic. Additionally, the examination rooms need to incorporate cabinets, an

examination chair, a computer desk/ countertop, and two waste containers (one for general waste and one for bio-hazardous waste). Upper cabinets may incorporate disposable gowns, sheets, and gloves and paper products, whereas the lower drawers may contain syringes, instruments, tongue depressors, and surgical gloves. In some cases, the examination room may also need to function as a treatment room (FGI, 2010).

Figure 2. Window Placement in the Examination Room

The placement of windows in the examination room needs to be carefully thought out. It is nice to have them in the examination room, yet they are not required. When included in the design, the location of the window must not interfere with medical examination procedures (Figure 2). The window placement should not disrupt the layout efficiency of the room or impact patient privacy. Appropriate shading and light and temperature control should also be considered with a placement of a window. The

window design must also consider the possibility of future renovations and/or expansions.

2.1.3 Minor Surgery/Procedure Room

Figure 3. Procedure Room

In addition to examination rooms, a medical practice suite will also have a minor surgery room, otherwise called the procedure room (Figure 3). It is larger than the typical examination room and is typically 12 feet by 12 feet; it can serve a variety of functions. For example, this minor surgery room can be the casting room to wrap or remove casting tape after injuries. It can also be used as an electrocardiogram (EKG) room, a minor operating room with local anesthetics, and even an emergency exam room for accidents. The multipurpose programming of the room demands a larger room size and more storage areas. A minor surgery room should have 10- to 12-feet-long upper

and lower cabinets, as well as spaces for family visitors, additional staff members, and minor surgical equipment. Additionally, there will be ceiling-mounted fluorescent lighting. It is also desirable for the room to have its own entrance for use only in emergencies (Malkin, 2002).

2.1.4 Lab Area

Figure 4. Blood-Draw Station

The lab area should have a "double compartment sink," some storage spaces, a refrigerator, certain countertop spaces, and a blood-draw station with a special blood-draw chair for the patient (Malkin, 2002). This area should be private, like an exam room; other patients might find it alarming to watch blood being drawn and the patient has a right to privacy during a blood draw (Figure 4). The countertop space close to the lab technician should have a centrifuge for spinning the blood once it is drawn from the patient and before it is sent out to be tested.

2.1.5 Nurses' Station

Figure 5. Nurses' Station

The nurses' station in a clinic is an area where the nurse performs all the preliminary tasks before the patient is seen by the doctors. This may include activities such as weighing the patient, taking his/her temperature, giving injections, sterilizing instruments, and routine office work such as answering telephones, handling office paperwork, and communicating with patients. The nurses' station may be a nook in a corner or even a countertop (Figure 5). It should have ample storage space, a sink, a under counter refrigerator, and a work area for paperwork. Patient privacy should be considered for these procedures as well.

2.1.6 Staff Lounge

Figure 6. Staff Break Room

Staff lounges (Figure 6) are also essential programmatic elements in a primary care facility. A typical primary care clinic will need a staff lounge of approximately 10 feet by 12 feet, with cabinets and a sink, tables, chairs, a microwave oven, and a refrigerator. Location of the staff lounge should be away from the main patient traffic area and patient visibility. Break times are very important for staff satisfaction and stress reduction, along with the opportunity to have a place to eat and socialize outside the office setting. Views to nature and the outdoors in the staff lounge are also desirable.

2.1.7 Office/Consultation Room

Figure 7. Consultation Room

A private office for the provider is often used as a consultation room for the patients (Figure 7). When serious issues need to be discussed via phone or in person, an office can provide the provider and the patient privacy and comfort to be able to discuss medical issues.

2.1.8 Storage Areas

Figure 8. Medical Storage Area

Typical storage areas in a clinic include a clean utility and a soiled utility room, bio-hazardous waste disposal room, medical supply closets, and perhaps an office supply area. According to Malkin (2002), a storage area in a primary care facility should have two or more walls of adjustable shelving (Figure 8). Clean and soiled laundry areas and bio hazardous waste disposal areas are kept away from patient visibility and high patient traffic areas, while medical supplies can be kept closer to examination areas.

2.2 Case Studies and Innovative Concepts in Clinic Design

The day-to-day operations and patient flows in primary care clinics are influenced by the built environment. In the recent literature, a number of community health centers and clinics have been studied to identify links between the physical

environment and the flow of patient, staff, and supplies. The Center of Health Design (CHD) in California has selected exemplary primary care facilities as "Best Practice Models" and included clinics of different sizes in rural, urban, and suburban settings. Case studies showed that smaller centers with three or four physicians were the most efficient primary care clinics. The following best practice clinics from the CHD study were examined before selecting the primary care clinic for this study.

2.2.1 Clinica Sierra Vista

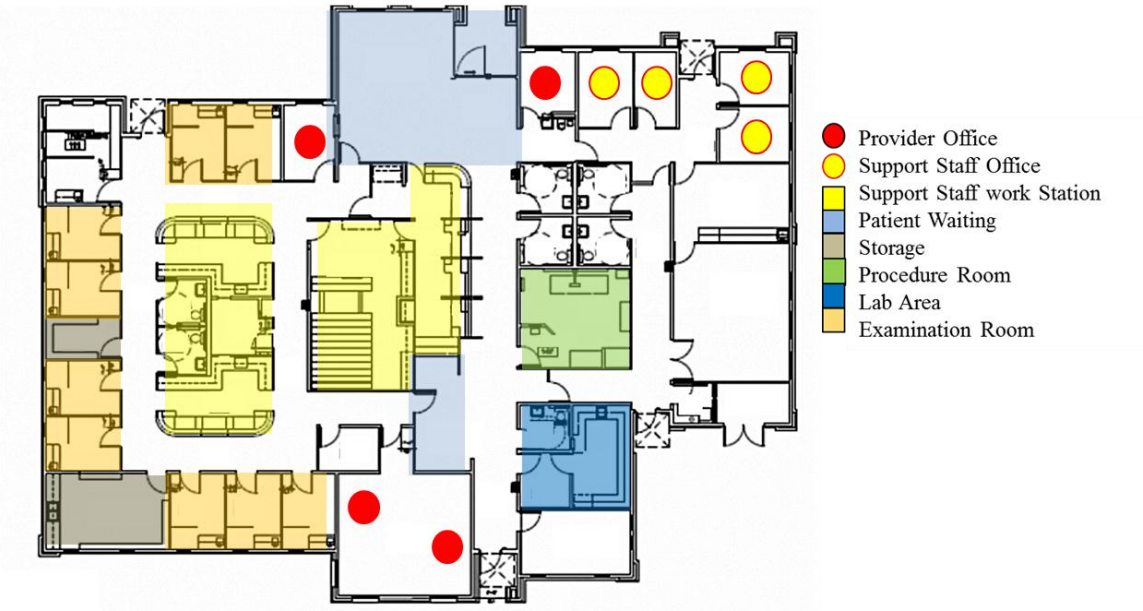

Figure 9. Clinica Sierra Vista- Central Bakersfield Annotated Plan.
Adapted Image Courtesy of KSA Group Architects
(Holdsworth, 2009)

Clinica Sierra Vista (Central Bakersfield Location) (Figure 9), designed by KSA Architects, contains primary care, teen outreach, and mother/child care and pediatrics areas. It holds nine exam rooms and one treatment room, and the staff is able to see about 200 patients per day with 4 providers. Based on the clinic staff experience, at 8,000 square feet with four providers in the clinic, this clinic was found to be the most efficient clinic size in terms of patient flow and clinic operations. This design was also determined to be the most effective from a way-finding and safety perspective. Last, the patients in this facility were also found to be the most comfortable (Center for Health Design, 2010). One negative aspect of the facility is that it includes a high patient volume and several family members often accompany patients; as a result, waiting areas tend to be crowded and maintaining patient privacy is often a problem (Center for Health Design, 2010).

2.2.2 Merced Suites of the Golden Valley Health Centers

Figure 10. Merced Suites Annotated Plan.
Adapted Image Courtesy of Bruce Dodd
(Dodd, 1995)

Another primary care clinic noted for its efficiency is the Merced Suites of the Golden Valley Health Centers in Merced, California. Since smaller facilities were the most efficient, the facility broke down its square footage into smaller suites (Figure 10). All the "suites" have separate entries and are connected through a common medical room and conference room.

Christina Noguera, a nurse practitioner from Merced Suites writes: "We have found that our optimal clinic design—which typically includes a three provider office, is around 2,500 square feet. It supports communication and staff work, and is a U hub form with a centralized nursing station in the middle" (Center for Health Design, 2010) (circled in red in Figure 10).

Designed by architect Bruce Dodd, the facility program incorporates family practice, women's health, behavioral medicine, and podiatry. The facility contains three suits with 12 exam rooms each. It holds four providers and sees approximately 150 patients per day.

A unique feature incorporated into this case study is its examination room configuration. As previously discussed, the examination room table needs to be kept at an angle to allow easy access and visibility. In this case study, "The corner of the exam rooms was chamfered so that the exam table could be placed flush against that wall to avoid the inevitable wasted space behind the exam table that occurs in a rectangular room. The resulting space in the hallway was converted to a nook where a charting table was then placed (Center for Health Design, 2010).

Certain security and privacy measures were also considered and integrated into the facility design. Counter heights were raised in the reception areas; certain staff areas are only accessible through keypads; and medication cabinets had a magnetic system in which a magnet unlocks the lock and a cabinet locks automatically when closed.

2.2.3 Thundermist Health Center

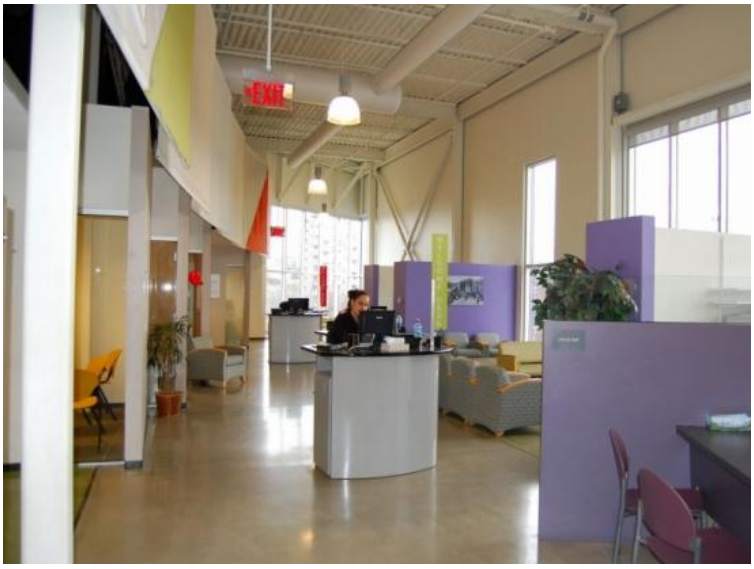

Figure 11. Thundermist Health Center.
Image Courtesy of Thundermist Health Center
(Thundermist Health Center, 2005)

Another clinic exemplified by the Center of Health Design is the Thundermist Health Center. Designed by Ashen and Allen Architects, the center is located in Woonsocket, Rhode Island. This facility was opened in 2005 and is a 26,000-square-foot suite within a 40,000-square-foot building. Program components include medical, behavioral, dental, and pediatric care. The facility has 28 exam rooms, and a staff body of —130 people. The facility is able to treat 200 to 400 patients per day. The Thundermist Health Center designed its office to be more patient centered. The waiting space (Figure 11) is less structured than most typical primary care settings, as each patient is handed a hand-held device that will blink when it is time for him/her to be

examined. The use of this technology enables patients to move around or even go outside while they wait to be treated, lessening the perception of wait time (Center for Health Design, 2010).

The Center for Health Design was able to collect plans, pictures, and some general information about the design and circulation patterns in each of its select best practice models to provide designers a variety of ideas and examples of innovative design concepts. A more thorough analysis of these clinics may allow more analytical comparisons and shed further light about the usability of clinic designs.

2.2.4 Study at Clemson University

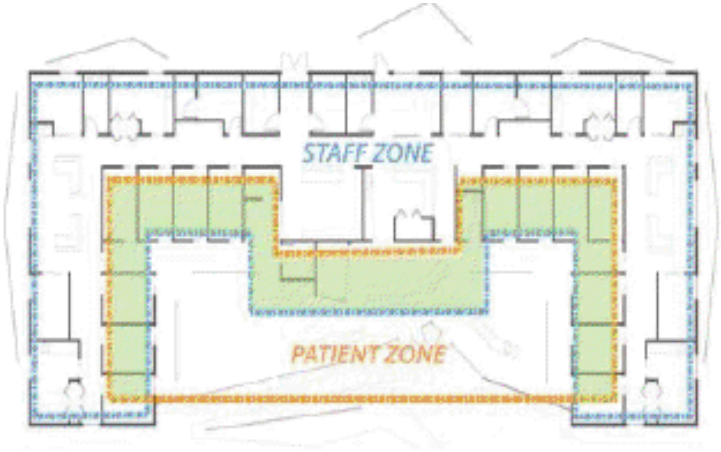

Figure 12."Schematic Floor Plan".
"Rethinking Family Medicine: Promotingn Efficient and Effective Work Processes Through Design" in *AIA Academy of Architecture for Health Journal*. Copyright 2009 By Dina Battisto. Reprinted with Permission
(Battisto, 2009)

A study conducted at Clemson University examined how the primary care office can be "redesigned to promote more efficient and effective work processes" (Battisto,

Thomas, Whitman, & Weeks, 2009). The author expressed a strong need to rethink the built environment of family practice by considering the new trends in primary care. "The American Association of Family Physicians' task force predicts that in the future family medicine will need to 'redesign the work and work place of family physicians' and integrate the concept of a 'relationship centered personal medical home' (AAFP, 2009)" (Battisto et al., 2009). Additionally, "electronic medical records will be central to allow for the fluid movement and access to patient medical information" (Battisto et al., 2009).

The study looked at three zones within the clinic environment, including "a) office personnel in the office support zone, b) a nurse in the clinical support zone and c) a physician in the provider zone." During the observation, steps involved in each work process were recorded along with the physical barrier perceived to obstruct work flow and the influence of the clinic's floor plan on the work flow (Battisto et al., 2009).

The collected data were then analyzed and assessments were made to detect inefficiencies in the floor plan. The gathered information was then used to design a new, efficient floor plan fit for the changing trends in primary care (Figure 12).

The proposed design separated patient and staff circulation zones. The assessment rooms where patients and staff meet (highlighted in green), is in-between these zones. The design is currently being constructed and will undergo a post-occupancy evaluation (POE) will examine the design hypotheses.

Although Battisto's design considered the work flow, physical barriers perceived in the work flow, and proposed innovative design ideas; the study was more focused on

a new design than on explaining the methodology of documenting the data that were translated into the design.

In a rapidly changing environment, basic programmatic guidelines and best practice clinic models may not be sufficient to provide architects a full understanding of the dynamics of clinic environment. Moreover, because each project may demand slightly different requirements or cater to a different population, case studies and design guidelines can only serve as potential applicable ideas for a project.

More than guidelines and case studies, building evaluation tools may provide the resources for architects and designers to think more critically and creatively about their project. Although there is ample information available in the literature, the literature has limited tools that can help apply discussed concepts to a design problem and provide a comprehensive evaluation of clinic design usability.

2.3 Building Evaluation Methods and Tools

2.3.1 Introduction to Post-occupancy Evaluations

The process of creating an effective building evaluation tool requires selecting appropriate research methodologies to understand the dynamics of the system that is being examined. A POE of existing buildings can provide a basis on which to build the building evaluation tool. Wolfgang Preiser defines POE as:

> … a process of systematically evaluating the performance of buildings after they have been built and occupied for some time. POE differs from other evaluations of building performance in that it focuses on the requirements of the building occupants, including health, safety, security, functionality, and efficiency, psychological comfort, aesthetic quality and satisfaction. (Preiser, 2002, pp. 42-43)

Researchers can use a variety of methodologies to perform a POE depending on what sort of information they are interested in finding. The selection and refinement of research methodologies (systematically evaluating building performance) are largely based on previous studies in the literature, the number of subjects being tested, available resources, IRB (institutional review board) impacts and protocols, and an individual's cognitive style (Shepley, 2011). More often, a combination of research methodologies can be applied to compare or triangulate various types of information to provide a more holistic understanding of the problem (Shepley, 2011).

There are as many ways to design research tools for building evaluation as there are ways to design a building. The literature addresses an array of measures and methodologies that are being applied to the design of healthcare environments at various scales. Some applicable evaluation research methods include 1) behavioral mapping, 2) questionnaires, 3) open and structured interviews, 4) cognitive mapping, 5) direct participation and observation, and 6) photography and video recording (Shepley, 2011; Zimring, 2008).

Research methodologies such as behavior mapping, direct participation and observation, photography, and video recording involve the researcher, directly engaging him/her in the physical environment at various levels. The researcher can use such methods to understand how a building is used. Interviews and surveys allow the researcher to have an understanding of how the users perceive the environment without him/her being involved in the environmental assessment. The advantage of having the researcher assess the environment is that it allows the researcher to connect theory (what

literature may say) and practice (what he is actually observing). Because the researcher may have a more comprehensive understanding of the literature than the actual building users, the involved researcher may have new research inquiries and/or further refine research objectives. None the less, interviews and survey may better represent what the actual building users perceive.

Design firms are beginning to conduct more and more POEs and use research to guide their designs although, the time and energy put forth in these efforts however sometimes becomes difficult to sustain.

2.3.2 Design Evaluation Tools in the Literature

Design evaluation templates can provide more efficient use to time and resources. Despite the existing literature on primary care facilities, there is a lack of evaluation tools that can help designers apply concepts in the literature to specific design problems and provide a comprehensive evaluation of clinic usability. Among limited building evaluation tools, an important survey example was developed by the Department of Health and The National Health Service (NHS) in the United Kingdom. They have developed a variety of healthcare building evaluation tools, through collaboration with a number of professionals, to assess the design success of their healthcare facilities. Existing literature was used to develop rating systems and evaluation criteria, which were used by the Department of Health to rate the design of a healthcare building.

An evaluation tool called "A Staff and Patient Environment Tool-Kit" (ASPECT) shows how the healthcare environment can impact levels of patients and staff satisfaction. The tool is designed to evaluate and compare existing facilities, plan a new building, develop existing plans, or be used in various aspects of construction to further refine the design. It consists of eight evaluation categories with statements about specific aspects of the building in each category. The evaluators (clients, developers, managers, and designers) indicate how much each statement applies to the building design using a Likert scale of 1 to 6, with 1 meaning they completely disagree with the statement and 6 meaning they are in complete agreement with the statement. Next to the score is a notes section to write more specific information or explanations regarding the answer.

The eight categories—1) privacy, company, and dignity; 2) views; 3) nature and outdoors; 4) comfort and control; 5) legibility of place; 6) interior appearance; 7) facilities; and 8) staff—each contain five to eight statements about the built environment. Example statements in the survey include: "Patients can choose to have visual privacy"; "Patients can have a private conversation" for category 1 (privacy, company, and dignity) and "It is easy to understand the way the building is laid out"; "There is a logical hierarchy of places in the building"; and "It is obvious where to go to find a staff member" for category 5 (legibility of place) (Department of Health, 2008b).

The ASPECT tool was constructed in a very logical manner. The tool effectively addresses points of the built environment that can improve patient and staff satisfaction with the physical environment. The statements provided in the tool are, however, very general statements that could be applied to any type of healthcare building. Specific

aspects of the design that cannot be addressed in the scored statements could be noted in the notes section next to the rating. The ASPECT tool does not provide a full comprehensive evaluation of the facility. A more specific tool addressing functional aspects of a certain building typology, such as primary care clinics, can be more useful to designers and researchers.

Another tool, Achieving Excellence Design Evaluation Toolkit (AEDET Evolution), is often used along with the ASPECT tool, to provide valuable information and guidance when evaluating a building. Like the ASPECT tool, the AEDET Evolution toolkit follows a 1–6 scoring system (1, "completely disagree with the statement"; 6, "in complete agreement with the statement") and consists of evaluation categories: 1) impacts, 2) built quality, and 3) functionality. Impacts consist of 1) character and innovation, 2) form and materials, 3) staff and patient environment, and 4) urban and social integration. Built quality analyzes 1) performance and 2) engineering and construction, and functionality analyzes 1) use, 2) access, and space (Department of Health, 2008a).

The "use" section in the AEDET Evolution toolkit addresses aspects of the design such as facilitating security, supervision, flexibility, adaptability, and optimal arrangements for efficient work flow, building capacity, and the satisfaction of basic functional requirements. Sample statements are: "Work flow and logistics are optimally arranged," "The building is sufficiently adaptable to respond to change and to enable expansion" and "The layout facilitates both security and supervision." The scores and

commentary given on a particular building provide a basic assessment of these building aspects (Department of Health, 2008a).

Other sample tools include Inspiring Design Excellence and Achievements (IDEAs), Better Health Buildings, Enhancing the Healing Environment, and the Design Development Protocol, that were developed by the NHS or the Department of Health in the United Kingdom. They also measure the impacts of the building environment on health and healing, but are not as comprehensive as AEDET and ASPECT. Therefore, they are not discussed in detail for the purposes of this thesis.

The creation of these tools packages healthcare design literature in a usable format so that design practitioners can integrate theory into design and design analysis. There is still however more literature that needs to be addressed to architectural design practitioners.

2.4 Theories in Healthcare Design

An array of theories and design concepts can be applied in healthcare architecture to develop "healing spaces". Environmental stress is often the greatest hindrance that deters the quality of space. Healthcare design theories examine the impact the physical environment can have on stress.

2.4.1 Ulrich's Theory of Supportive Design

Roger Ulrich is a pioneer in addressing how design of the physical environment reduces stress and improves health. According to Ulrich, a stressful situation (e.g.t vising a healthcare facility) can bring "numerous psychological/emotional, physiological,

biochemical, and behavioral changes" in an individual, and therefore healthcare facilities should be designed to support patients in coping with stress (Ulrich, 1991, 1997). In Roger Ulrich's theory of supportive design, providing a sense of control, social support and access to privacy can support coping with stress and improve health outcomes.

2.4.2 Psychosocially Supportive Design Theory

The concept of stress in relation to environmental psychology was also later investigated by Allen Dilani in psychosocially supportive design theory. This theory summarizes existing terms in the literature related to the perception of stress in relation to the built environment.

Dilani writes:

> The basic function of psychosocially supportive design is to start a mental process by attracting human attention, which may reduce anxiety and promote positive psychological emotions. Health processes could be strengthened and promoted by implementing design that is salutogenic – ie, that focuses on the factors that keep us well, rather than those that make us unwell. The aim of psychosocially supportive design is to stimulate the mind in order to create pleasure, creativity, satisfaction and enjoyment (Dilani, 2001, p. 16).

Psychosocially supportive design stimulates the user mentally and socially, and supports his sense of coherence thus promoting mental, physical and social heath. Building on Ulrich's theory of supportive design, psychosocially supportive design theory further provides key variables in the literature that influence stress. Dilani writes:

> …architectural dimensions such as *stimulation* (intensity, variety, complexity, mystery, novelty, noise, light, odor, color, crowding, visual exposure, proximity to circulation, adjacencies), *coherence* (legibility, organization, thematic structure, predictability, landmark, signage, pathway configuration, distinctiveness, floor plan complexity, circulation alignment, exterior vistas), *control* (crowding, boundaries, climatic & light controls, spatial hierarchy,

> territoriality, symbolism, flexibility, responsiveness, privacy, depth, interconnectedness, functional distances, focal point, furniture arrangement), and *restoration* (minimal distraction, stimulus shelter, attraction, solitude) are closely linked to the perception of positive and negative stress (Dilani, 2003, p. 15).

Understanding psychosocially supportive design theory in respect to the usability concept can provide a stronger theoretical basis to analyze healthcare building usability. Previous usability studies in healthcare design and in the evaluation tools have not applied all the principles identified in psychosocially supportive design theory in their evaluations.

2.5 Usability Concept and Its Application in Healthcare Architecture

2.5.1 Introduction to the Usability Concept

The term "usability" is widely used in fields such as product design, information technology, and web design. Standardization of the concept of usability was first called for in 1998, where a study stated that no valid definition or metric for usability existed in the literature (Lund, 1998). A number of authors have questioned the idea of usability standards (Hertzum & Jacobsen, 2001; McGee, Rich, & Dumas, 2004; Wixon, 2003). Different products have slightly different usability criteria. For example, the usability of a web site design may have different usability evaluation criteria than the usability of a product such as a cell phone or Bluetooth device.

Nonetheless, certain baseline criteria exist within usability frameworks and hold a universal application. Thus, the International Organization for Standardization (ISO, 1998) defines *usability* of a product as "the extent to which the products can be used by specified users to achieve specified goals in the specific context of use with the

particular environment." ISO also pointed out that the usability is measured based on three basic parameters: effectives, efficiency, and user satisfaction (ISO, 1998). "Effectiveness is the accuracy and completeness with which users achieve specified goals" (ISO, 1998). Effectiveness indicators from previous literature include "quality of solution and error rates" (Frøkjær, Hertzum, & Hornbmk, 2000) . "Efficiency is the resources expended in relation to the accuracy and completeness with which users achieve goals" (ISO, 1998). Noted efficiency indicators include "task completion time and learning time" (Frøkjær et al., 2000) . "Satisfaction is freedom from discomfort, and positive attitudes towards the use of the product" (ISO, 1998). Satisfaction in this definition is more of a subjective measure regarding comfort and user preferences (Welie, Van Der Veer, & Elie'ns, 1999).

2.5.2 Application of Usability Concept in Healthcare Architecture

An architectural application of usability is very limited compared to its use in other design fields. Unlike web site design, product design, and other technologies that are consciously used and dealt with on a smaller scale, architectural usability is about an entire experience and includes sensation, perception, and cognition. Furthermore, building occupants who "use" architecture on a daily basis often are not cognizant of what they are using. Interestingly, architecture most often is noticed when there are certain discomforts, such as bad lighting, uncomfortable temperature, or lack of coherence. The process that measures usability and translates the ISO definitions within an architectural context demands some critical thinking and meticulous research.

Existing literature on healthcare facilities addresses factors such as layout efficiency, privacy, and user satisfaction and how the environment can impact the health and well-being (design effectiveness). A study may just examine user satisfaction in in a building, or a certain aspect of the design however limited research has examined all three components effectiveness, efficiency and user satisfaction (ISO definition of usability) of a healthcare building together. The integration of the usability concept into a building evaluation can help designers and researchers to gain a deeper and more holistic understanding about building usability.

Though design effectiveness, efficiency, and user satisfaction have not been thoroughly developed within an architectural context; a few recent studies have made strides toward framing usability concept within healthcare architectural design. Starting with the ISO definition stating *usability* as "the extent to which the products can be used by specified users to achieve specified goals in the specific context of use with the particular environment," Hamid and Harun define *architecture usability* as the "users' experience and feedback to the design and environment" (Harun, Hamid, Talib, & Rahim, 2011a). Furthermore, Harun and Hamid say, "The most significant aspect of patient experience is through spatial design which contributes to satisfaction as well as the overall efficiency and effectiveness of the hospital design" (Harun et al., 2011a).

It is through understanding the *users' experience*, which is defined as "a personal interpretation of a situation based on the cultural, background, mood, sensation and physical conditions of users," that an accurate design assessment can be made (Harun,

Hamid, Talib, & Rahim, 2011b). According to the authors, the usability criteria for a design are therefore very dependent on the situation and context.

The users' experience in healthcare settings literature focuses on the quality of service and overall users' (patients', staff's, and visitors') satisfaction with the facility. Surveys such as Consumer Assessment of Healthcare Providers and Systems (CAHPs) instruments, Promoting Healthy Development Survey (PHDS), and Young Adult Health Care Survey (YAHCS) can be useful tools in assessing the patients' experience; however, these tools do not specifically examine the physical design aspects of a healthcare setting (Co et al., 2011).

Harun and Hamid developed a healthcare building usability evaluation tool using nine dimensions derived from Voordt and Wegen (2005) and T. J. M. Voordt (2009). One of Haurn and Hamid's studies on hospital usability examines the usability evaluation in more detail. In a hospital design study, usability evaluation criteria included "1) reachability and parking facilities, 2) accessibility, 3) efficiency, 4) flexibility, 5) safety, 6) spatial orientation, 7) privacy, territoriality and social contact, 8) health and physical well-being, and 9) sustainability" (Harun et al., 2011a).

In the evaluation tool, a checklist was created with each dimension containing several items specific to the hospital design. For example, the accessibility dimension contains items about parking accessibility, lack of signage, walkway to main entrance, and rest areas with seating and landscape along the way for people who need a break. The flexibility dimension examines multifunctional activities in an area and space utilization by various users, and the safety dimension examines efficient lighting and

damaged or broken furniture (Harun et al., 2011a). This checklist highlights some essential aspects of a successful facility design that can be evaluated in a variety of healthcare settings.

In addition to the checklist evaluation tool, other existing research, and hospital documents were analyzed, and semi-structured interviews were conducted for the usability evaluation. The semi-structured interview asked open-ended questions dealing with sensation and perception. Sample questions from the checklist include:

1. "How do you feel about this space?"
2. "How does this area make you feel?"
3. "How do you find your experience along this journey? Do you like it?"
4. "How would you describe it?"
5. "What do you think of this environment and the facilities?"
6. "Where do you want to go from where? What is your expectation from this experience?"
7. "How long have you been here? What do you do?"
8. "Are you satisfied?" (Harun et al., 2011a, p. 141)

An open-ended questionnaire allows the opportunity to collect cognitive information and to see how different individuals (e.g., nurses vs. physicians) may view the same physical environment differently. When the user writes about their experience from their own words, different key aspects of a space hold the potential to be addressed in the response.

Harun and Hamid published another study analyzing the usability of an outpatient facility (Harun & Hamid, 2011).The study focuses more on a theoretical framework for usability in healthcare design. They also stated that "Usability dimensions should be defined case by case and depend on the type of building purpose and goals of users or organization" (Harun et al., 2011a). The authors put together a list of usability criteria in the literature, associated with building design (Table 1)

Usability Criteria for Building Design Adapted from (Harun & Hamid, 2011)
efficiency, ideal, informative, accessibility, networks, problem solving, flexibility, learnability, memorability, prevention or errors, navigation, functionality, atmosphere, visual design, interaction and feedback, **satisfaction,** feeling secure, spatial orientation, reachability and parking facilities, design usability vs. design emotion, health care and physical wellbeing, signage and initial orientation and social contact, generality, elasticity, aesthetics, enjoyable, memorable, valuable, clear, understandable, consistent, logical, productive, predictable, organized, natural, **effective,** privacy, sustainability, expected, simple, complete, helpful, dependable, useful, controllable, customizable, safety, familiarity, landmark, user-friendly, familiar, manageable, stress free, integrated, services

Table 1. Terms Used to Assess Building Usability in the Literature

The list of usability criteria for buildings can provide some insight for the development of evaluation tools for primary care facilities. The original ISO usability parameters however, got lost within various other usability terms. Though effectives, efficiency, and user satisfaction were originally built within Harun and Hamid's conceptual framework, more theoretical development and analysis was needed to define and understand these terms within a healthcare architectural context.

3. RESEARCH DESIGN

3.1 Conceptual Framework

Healthcare design theories can benefit through integrating the usability concept within their constructs. Interestingly many of the usability criteria terms selected by Harun and Hamid and very similar to Dilani's selection of psychosocially supportive design terms. The conceptual framework for this study re-categorized the psychosocially supportive design terms identified in the literature by Dilani and some of usability terms (accessibility, navigation, and prevention of errors) selected by Harun and Hamid within the usability parameters developing a usability construct for healthcare design-"The Building Usability Framework" (Table 2 and Table 3).

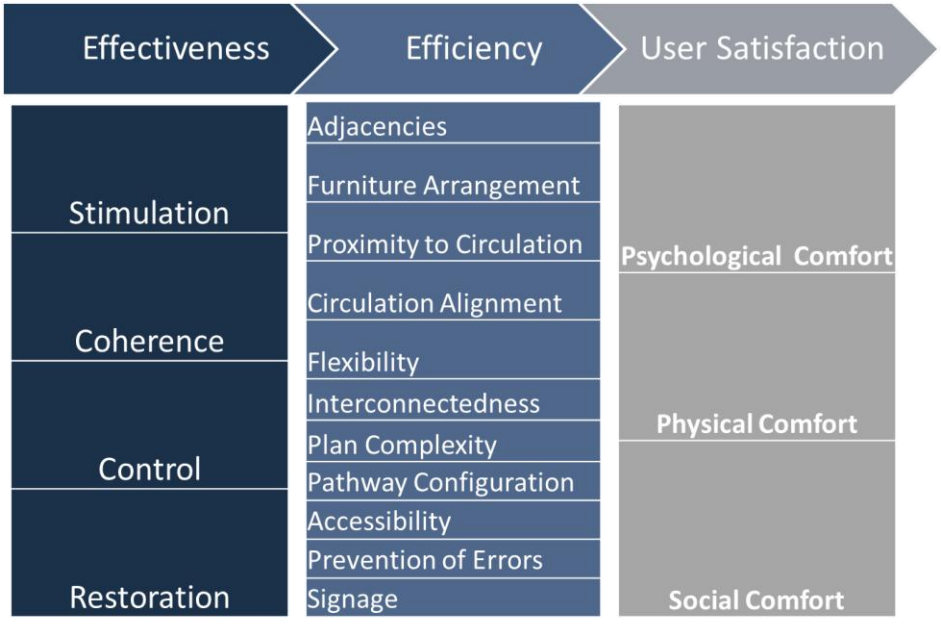

Table 2. Building Usability Framework for Healthcare Design

Effectiveness			
Stimulation	**Coherence**	**Control**	**Restoration**
Intensity	Legibility	Crowding	Minimal Distraction
Variety		Boundaries	
Complexity	Organization	Climatic & Light Controls	
Novelty	Thematic Structure	Spatial Hierarchy	Stimulus Shelter
Mystery		Territoriality	
Noise	Predictability	Symbolism	
Light		Responsiveness	
Odor	Distinctiveness	Privacy	Attraction
Color		Navigation	
Crowding	Landmarks	Depth	
Visual Exposure	Exterior Vistas	Prevention of Errors	Solitude
		Functional Distances	
		Focal Point	

Table 3. Effectiveness Parameter of the Building Usability Framework

3.1.1 Architectural Parameter for Design Effectiveness

Design effectiveness is defined by the intent expressed in the details of design and how it meets its functional requirements. Design goals set in healthcare architecture always relate to improving the health. Therefore terms identified from the literature that influence the amount of stress put forth by physical environment have been categorized as design effectiveness (Table 3).

3.1.2 Architectural Parameter for Efficiency

Efficiency of the design is determined by the amount of "resources expended in relation to the accuracy and completeness" (ISO, 1998) of certain the programmatic

functions. Terms within psychosocially supportive design theory and building usability criteria which are more closely related to efficiency include: adjacencies, furniture arrangement, proximity to circulation, circulation alignment, flexibility, interconnectedness, plan complexity, pathway configuration, accessibility, prevention or errors, and signage (Table 2). Definitions for the effectiveness and efficiency usability terms as used in environmental psychology literature can be found in Appendix E.

3.1.3 Architectural Parameter for Users Satisfaction

Ideally a successful design will not only be effective in performing is function but also be efficient in the resources it requires for proper functions. The satisfaction of the design determined by the effectiveness and efficiency can be analyzed in the three sub-architectural dimensions of psychological, physical, and social comfort.

3.2 Study Site

In order to develop assessment tools based on the proposed Building Usability Framework, this study selected a primary care clinic as a "test" case study. Similar to the best practice clinic models selected by the Center for Health, the case study clinic for this study was also a newly constructed one story clinic with five full-time providers and a building square footage of approximately 9,000 square feet. The clinic is located in a corner area of a larger office building in a Maryland suburb. It had 16 examination rooms and a total of 18 staff members working in the clinic on a full time basis, including 5 providers, 5 certified medical assistants, 5 medical office assistants, 2 registered nurses, and an office manager. In addition, there is a part-time healthcare

administrative assistant and two part time specialists that visit the clinic. The facility saw approximately 100 patients per day.

Programmatic elements in the clinic include a waiting area, a staff lounge, offices for providers and workstations for other staff, storage areas, a lab room, and bathroom facilities for patient and staff. Figure 13 shows the location of each provider (red dot) and the provider's designated exam rooms.

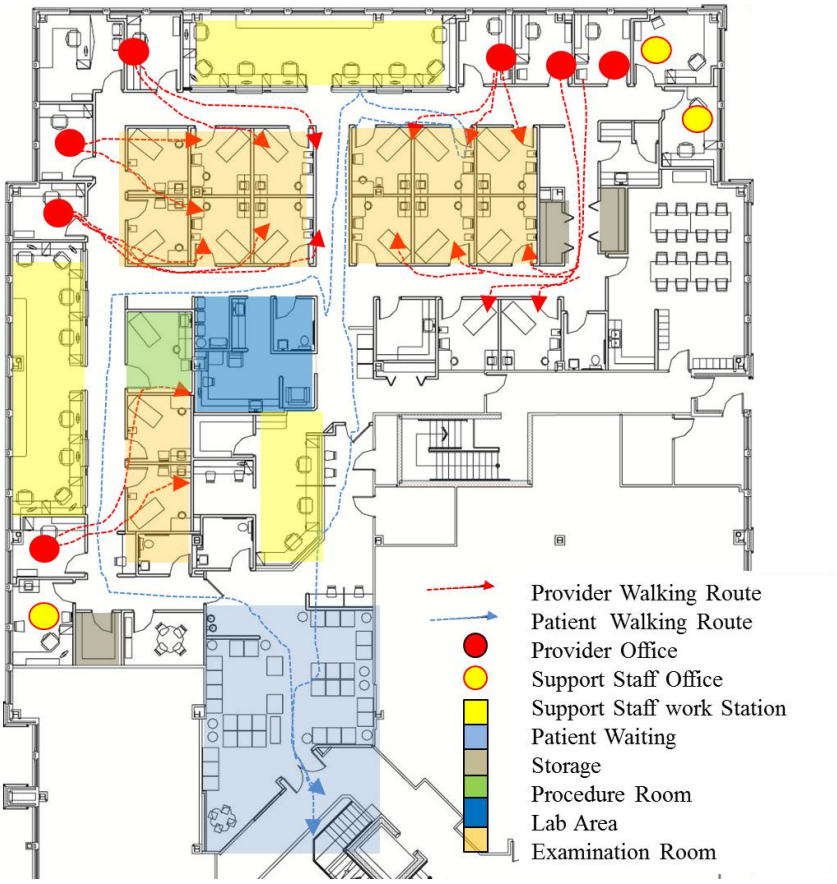

Figure 13. Annotated Facility Plan.
Adapted Image Courtesy of Creative Access
(Creative Access, 2009)

3.3 Study Methodology and Building Evaluation Tools

3.3.1 Interview and Behavioral Observation

The preliminary data about the clinic was collected through a site visit and an interview with the head nurse. After these data were analyzed, a 40-hour behavioral observation was conducted in the clinic. Previous healthcare design studies such as "Impact of Single Family NICU Rooms on Family Behavior" (Shepley, Harris, White, & Stinberg, 2008) suggest that a 40-hour observation at a given site can provide an adequate range of data for analysis.

For this study, one full 9a.m. -5p.m. work day was spent in each following clinic areas: 1) check-in area, 2) waiting room, and 3) lab area (a total of 24 hours). The remaining 16 hours were split in 2-3 hour periodic observations in the examination rooms, procedure room, provider offices, and the work stations until a basic understanding of systems and flow were understood. Information about the billing/nurse triage room, staff lounge area, sharps room and other storage areas were obtained preliminary data collection during the interview with the head nurse.

3.3.2 Usability Observation Tool

The observations were conducted using the Usability Observation Tool (Table 4), which noted the furniture, medical supplies, and equipment within the environment, the tasks that occurred in relation to the objects, and the types of interactions that occurred between people who performed these tasks. Additionally the tool noted the spatial

attributes of the behavioral patterns in the observed area. The behavioral observation notes from various observation points can be found in Appendix A.

Objects	Interaction	Tasks	Spatial Attributes and Noted Behaviors

Table 4. Usability Observation Tool

3.3.3 Coding Analysis Table

The information collected from the behavioral observation were then analyzed and coded using the Coding Analysis Table (Table 5). This table categorized the information collected under the usability dimensions of effectiveness, efficiency, and user satisfaction. The table helped fill in the missing links under the usability dimension that were not written down during the observation. The Coding Analysis Tables for different observed clinic areas can be found in Appendix B. Along with the usability parameter categorization, the observations were also coded in three colors. Green indicated spatial attributes which work with the space, red indicated special attribute not working or spatial attributes that were missing, and black includes other observations or ideas that could be applied to a project or survey.

	Effectiveness	Efficiency	User Satisfaction
Tasks	Ergonomic Details	Travel Distances , Access	Mental, Physical & Social Comfort

Table 5. Coding Analysis Table

The completed Coding Analysis Tables were then used to develop a staff survey to assess the usability of the primary care clinic. The purpose of this survey was to triangulate the observations with the literature and staff feedback as well as to develop possible alternative design recommendations.

3.3.4 Staff Survey Instrument Development

The survey provided statements about the facility design. The staff members were asked to rate how much they agree or disagree with the statements provided on a scale of 1-5 (1, “strongly disagree” and 5, “strongly agree”). Additionally an open-end question was asked in each section to allow the building user (staff member) to explain how he/she would add to or change any design feature if able to do so.

Based on the information collected in the behavioral observations, eight sections were developed in the survey, including: 1) Check-in and Waiting Area, 2) Examination

Room, 3) Procedure Room, 4) Check-out Area, 5) Communications, 6) Storage Capacity and Locations, 7) Labs, and 8) Workstations or Offices. The results from the Coding Analysis Tables from the behavioral observation were used to develop the statements in the corresponding section.

This survey also collected information about the respondent's profession (provider, medical office assistant [MOA], certified medical assistant [CMA], or nurse [RN]). It also asked each respondent to locate where he/she works most often in the plan. This information allowed more detailed and thorough data analysis.

Check-in and Waiting Area

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
Check-in And Waiting					
1. The check-in area provides privacy to patients.	1	2	3	4	5
2. The check in area provides strong visibility/ surveillance of the waiting space for the MOA.	1	2	3	4	5
3. The waiting space provides a variety of seating for the patients.	1	2	3	4	5
4. The children's corner has strong visibility to certain "parent chairs".	1	2	3	4	5
5. The children corner have strong visibility for the MOA?	1	2	3	4	5

What would you add or change in the check-in and waiting area if you could?

Table 6. Section 1 Staff Survey: Check-in and Waiting

The first section of the staff survey (Table 6) examines the "Check-in and Waiting" area of the clinic. The entrance of the clinic has to be comfortable for the

patient. It needs to provide security and surveillance, as well as some privacy from other individuals. Statements 1.1 and 1.2 are designed to be reciprocal statements. Often the more privacy that is provided, the less visibility is available. Mental, physical, and social comforts are also addressed in statements 1.3, 1.4, 1.5. Additionally, the staff was asked what they would change about the space if they could.

Examination Room

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
Examination					
1. Examination room is large enough to accommodate all tasks.	1	2	3	4	5
2. Patients often come with families in the examination room.	1	2	3	4	5
3. The examination room get too crowded when more than one patient is in the room.	1	2	3	4	5
4. Examination rooms around central check-in station area have limited privacy.	1	2	3	4	5
5. EKG machines are easily accessible when needed.	1	2	3	4	5

What would you change about the examination room if you could?

Table 7. Section 2 Staff Survey: Examination Room

The second section looks at the examination room design (Table 7). The examination rooms in the clinic were fairly small at about 100 square feet each with only one extra seat, which was for the patient to sit in during while the CMA took the patient's vital signs. Family members often came with the patient into the examination

room. Statements 2.1, 2.2, and 2.3 were constructed to see how the staff member felt about the dynamics of this spatial situation.

The next statement 2.4, dealt with a privacy issue. Examination rooms that were in front of check-out areas often had other patients who crowded close to the examination room entrance during the behavioral observation. Statement 2.4 sought to find out how staff members felt about this situation.

The clinic plan had two nooks for the electrocardiogram (EKG) machine. The EKG machine (also known as the ECG machine) is a piece of equipment that is often found in primary care clinics because it is used to perform noninvasive procedures known as electrocardiograms. If this procedure was needed, the CMA brought the EKG machine cart into the patient room. The EKG machines therefore needs to be located in close proximity to the exam rooms. The last statement in the survey was designed to see if the current locations work efficiently for the staff.

Procedure/Bariatric Room

Procedure/ Bariatric Room					
1. Procedure room is an adequate size for comfortable usage.	1	2	3	4	5
2. Shelving in the procedure room is not effectively positioned and designed.	1	2	3	4	5

What would you add or change in the Procedure/ Bariatric room if you could?

Table 8. Section 3 Staff Survey: Procedure/ Bariatric Room

The third section (Table 8) examines the procedure room, which is slightly larger than the exam room, at about 11 by 12 feet. Because the room is not as large as what Malkin had recommended in *Medical and Dental Space Planning: A Comprehensive Guide to Design, Equipment, and Clinical Procedures* at (12 by 12 feet), the survey sought to see how the staff felt about using this space. Additionally, the shelving and counter space were encompassed most of the width. The survey also addressed the design and positioning of the storage space.

Lab Area

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
Labs					
1. The patient chair in the lab rooms seems to be comfortable.	1	2	3	4	5
2. There is enough counter space to organize all my lab slips in the lab room.	1	2	3	4	5
What would you add or change in the lab room if you could?					

Table 9. Section 4 Staff Survey: Lab Area

The next section addresses the lab area (Table 9). The main activity that occurred in the lab area was the drawing of blood. The lab tech needed ample counter space to organize all the blood samples and tubes. The survey sought to assess whether adequate space was provided for the lab technician to organize his/her tasks. The patients' comfort

and privacy were also examined in the survey. The staff was asked whether they thought the chair in which the patients sat looked comfortable.

Communication Systems

Communication Systems					
1. I communicate often with my co-workers via face to face conversation.	1	2	3	4	5
2. I communicate often with my co-workers via email.	1	2	3	4	5
3. I communicate often with my co-workers via phone.	1	2	3	4	5
4. I wish I could communicate more with my CMA, MOA, or provider.	1	2	3	4	5

How do you communicate most often with your co-workers and what do you think may help improve communication between them?

Table 10. Section 5 Staff Survey: Communication Systems

The fifth section in the staff survey investigated communication systems within the clinic (Table 10). Unlike other sections of the survey, which focus on a particular area of the clinic, this section looked at the plan as a whole system.

An effectively designed clinic provides strong face-to-face communication with its most essential staff systems (CMA, MOA, or provider). Statements 5.1-5.5 therefore identify the frequency of different types of communication, and, lastly, the open-ended question asks how communication can be improved.

Work Station/Office Area

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
My Work Station or Office					
1. I am satisfied with my work environment.	1	2	3	4	5
2. I feel organized.	1	2	3	4	5
3. My works space helps me be stay organized.	1	2	3	4	5
4. My work area is noisy.	1	2	3	4	5
5. My job is stressful.	1	2	3	4	5
6. My work environment contributes to my stress .	1	2	3	4	5
7 Providers, CMAs (Certified Medical Assistants), and MOAs (Medical Office Assistants) should work in the same room/ work station.	1	2	3	4	5

Please indicate why you agree or disagree with Providers, CMAs, and MOA being in the same room/ work station (statement number 7).

Table 11. Section 6 Staff Survey: Work Station or Office

The next section examined the staff work spaces (Table 11). Two central open areas in the plan where the CMAs and MOAs worked are referred to as the work stations in this section of the survey . Work stations and the provider's offices were grouped together because these areas are "staff only" work areas in the clinic. Other than the exam room, most staff members spend their time in these locations. Traditionally in clinic designs, providers are given their own office and other staff members have similar work stations. The survey examined how the work station environment was perceived

differently from an office environment in terms of noise, organization, satisfaction, and stress and whether these distinctions in the work environment were needed.

Check-out Area

Check -out					
1. Patients often get lost trying to find the check-out counter.	1	2	3	4	5
2. The central location helps patients orient themselves in the facility.	1	2	3	4	5
3. The central location and design limits patients' privacy.	1	2	3	4	5
4. The sticker box can be used as better motivation/ encouragement tools if made directly visible in the front area of the check-out corner.	1	2	3	4	5

What would you add or change in the check-out area if you could?

Table 12. Section 7 Staff Survey: Check-out Area

Section seven statements 7.1, 7.2 and 7.3 of the staff survey examined the check-out area locations (Table 12). Because the clinic provides multiple check-out locations, some check-out stations were ideally located in relation to the exam rooms, whereas others were more confusing. Each provider had a designated check-out location along with their exam room. The walk from the exam room to the check-out area became a key design feature for way-finding.

Statement 7.4 examined possible landmark solutions to guide and motivate users at the check-out locales. During the behavioral observation that the sticker box was always kept hidden even though it may have not been necessary.

Storage Capacity and Locations

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
Storage Capacity and Location					
1. Storage areas would be better utilized if there were smaller decentralized unites dispersed between and in front of examination rooms.	1	2	3	4	5
2. The sharps rooms need to be centrally located.	1	2	3	4	5
3. The sharps room is often used.	1	2	3	4	5

Table 13. Section 8 Staff Survey: Storage Capacity and Locations

The last section of the survey examined the storage area (Table 13). All storage areas were grouped into one section of the survey. The main issue with storage is its location; therefore, statements 8.1, 8.2 and 8.3 attempted to understand the needs for centralization and decentralization and accessibility demands.

4. RESULTS AND DATA ANALYSIS

After the survey was distributed and information was collected, JMP Pro 9 software was used to organize and analyze the data to draw conclusions about the design. The feedback from the staff then compared with the behavioral observation analysis and the collective information was integrated into the "Building Usability Framework" developed by this study.

4.1 Waiting and Check-in Area

Figure 14. Waiting area
(Note: Children's corner is located behind counter/wall to the right of the glass entrance door.)

4.1.1 Behavioral Observation

The waiting and check-in area is divided into clusters of different seating areas (Figure 14). Two thick walls separate the seating area and the check-in area and provide some visual and acoustical privacy to the people signing in at the counter. The design also has two entrances into the clinic from the waiting area for easy flow.

As patients came in during the behavioral observation, they tried to spread out as much as possible. At the beginning, patients occupied his/her own "cluster" in the waiting area. As more patients came in, seats within the same cluster started getting occupied. The clustered seating seems to be a successful way of providing personal space for the patients during their wait for their provider.

The clinic also provided wider seats for patients who might need more room. Women in particular found these seats well suited as they were able to place their purses or bags right next to them instead of on the floor, a corner table, or the seat next to theirs. Parents or guardians who came with children sat in seats close to "the children's corner" in the back of the waiting area.

Figure 15. Check-in Area
(Note: The printer/scanner can be seen on the back counter space)

Once a patient came in, he/she directly approached the check-in counter, signed in, and signed a consent form (Figure 15). The MOA then usually scans the patient's scanned their insurance and identification cards and double-checks the patient's emergency contact phone number and address. The identification card scanner was small enough to be located directly in front of the MOA at the desk. Other letter sized paper work such as the consent form needed to be scanned in the back of the check-in area. For better efficiency, a printer/scanner could be placed in closer vicinity to the MOA. The digital copies of the consent form, insurance card, and identification card were then electronically attached to the individuals' electronic medical records (EMRs) and a digital flag was sent to the CMA notifying him/her that the patient has arrived and is waiting. The MOA also printed out their current medication list and gave it to the patient

to review before he/she went in. Because the printer and scanner were placed in the back of the check-in space, the MOA moved back and forth to collect the sheet(s) of paper. Once the patient was signed in, he/she went back to the waiting area and waited to be called. Patients usually waited 10 to 15 minutes and the CMA came out to stand by the door, called out the patient's name and walked the patient to the examination room.

In addition to accommodating patients, the MOAs in the check-in area also dealt with visitors who came to pick up referrals or doctor's notes, or visitors who came in to arrange their next appointment.

Patients were required to fill out long forms sat in the computer area right behind one of the thick walls that separated the check-in and waiting area. With new emerging technologies and web applications, it is important to understand that paper and pencils are still used. The patients who used the computer desks had little space to write comfortably write.

4.1.2 Staff Feedback

In the survey for the check-in and waiting area, statements 1.1 and 1.2 addressed whether the check-in area design provided sufficient privacy and surveillance.

Statement 1.1 *The check-in area provides privacy to the patients* (Figures 16-17).

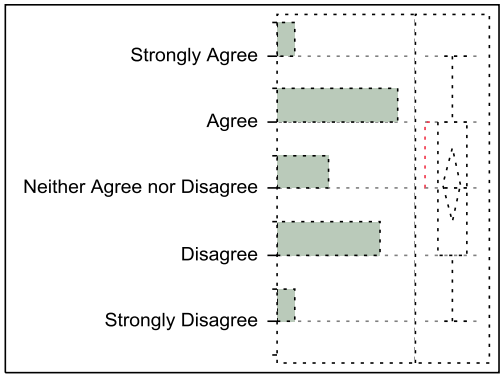

Figure 16. Ratings for 1.1

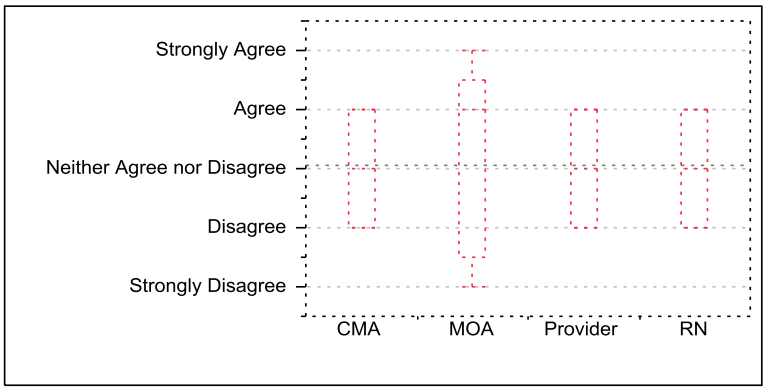

Figure 17. Ratings by Staff for 1.1

Statement 1.2 *The check-in area provides strong visibility/ surveillance of the waiting space for the MOA* (Figures 18-19).

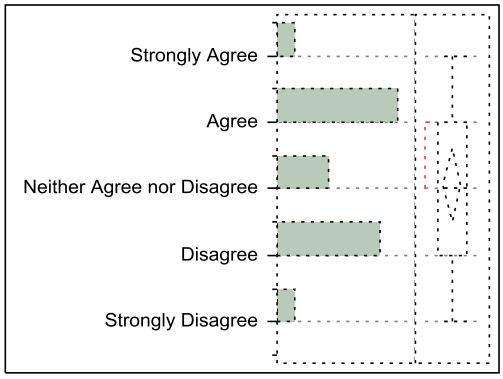

Figure 18. Ratings for 1.2

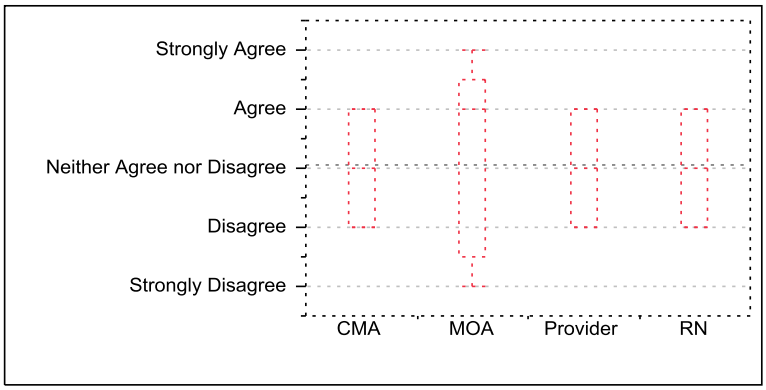

Figure 19. Ratings by Staff for 1.2

Interestingly, the survey showed a variation of opinions even among the same type of healthcare professionals. The survey also showed that staff members who considered the design to provide adequate privacy also believed that the design provided a strong surveillance over the waiting area.

More insight regarding the check-in/waiting area design was revealed in the open-ended question asking staff member what he/she would change about the space. When asking the building users what they thought of the space, one MOA's suggestion was to "remove walls, so patients behind it can be seen and patients can hear." A common dilemma in healthcare architecture is brought out in the MOA's statement as a design element that provides privacy becomes a hindrance to the staff's need to be able to see the patients in the waiting area for security and safety purposes. One nurse suggested that "maybe the floor where the MOA sits should be elevated to have a better view of the waiting area without having to stand." This is an interesting suggestion as the MOA may have better visibility and some level of privacy can be maintained.

The check-in area does become crowded at times with patients and visitors gathering at the check-in front desk and CMAs calling out to patients to come in for their appointments. One CMA suggested designing a "walking path. Patients being called back have to squeeze past patients waiting to sign in or standing at counter."

Results of other statements in the survey section were more straightforward as the staff agreed that a variety of seating was offered in the waiting area and that the children's corner had strong visibility to the MOA and certain seats in which the parents of the children could sit.

Statement 1.3 *The waiting space provides a variety of seating for the patients* (Figure 20-21).

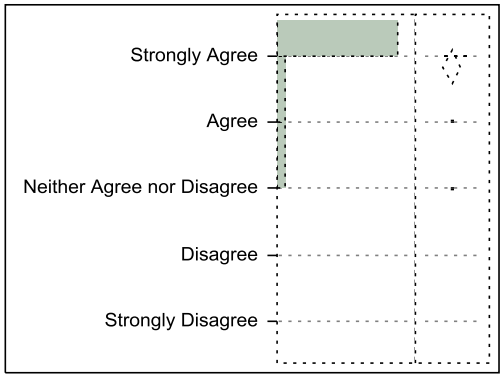

Figure 20. Ratings for 1.3

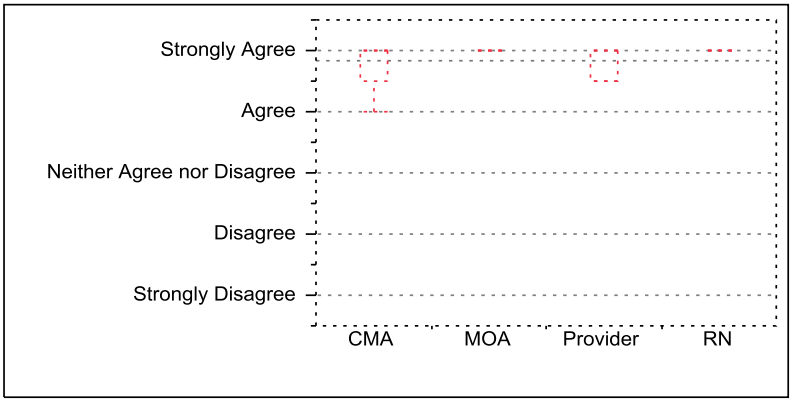

Figure 21. Ratings by Staff for 1.3

Statement 1.4 *The children's corner has strong visibility to certain "parent chairs* (Figures 22-23).

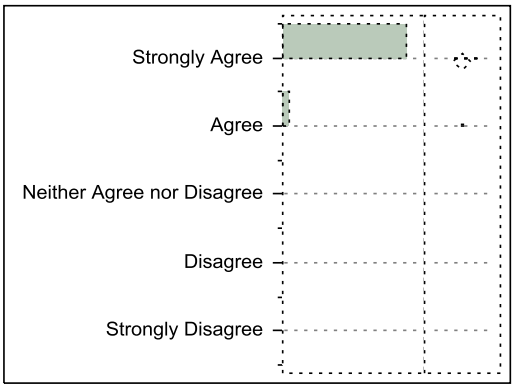

Figure 22. Ratings for 1.4

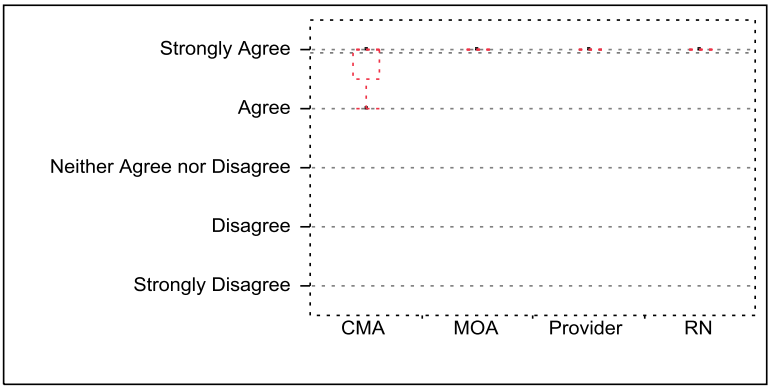

Figure 23. Ratings by Staff for 1.4

Statement 1.5 *The children corner has strong visibility for the MOA* (Figures 24-25).

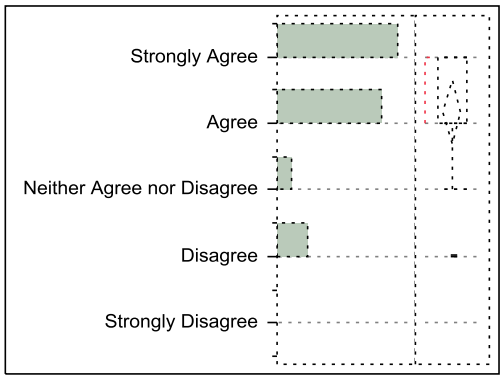

Figure 24. Ratings for 1.5

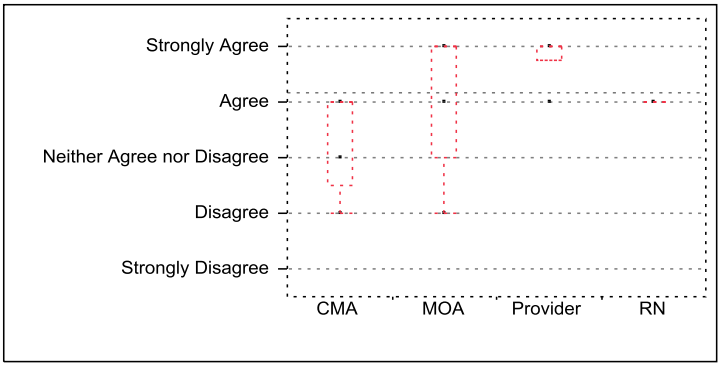

Figure 25. Ratings by Staff for 1.5

4.2 Examination Room

Figure 26. Examination Room

4.2.1 Behavioral Observation

The CMA walks the patient from the check-in area to the assigned examination room (Figure 26). A second flag was posted in the EMR indicating that the patient was in the examination room. The CMA then noted the vital signs or basic health information before the provider came in to see the patient. These measures include 1) height, 2) weight, 3) blood pressure, 4) pulse, 5) temperature, 6) respiration rate, and 7) the main reason for the patient's visit. This information is noted and updated in the computer via

EMR so the provider had all the basic information needed to assess the patient before he or she came into the exam room to see the patient.

Objects and furniture placed in the examination room for the staff included: a computer desk, computer and staff chair, scale, glove container, hand-washing sink, and antibacterial gel or soap. There was also a waste bin and a separate bio-hazard waste bin to dispose objects that might be considered contagious such as used tongue dispenser, gloves, and bandages. The hand-washing sink was directly visible from the entrance door as a reminder for the caregiver to wash their hands. The trash bin, bio-hazard bin, gloves, and computer desk area were kept in close proximity so they were all easily accessible to the provider or CMA.

Additionally, for the patient there was a patient chair right next to the computer desk and an examination chair/bed. While blood pressure is measured, one nurse advised, "For a more accurate reading, it is better for the patient to have both feet on the ground and be in an upright position." A separate chair next to the staff desk is placed in the examination room specifically for this reason. During this time, the CMA also reviewed previous examinations, referrals, and prescriptions with the patient. If required, the CMA may bring in the EKG machine to get a reading on the patient or make a trip to the storage room to get additional needed supplies.

Once the vitals had been recorded, the provider was able to review the patient's history from his/her office and recollect the patient's last visit if possible. The patient was then asked to change into designated gowns if necessary and wait for the provider's arrival.

During examination the provider sat in front of the computer screen typing away patient information. The provider then reviewed and explained medication and health issues as necessary. An alternative design solution could provide more patient-staff interactions by having the patient and provider view the computer monitor together while engaged in these discussions.

In general, an acute visit (when, for example, someone called in sick) was given a 15-minute interval. These appointments were usually set in no more than 48 hours in advance. A follow-up visit to check on how the patient was doing was also 15 minutes. Physicals are usually set weeks or months in advance and last 30 minutes. Often, families or a couple will come in to be seen together. In this case, visits would take longer as multiple patients were seen at a time. A patient may also bring in a family member or friend with him/her not as a patient but simply as a visitor for social support.

After the patients had been seen, the patients proceeded to the provider's designated check-out area and the provider went back into his/her office to record any notes and any other specific information into the EMR system. The CMA then came into the room to prepare the area for the next incoming patient.

4.2.2 Staff Feedback

The staff survey provided additional information about the area for further analysis. Eight respondents answered the open-ended question, and out of those, seven indicated that if they could change anything about the exam room, they would make it larger. One physician wrote more specifically, "Spend more money to make them larger

by 2 feet." A CMA also indicated the needs for "Larger space, lower exam tables, and one more chair." It was apparent that the exam room was designed to examine precisely one patient at a time and with group patient visits and other visitors space runs short.

A statement in this section of the survey (statement 2.1), however yielded more diverse results.

Statement 2.1 *The examination room is large enough to accommodate all task* (Figures 27-28).

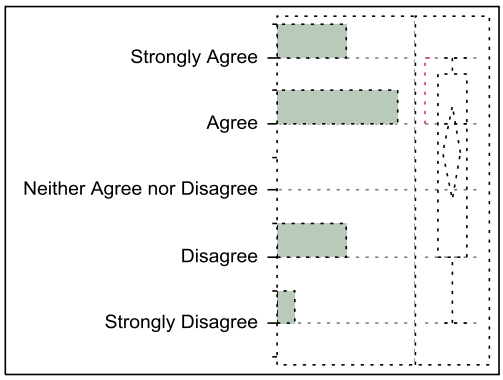

Figure 27. Ratings for 2.1

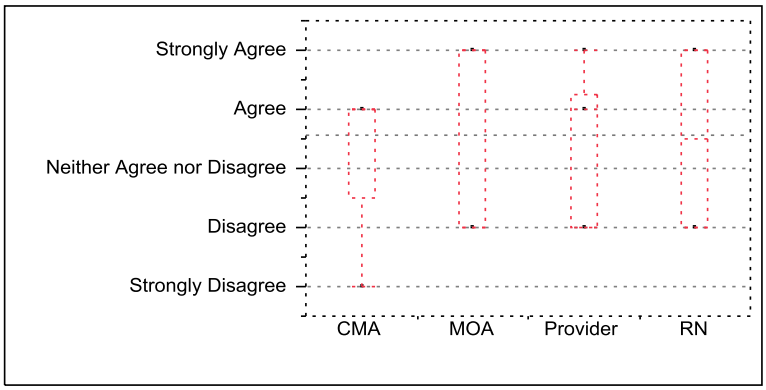

Figure 28. Ratings by Staff for 2.1

In statement 2.1, the staff members showed a range of opinions regarding whether or not the room size was adequate. However, both the open-ended question and statements 2.2 and 2.3 strongly indicated that patients often came with visitors and the exam room got crowded when more than one patient was in the exam room. Therefore, it can be assumed that it would have been better if the space was slightly larger.

Statement 2.2 *Patients often come with families in the examination room* (Figures 29-30).

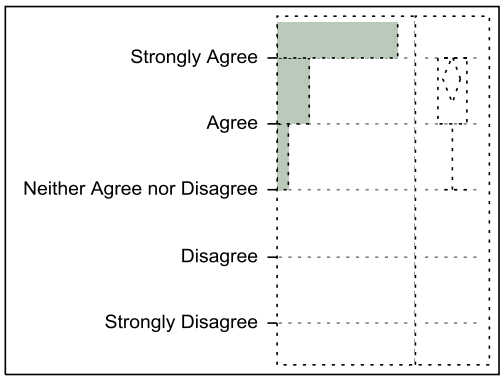

Figure 29. Ratings for 2.2

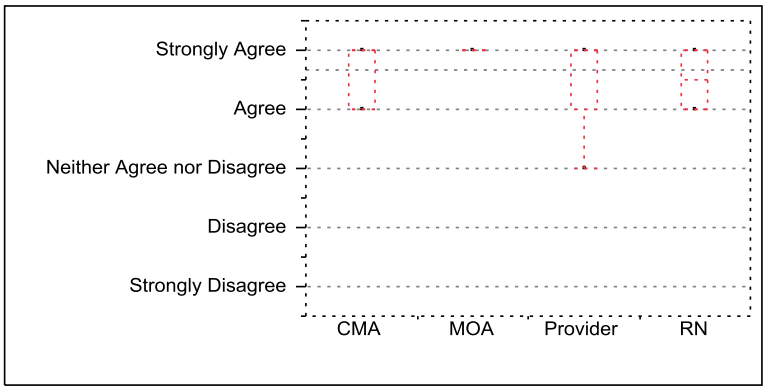

Figure 30. Ratings by Staff for 2.2

Statement 2.3 *The examination room gets too crowded when more than one patient is in the room* (Figures 31-32).

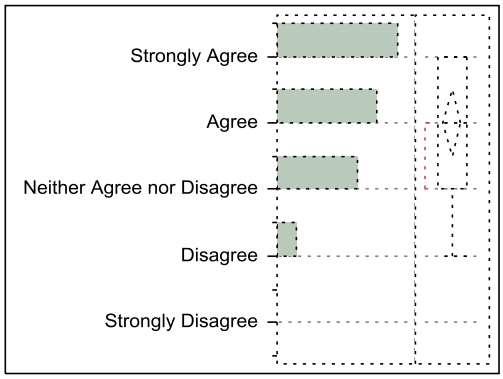

Figure 31. Ratings for 2.3

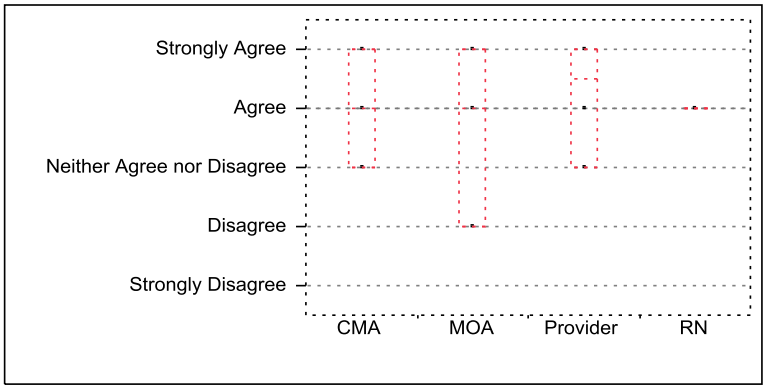

Figure 32. Ratings by Staff for 2.3

Though more square footage needs to be accommodated in the exam room, other factors such has the interior arrangement, furniture and layout also strongly influence the success of the design.

When considering the placement of the examination room from an organizational layout context, the designer should consider multiple issues. Ideally the storage room, EKG machine access, and sharps room (room where vaccinations are kept) all need to be within close proximity to the examination rooms.

A central area where there is busy traffic is not ideal for an examination room. In the survey, all staff members indicated that this was an important concern. As providers and CMA came in and out of the examination room, the patient if in their gowns was often left exposed and visible to the people passing by. Also, HIPAA concerns apply to this situation if conversations can be overheard by the people passing by the examination room.

The examination rooms located closest to the central check-out area/CMA station had this issue as examined in statements 2.4. The positioning of the examination room table and the door also limited the patients' privacy in the room. During the observations, these rooms were always avoided by the staff unless it was absolutely necessary.

Statement 2.4 *Examination rooms around central check station area have limited privacy* (Figures 33-34).

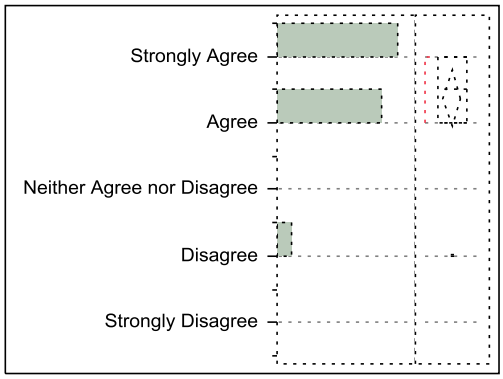

Figure 33. Ratings for 2.4

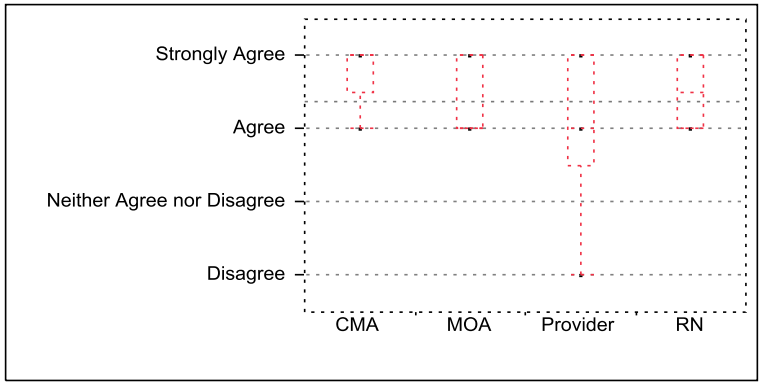

Figure 34. Ratings by Staff for 2.4

Though some exam rooms were not ideally located, the two nooks designed for the EKG machines were positively rated by the staff as convenient locations in between the exam rooms in statement 2.5. The two decentralized locations allowed the CMAs to bring in the EKG cart whenever it was needed by a patient no matter which examination room he/she was inside.

Statement 2.5 *EKG machines are easily accessible when needed* (Figures 35-36).

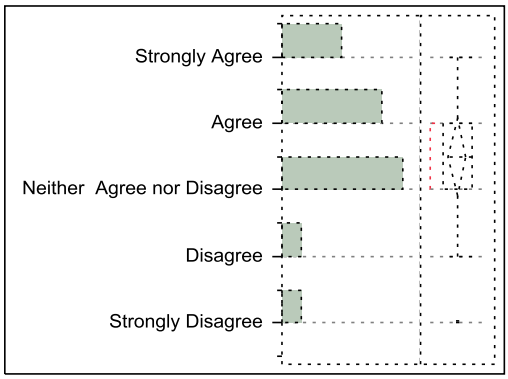

Figure 35. Ratings for 2.5

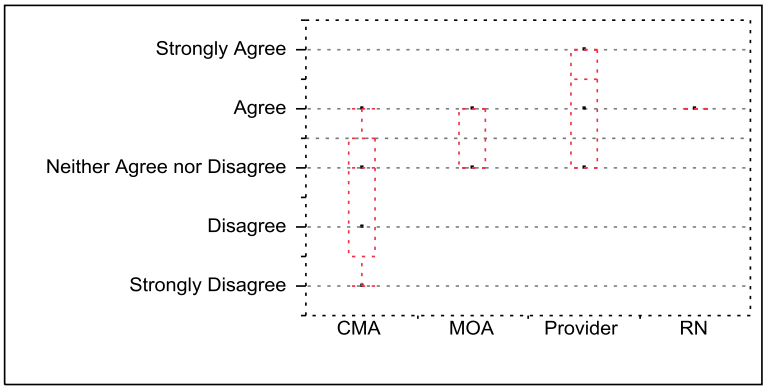

Figure 36. Ratings by Staff for 2.5

The behavioral observations and the survey for the examination room both highlighted the need to accommodate for social support and patient privacy, and the need to use efficient planning to make it easier for the staff and the patients.

4.3 Procedure/Bariatric Room

Figure 37. Procedure Room

4.3.1 Behavioral Observation

Other than exams, a primary care clinic is also able to perform small procedures such as biopsies (collecting sample tissue), incisions, abscess drainage and suturing in a separate room known as the bariatric or procedure room (Figure 37). This room is slightly larger than an exam room and is equipped with more storage and equipment. Additional items found in bariatric room other than items found in the exam room

include a surgical tray, liquid nitrogen, gauze, beta-dine (antiseptic solution), alcohol, steroids, and other medications needed for certain procedures.

Most providers preferred to have an assistant (CMA) in the bariatric room while performing a procedure on the patient. As the provider was performing the procedure, the CMA could also be in the room handing sterile equipment to the provider and labeling specimens. Also, while the provider was operating on the patient, it was important for him/her to be in close proximity to the trash can and bio-hazardous waste bin so anything can be tossed while not having to move away from the patient. Understanding the tasks associated with the given procedure, it was apparent that the width of the procedure room was more important than the length of the space in order to accommodate multilevel tasks in the room. The procedure room only is 11 feet wide minus the counter space and storage on the inner wall, which leaves a tight space to perform all of these tasks.

The procedure room additionally requires more storage than the exam room. Although the clinic design includes this, the spacing of the shelving in the procedure room was 12 feet apart, leaving an ample amount of unused space. Ideally, 7- to 8-foot spacing would provide a more efficient use of space.

4.3.2 Staff Feedback

Gathering staff feedback regarding the usability of the procedure room shows that the staff also agreed about the inadequate size of the procedure room and the

inefficient storage design. The survey results in statements 3.1-3.2 show that a strong majority of the staff indicated that both of these features were not adequate.

Statement 3.1 *Procedure room is an adequate size for comfortable usage* (Figures 38-39).

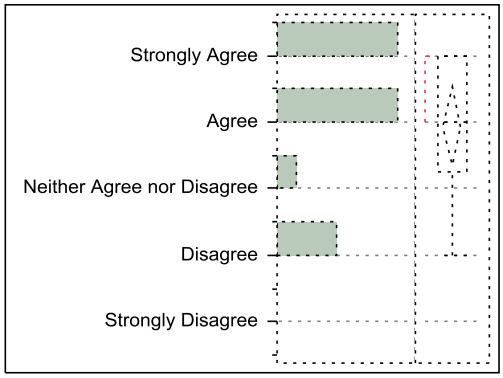

Figure 38. Ratings for 3.1

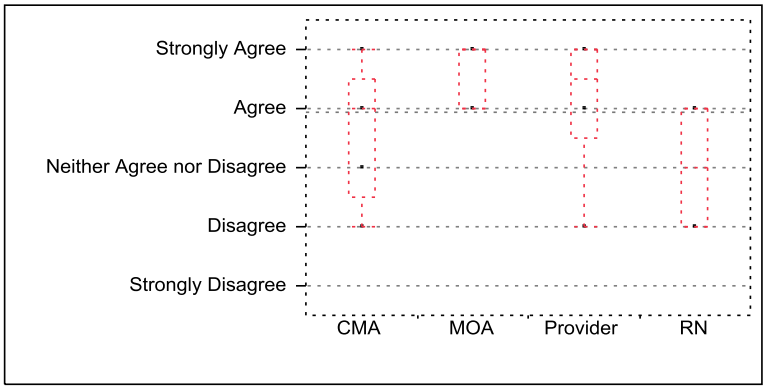

Figure 39. Ratings by Staff for 3.1

Statement 3.2 *Shelving in the procedure room is not effectively positioned and designed* (Figures 40-41).

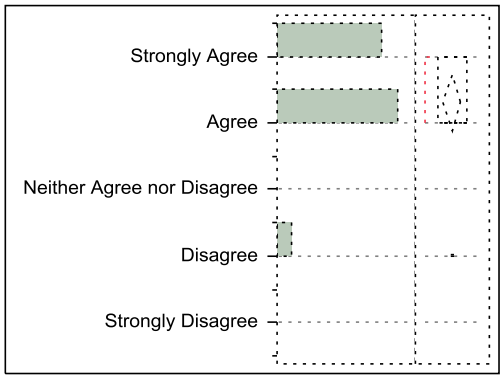

Figure 40. Ratings for 3.2

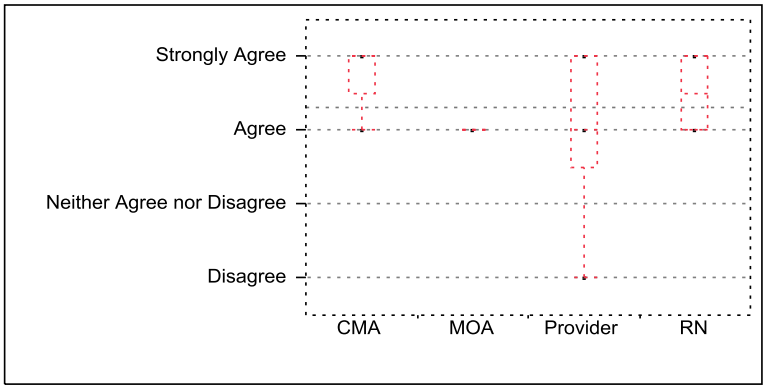

Figure 41. Ratings by Staff for 3.2

When analyzing some of the comments, additional insights were revealed regarding the usability of the procedure room. One CMS said: “Sink and cabinets are not in most productive areas. Exam table should be more centralized in the room (larger to accommodate the above).” Currently the procedure room has the same width as the other

exam rooms and needs more space around the exam table. The additional cabinets and counter space in the procedure room actually make the room even smaller than it by taking up more square footage. The design did not leave room for flexibility. When a provider was asked what changes he/she would make to the procedure room, he/she wrote: “more positioning of procedure tray movability”. Also, the addition of surgical light in the room was recommended by a provider.

The storage cabinets could have been better positioned and better designed. In the survey, on average most of the staff members agreed that the shelving in the procedure room were not adequately positioned or designed. Ideally the staff would like to have more items stored in the room so that they would not have to restock the items so often. One nurse suggested: “I would have a floor to ceiling cabinet—with enough room to organize supplies. It would be larger.” It is also important to consider the height of the shelves to the supplies as they should be within the reach of most staff member.

4.4 Lab Area

4.4.1 Behavioral Observation

Medical reports and diagnosis are made through analyzing lab results. In this primary care clinic, the lab area was in a central location close to the waiting area. A patient may come in just to get blood drawn or, if it is Wednesday or Friday when labs are done, they may walk right in after the visit with the doctor.

Once a provider ordered “certain lab tests,” the MOAs in the front check-in area printed the exact order and left it in a designated area on the lab counter for the lab

technician to look over. The lab technician (a CMA) then reviewed the order and collected the required syringes and specimen containers to collect blood samples from the patient. If the patient came in specifically for the lab, they were called in from the waiting area up front and were seated on a lab chair. If the patient had just been seen by a provider and needed labs, they waited in a small lab waiting area alcove and got squeezed into the lab schedule. The plan also included a separate lab waiting space. However, this space was seldom used, as it looked awkward and small (Figure 42).

Figure 42. Lab Waiting Area Alcove (left) & Seldom Used Lab Waiting Area (right)

Once the lab orders from the MOA were placed in the lab area (Figure 43), the technician spread out the sheets of paper on the countertop. The specimen containers for each order were then placed on top of the paper and when a person came in, the specimen was drawn.

Figure 43. Lab Area

When the technician was about to interact with a patient, he/she first put on hand sanitizer and gloves, and then sat in front of a computer desk with the patient on one side and the order forms and specimen containers on the other side. Also next to the technician was the bio-hazardous waste bin and a special bio-hazardous box to discard sharp objects such as syringes.

When ready, the technician asked the patient to show their arm and the technician found the right vein in the patient to insert the syringe and draw the blood. Once the specimen samples were collected, the lab technician needed to place gauze and a bandage on the patient's arm before they left. The used syringes were then tossed into

the sharps box, which were then discarded in the bio-hazardous waste bin. The gloves that the technician wore were also removed and tossed into the bin. Back on the counter table there was a device known as the spinner. The specimens were then placed in this device and spun for approximately 20 minutes. In the meantime, the lab technician prepared for and started drawing blood for the next patient.

Once spun, the specimens were placed in a separate bin, which was locked and placed outside the back door. At the end of the day, the specimens got pick up and taken to a lab outside the clinic to be tested. After the tests were conducted, the results were returned to the clinic electronically and reviewed by the provider.

When considering the lab design from a patient's perspective, it was noted that a hanger or hook to place personal items such as a jacket or purse was needed for the patient while his/her blood was being drawn.

Also, all the tasks done in the lab area could be divided into two categories: tasks in a personal work station (preparation and recoding tasks done by the technician) and tasks performed with the patient (clinical). This differentiation however was not as clear in the layout of the lab space.

4.4.2 Staff Feedback

Statement 4.1 assessed the staff's opinion regarding the aesthetics and ergonomics of the patient chair. The majority of the staff members thought the chair was comfortable for the patient. However, the two nurses strongly disagreed.

Statement 4.1 *The patient chair in the lab rooms seems to be comfortable* (Figures 44-45).

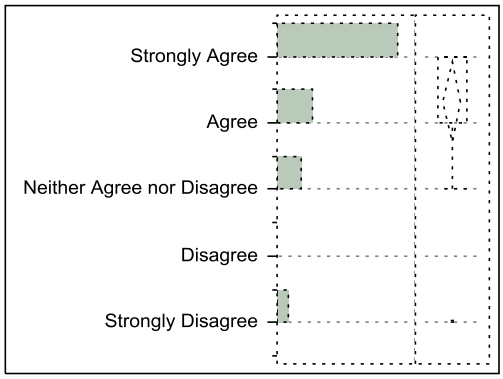

Figure 44. **Ratings for 4.1**

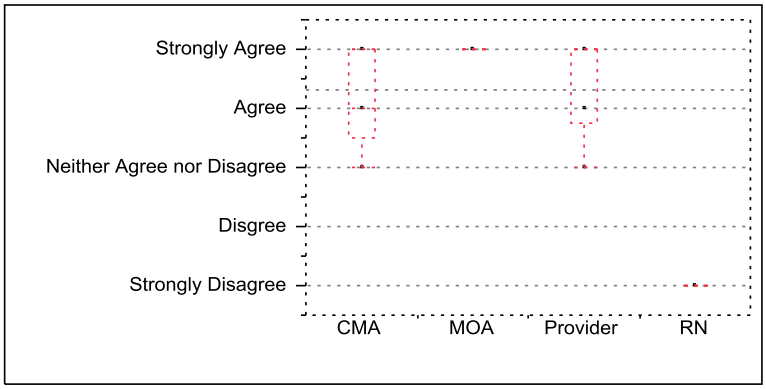

Figure 45. Ratings by Staff for 4.1

RNs and CMAs usually worked in the lab while providers and MOAs usually did not. It is interesting to see how there is such a variation in the rating scale by staff profession. It would also be interesting to see how patients actually feel about the chair.

There was also a significant variation in perception by staff profession in statement 4.2 regarding adequate counter space in the lab area.

Statement 4.2 *There is enough counter space to organize all my lab slips in the lab room* (Figures 46-47).

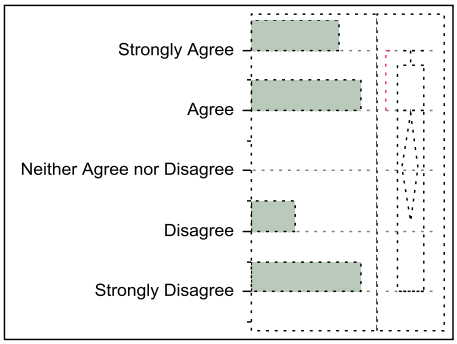

Figure 46. Ratings for 4.2

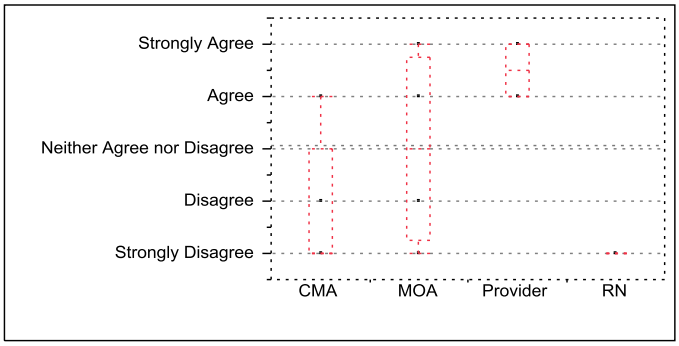

Figure 47. Ratings by Staff for 4.2

The RNs and CMAs tended to disagree with the statement while the providers clearly agreed with the statement. Since the RNs and CMAs were the staff who collected the specimen samples and did all of the lab-tech work, their opinions held more weight

in these statements. Their opinions along with the data collected in the behavioral observation suggested that more square footage; clearer equipment organization and circulation pattern could have improved the lab area.

4.5 Communication Systems

4.5.1 Behavioral Observation

The usability of a primary care clinic design cannot only be analyzed through dissection of each design component; the overall system and experience in the clinic must also be considered. Data collection also involved understanding how the building design influences communication patterns and behavior.

The integration of EMRs in the clinic has established a systematic way of recording, updating, and notifying clinic activities and of communicating information among staff. Once a patient was signed into the system, all relevant care givers were notified that the patient was ready to be examined. Providers were presented with the patient's history and reason of coming to the clinic via the EMR system, while the CMA assigned an exam room for the patient and got the room ready.

Additionally, the provider and CMA may communicate via telephone, EMR messaging, or a face-to-face conversation regarding details of the room prep and patient needs. The design of the clinic can further encourage or hinder the system flow.

4.5.2 Staff Feedback

The development of the EMR system has definitely eased communication and clinic organization. No matter how efficient an electronic system may be, it cannot replace face-to-face communication (Allen and Henn, 2007). A provider noted: "Physical proximity and visual face-to-face communication become very important in emergent situations."

In the survey, all staff member indicated that they needed face-to-face interaction with their peers along with the EMR technology. MOAs, CMAs, and RNs also indicated that often communicated with their peers via phone conversation; however, providers somewhat disagreed.

Statement 5.1 *I communicate often with my co-workers via face-to-face conversation* (Figures 48-49).

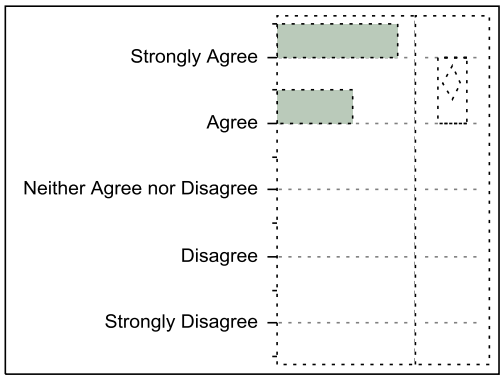

Figure 48. Ratings for 5.1

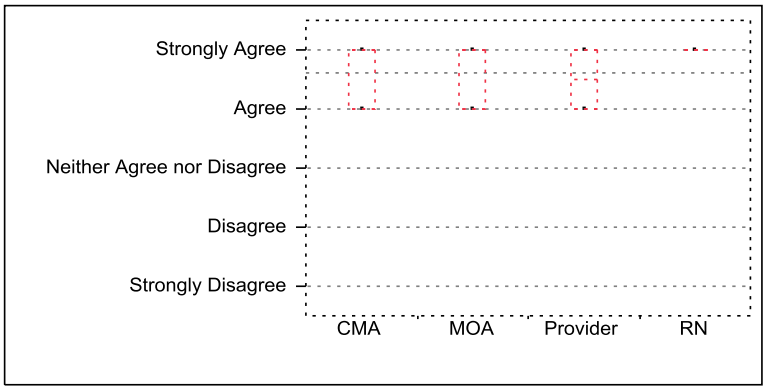

Figure 49. Ratings by Staff for 5.1

Statement 5.2 *I communicate often with my co-workers via email* (Figures 50-51).

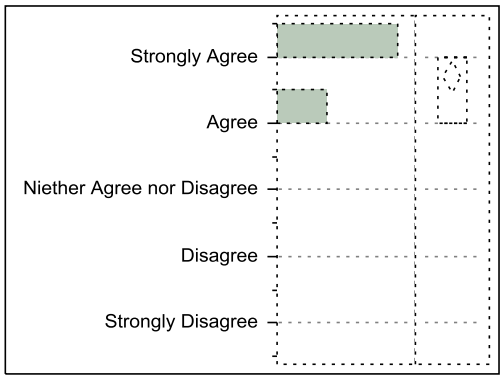

Figure 50. Ratings for 5.2

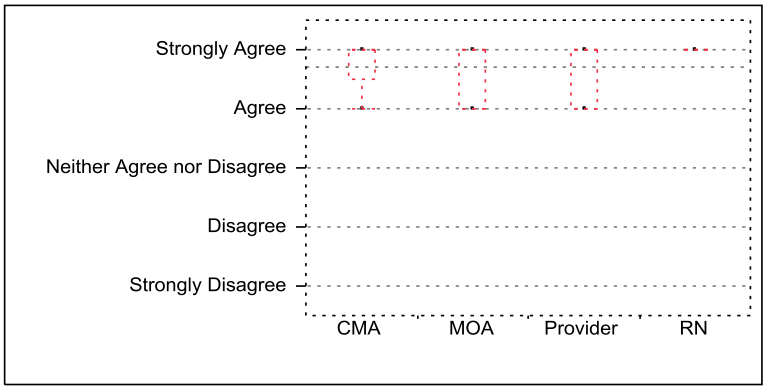

Figure 51. Ratings by Staff for 5.2

Statement 5.3 *I communicate often with my co-workers via phone* (Figures 52-53).

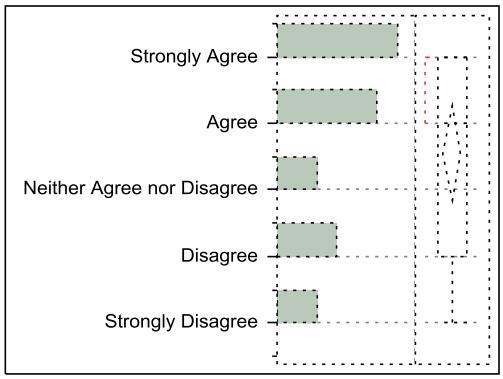

Figure 52. Ratings for 5.3

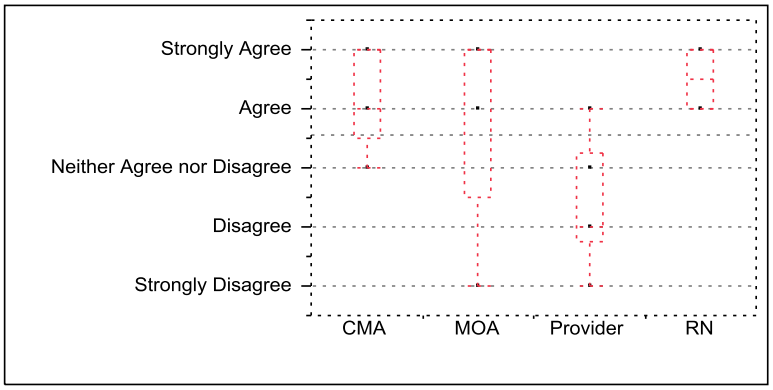

Figure 53. Ratings by Staff for 5.3

The level of face-to-face communication the providers have with the other staff members differs, as they are physically separated in their own offices opposed to the open "nurses' station" design, where the MOAs, CMAs, and sometime RNs are seated. Nonetheless, the staff in general was satisfied with their current level of

communication provided by the workstation/providers' office design as indicated through statement 5.4.

Statement 5.4 *I wish I could communicate more with my CMA, MOA, or provider* (Figures 54-55).

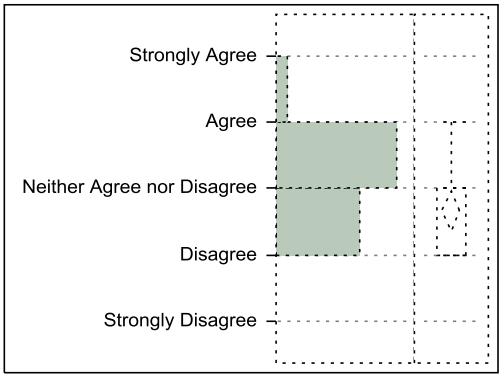

Figure 54. Ratings for 5.4

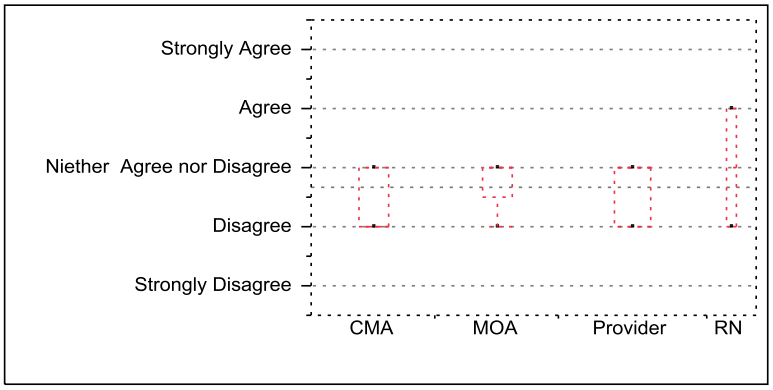

Figure 55. Ratings by Staff for 5.4

4.6 Work Stations and Provider's Office

Figure 56. Work Station (left) & Provider's Office (right)

4.6.1 Behavioral Observation

In the current clinic design, the provider uses the office as a break-and-recap area between patients (Figure 56). The provider reviewed a patient's history before he or she went into the examination room to see the patient. In the office, there was a computer desk with the EMR portal, source of daylight, and personal belongings of the provider. Before the EMR system, the provider usually had stacks of papers (medical records) on top of their desk and a calendar to review their daily schedule.

The work stations (otherwise known as the check-out area) were centrally located in the clinic with limited privacy and close proximity to the provider's office (Figure 56). The staff was satisfied with their current level of communication in the clinic, as the clinic design considered the physical proximity of the providers' office to the designated

CMA/MOA work station. However, the physical separation of the provider in his/her office hindered face to face interaction between the provider and other supporting staff members.

4.6.2 Staff Feedback

Further analysis was conducted to compare perceptions of the open work area (work station) and the private provider office in the next section of the survey. Results for statements 6.1-6.3 showed that staff in both the office and work station were satisfied with their work environment and believed that the design of their work environment helped them stay organized.

Statement 6.1 *I am satisfied with my work environment* (Figures 57-58).

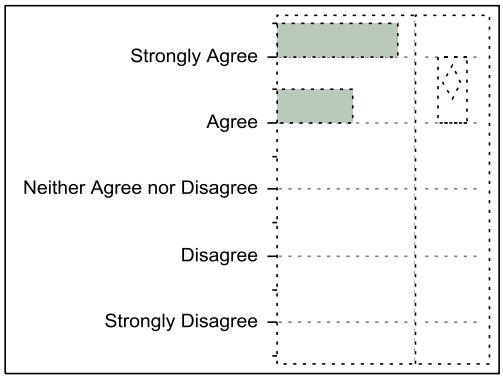

Figure 57. Ratings for 6.1

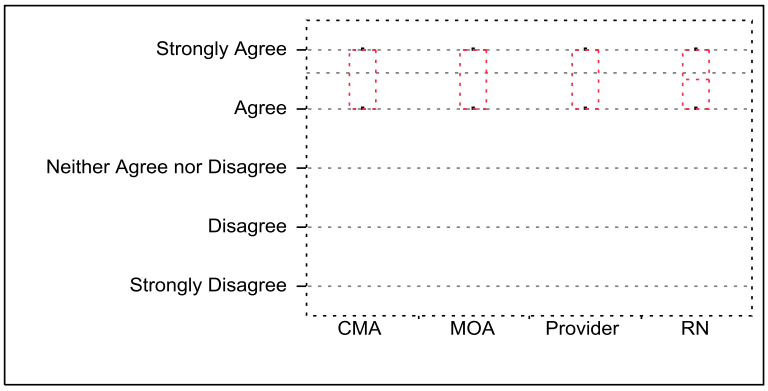

Figure 58. Ratings by Staff for 6.2

Statement 6.2 *I feel organized* (Figures 59-60).

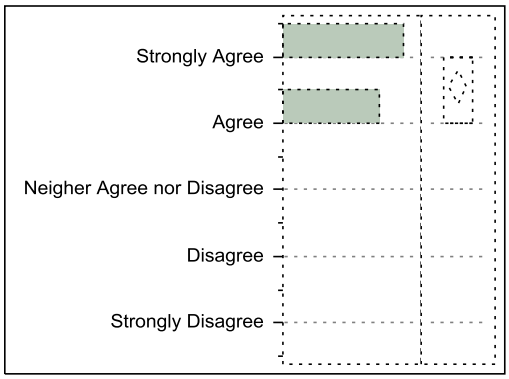

Figure 59. Ratings for 6.2

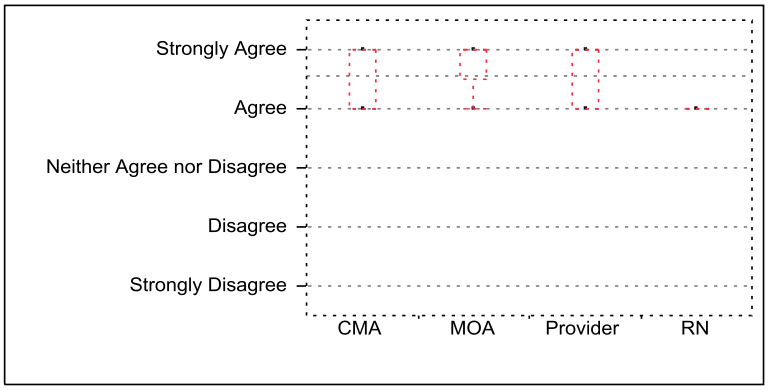

Figure 60. Ratings by Staff for 6.2

Statement 6.3 *My works space helps me stay organized* (Figures 61-62).

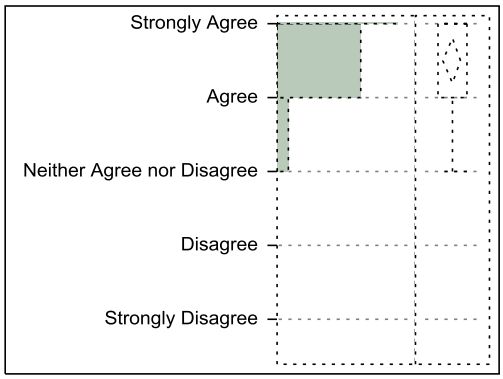

Figure 61. Ratings for 6.3

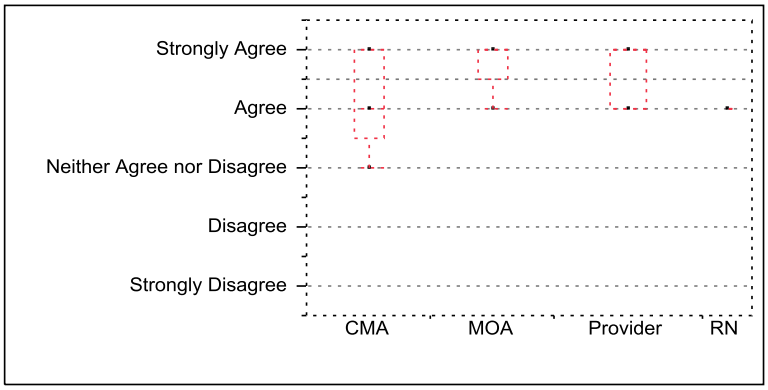

Figure 62. Ratings by Staff for 6.3

Also, the office environment and work station showed no significant differences in the perception of noise or stress as indicated in the results in statements 6.4-6.6.

Statement 6.4 *My work area is noisy* (Figures 63-64).

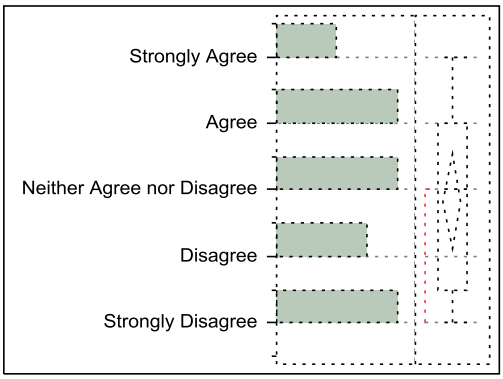

Figure 63. Ratings for 6.4

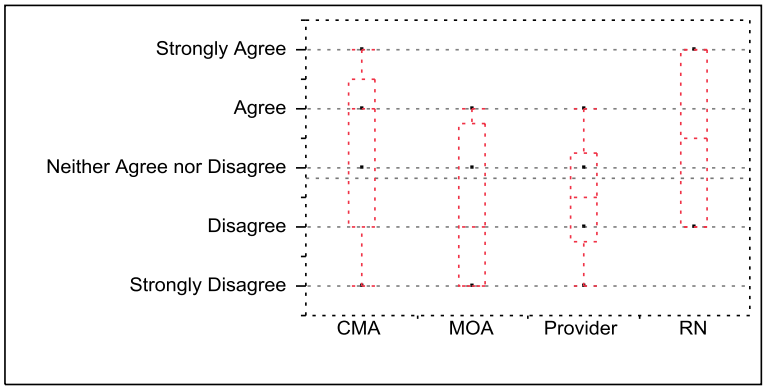

Figure 64. Ratings by Staff for 6.4

Statement 6.5 *My job is stressful* (Figures 65-66).

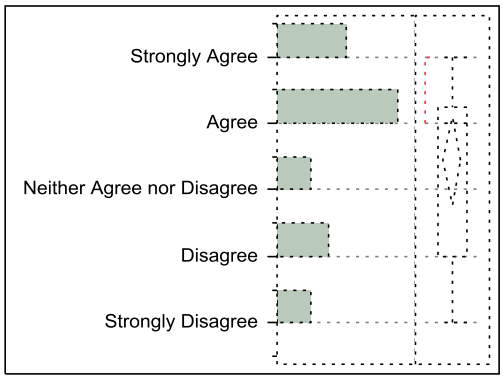

Figure 65. Ratings for 6.5

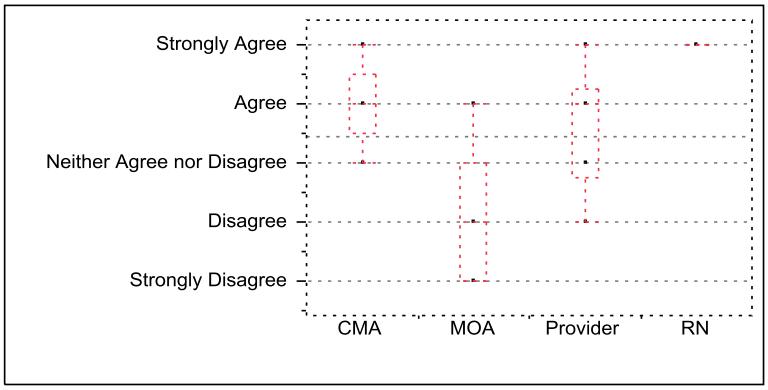

Figure 66. Ratings by Staff for 6.5

Statement 6.6 *My work environment contributes to my stress* (Figures 67-68).

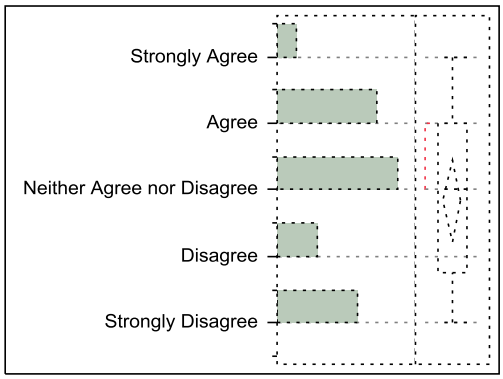

Figure 67. Ratings for 6.6

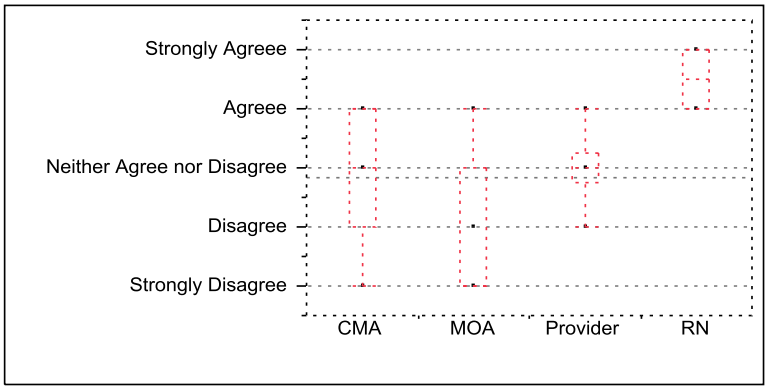

Figure 68. Ratings by Staff for 6.6

What results from the survey show is that the RNs who do much of the coordinating and running around are the most stressed-out professionals among the staff. Being in multiple environments is more stressful than being in any one particular environment.

All staff members were asked if providers, CMA, and MOAs should work in the same office or workstation and a variation of opinions were expressed across disciplines. On average, providers and CMAs were not in favor of this idea, while MOAs and RNs were more in favor of such collaborative environments.

Statement 6.7 *Providers, CMAs, and MOAs should work in the same room/work station* (Figures 69-70).

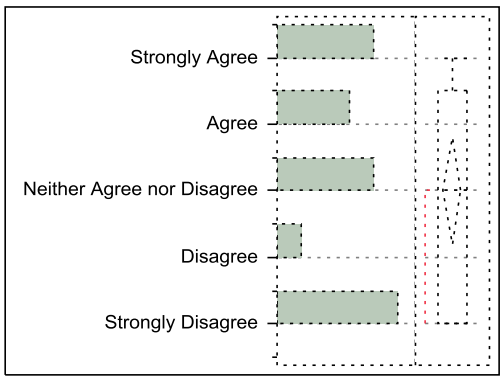

Figure 69. Ratings for 6.7

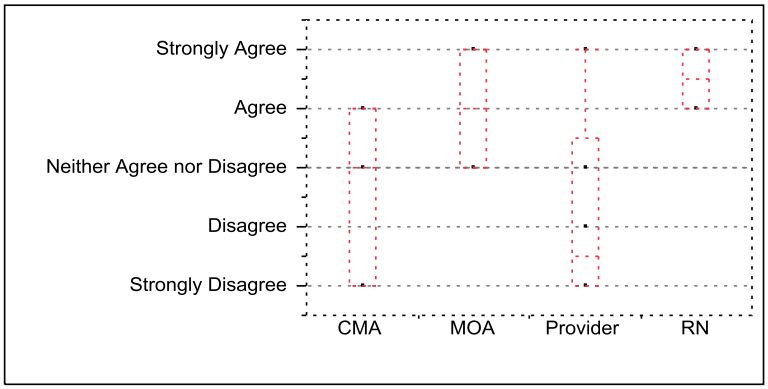

Figure 70. Ratings by Staff for 6.7

In the open ended questionnaire, providers pointed out that the main reason for private offices was for private conversations and less noise for better communication. One provider wrote: "A private area is needed when speaking with patient on the phone regarding the results, and patient questions. Also privacy is needed for documentation without unnecessary exposure to medical record." Another provider explained: "Physician needs quite time to catch up, notes, billing, and documentation." Though the perceptions of noise in both environments were not significant as shown in the previous section of the survey, the open ended question provided greater insight into the providers' desire for privacy and separation from the other staff.

The MOAs and RNS were more in favor of having providers working in more collaborative environments with the MOAs, CMAs and RNs. Advantages of a more collaborative open environment may include stronger face to face communication and overall staff awareness of what is going on. One CMA wrote: "It helps to keep everyone on the same page and promotes team work. Improve quality care." An RN wrote: "Everyone is better informed about what is going on." Other staff members believed

that the “work station” setup is fine just as it is. An MOA explained: “The way the pods are set up now is perfect. As long as the provider’s office is within close proximity, as it is now, it makes it easier for the CMA and MOAs to access their provider.”

Though, the work station is more effective in providing a more open collaborative environment and an environment that is more welcoming to the patients, some degree of privacy is needed between patients during check-out procedures.

4.7 Check-out Area

Figure 71. Check-out Station

4.7.1 Behavioral Observation

As discussed, each provider in the clinic had his or her own designated check-out area (Figure 71). Once the patient was examined, the patient proceeded to the provider's designated check-out area, where they could set up their next appointment or follow-up visit, get their prescriptions, or set up an appointment to get their blood drawn (if needed). The check-out locations were centrally located in the plan while maintaining the closest distance to the provider's office and designated exam rooms. However, in the way the plan is arranged, some providers' check-out stations overlap another's examination room proximity and could easily confuse patients in way-finding. Also, since the check-out stations are literally in the middle of a hallway, some areas are often crowded and privacy can become an issue then. However, having separate check-out stations versus one check-out station does make organization easier for the staff and probably adds a greater level of privacy.

4.7.2 Staff Feedback

According to statements 7.1 and 7.2, the current set-up of examination rooms and check-out locations was confusing to the patients and the central location did not help the patents in their way-finding. In the open-ended questionnaire, one provider explained "…separate check out for provider adds privacy but creates confusion." And another physician explained "Separate check out, not central, would be more private, multiple patient tasks done at same site."

Statement 7.1 *Patients often get lost trying to find the check-out counter* (Figures 72-73).

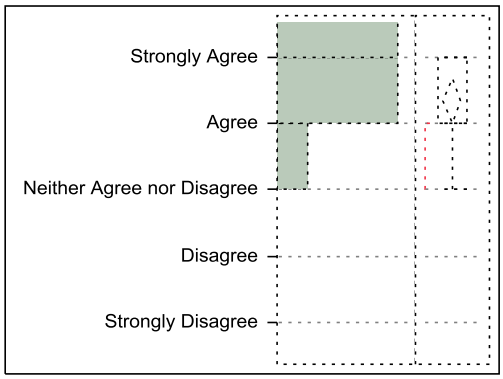

Figure 72. Ratings for 7.1

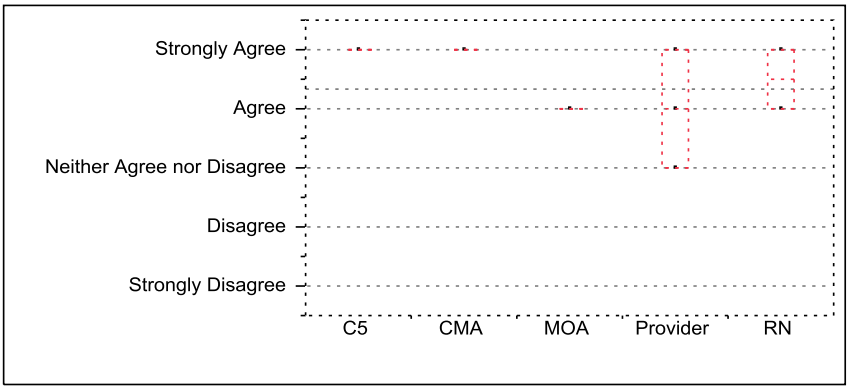

Figure 73. Ratings by Staff for 7.1

Statement 7.2 *The central location helps patients orient themselves in the facility* (Figures 74-75).

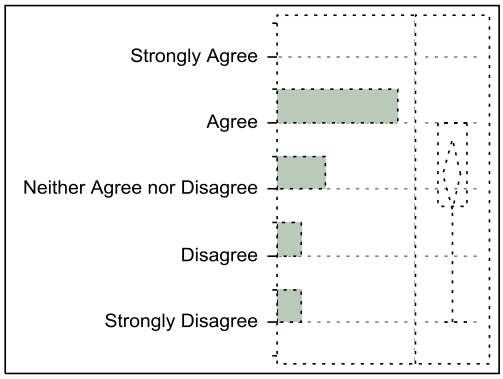

Figure 74. Ratings for 7.2

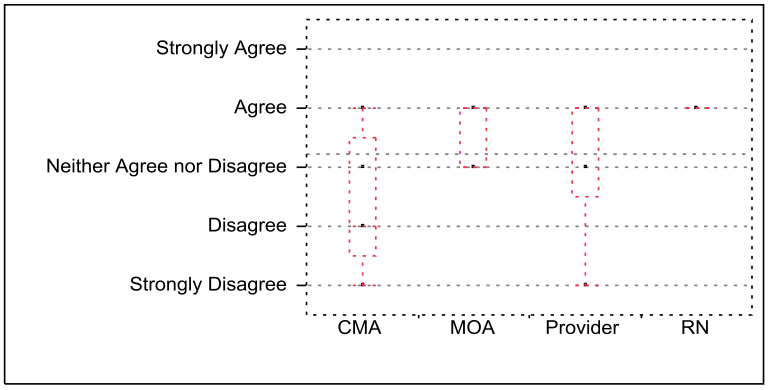

Figure 75. Ratings by Staff for 7.2

There are varying opinions as to whether the current locations limit the patient's privacy, as other design features may influence this factor as well. Statement 7.3 should be better phrased in future research to discuss a more specific design feature.

Statement 7.3 *The central location and design limit patients' privacy* (Figures 76-77).

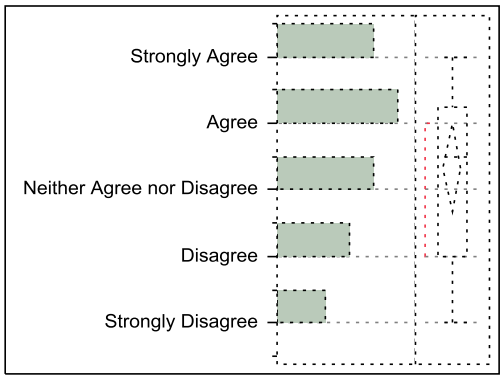

Figure 76. Ratings for 7.3

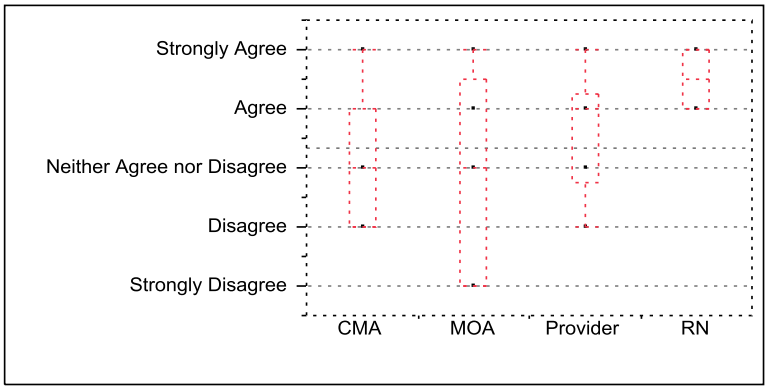

Figure 77. Ratings by Staff for 7.3

Designers should understand that although centrally located in plan, the walk from the exam room to the right check-out station is really what creates way-finding dilemmas. A CMA noted: "Better signage to direct patients to correct check out since we have more than one check out area."

To ease way-finding, landmarks and focal points can be used in the check-out design to mark their locations according to the provider. However, it is always better if the configuration itself should be able to navigate the patient flow.

Perhaps the sticker box could serve as a check-out focal point to easy way-finding; as a positive design tool that motivates patients, it may also prove to be an effective way-finding device. According to the staff in statement 7.4, the sticker box, which is currently hidden under the check-out counter, can be redesigned as a positive reinforcement mechanism.

Statement 7.4 *The sticker box can be used as a better motivation/encouragement tool if made directly visible in the front area of the checkout corner.*

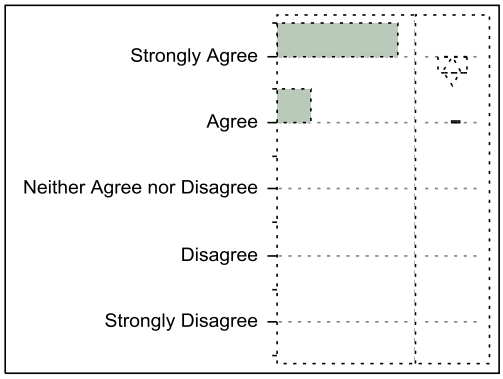

Figure 78. Ratings for 7.4

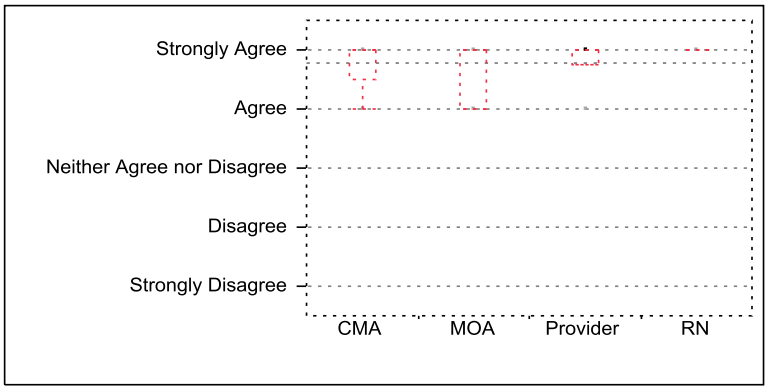

Figure 79. Ratings by Staff for 7.4

4.8 Storage Areas

Figure 80. Storage Area

4.8.1 Observations

Studying the supply flow is just as vital to a clinic design as the study of the people flow. Four main separate storage areas existed within the clinic. The sharps room contained a refrigerator and freezer to hold all the vaccinations available in the clinic. There were also additional syringes and needles as needed. CMAs or RNs usually came into the room to pick up a vaccination while the patient was in the exam room.

There was also another storage area for laundry. Clean gowns were kept in cabinets and used gowns were stored separately in the soiled closet. Gowns were cleaned and replaced every two weeks at the clinic.

A separate storage area must also be kept for the bio-hazardous waste collected in the facility. Unlike the regular trash, the bio-hazardous waste needed more precaution than normal waste. A special facility came to collect the waste every two weeks as well.

The clinic also needed a separate supply closet to stock medical supplies needed in the exam rooms (Figure 80). Items kept in stock during the observations included the items listed below (Table 14).

Storage Items		
Infant measuring tape	Accu-Chek equipment	Alcohol
Blood sugar measuring kit	Swab sticks	Urine cups
Hydrogen peroxide	Bandages	Lubricant jelly
Thermometer probe covers	Pillows	Iodine
Pediatric aerosol masks	Catheters	Sterile bowls
Tissue rolls	Airways	Masking tape
Gloves (latex and non latex)	Specimen collection devices	Insulated cold packs

Table 14. Medical Supplies in Storage Closet

Although the shelving in the storage was spaced 12 inches apart, most items needed no more than 8 inches. The storage space could have been better utilized if the shelving was spaced closer together. The examination rooms were restocked weekly with supplies from the storage closet. The CMA may also go to the storage closet during an examination to get an as-needed item. The supply storage and the sharps room need accessibility while a CMA, provider, or RN is seeing a patient so their proximity to the exam rooms were more essential, whereas the laundry area and the bio-hazardous waste area could be in a more non-accessible area away from the main patient circulation areas as they are currently located in plan.

4.8.2 Staff Feedback

The noted observations of the supply closet and the sharps room were presented as statements in the staff survey; however, results showed non-conclusive evidence regarding their locations in survey statements 8.1-8.3.

Statement 8.1 *Storage areas would be better used if there were smaller decentralized units dispersed between and in front of examination rooms* (Figures 81- 82).

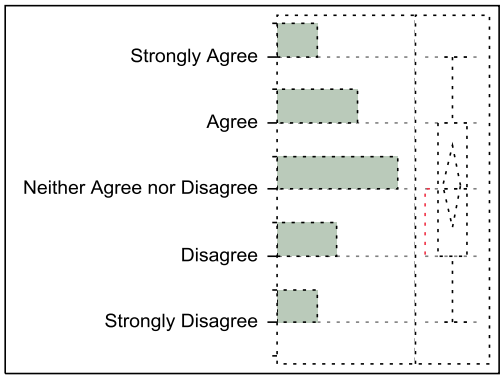

Figure 81. Ratings for 8.1

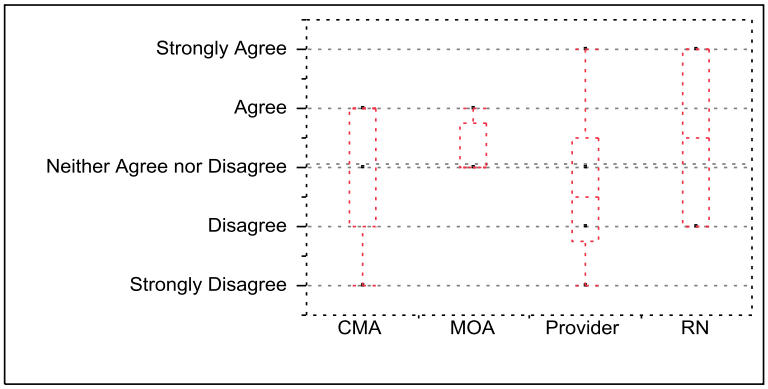

Figure 82. Ratings by Staff for 8.1

Statement 8.2 *The sharps rooms needs to be centrally located* (Figures 83-84).

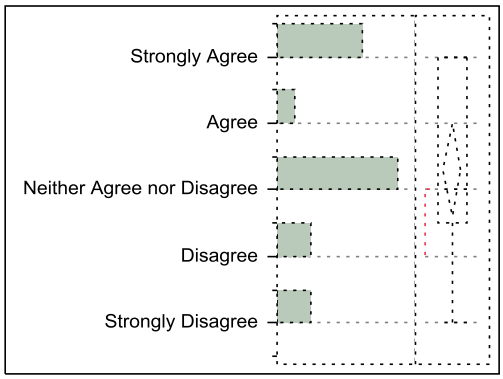

Figure 83. Ratings for 8.2

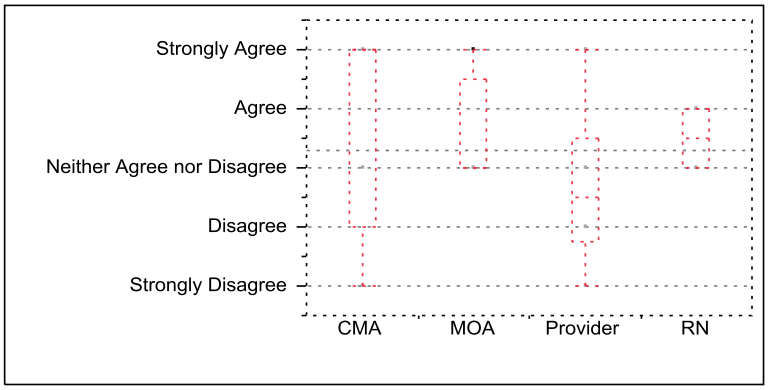

Figure 84. Ratings by Staff for 8.2

Statement 8.3 *The sharps room is often used* (Figures 85-86).

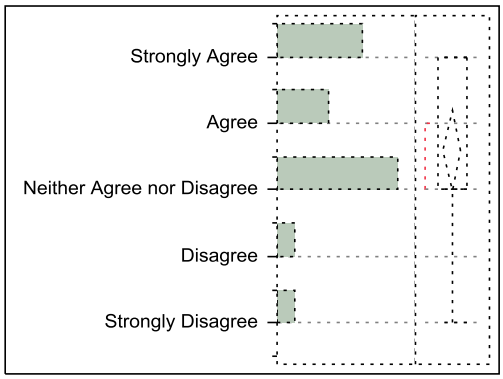

Figure 85. Ratings for 8.3

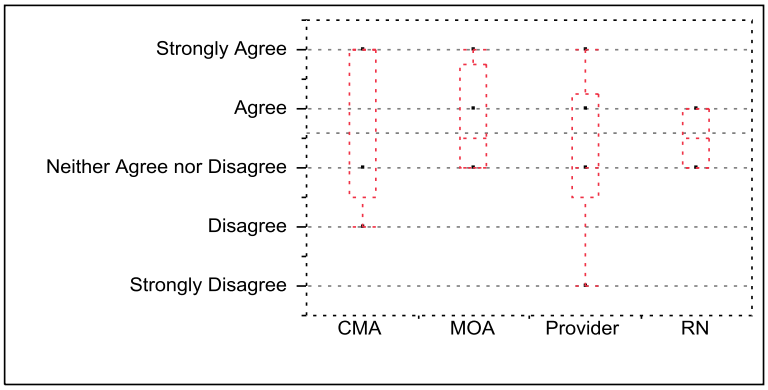

Figure 86. Ratings by Staff for 8.3

4.9 Integration of the Data Analysis within the Building Usability Framework

The data analysis highlighted the major functions and design features that enhanced the usability of the case study primary care clinic. The survey analysis was able to compare the design recommendation in the literature to the design features of the primary care clinic as well as determine the success of the applied design strategies. However, in order to produce a comprehensive usability evaluation, it was important to understand how the analyzed data fit in with the psychosocially supportive design terms identified in the conceptual framework.

A deeper level of analysis was needed to successfully integrate the empirical and theoretical research. The staff survey was revised to be more applicable to primary care clinics in general and to cover more usability topics through the help of a third research tool: The Usability Matrix (Table 15).

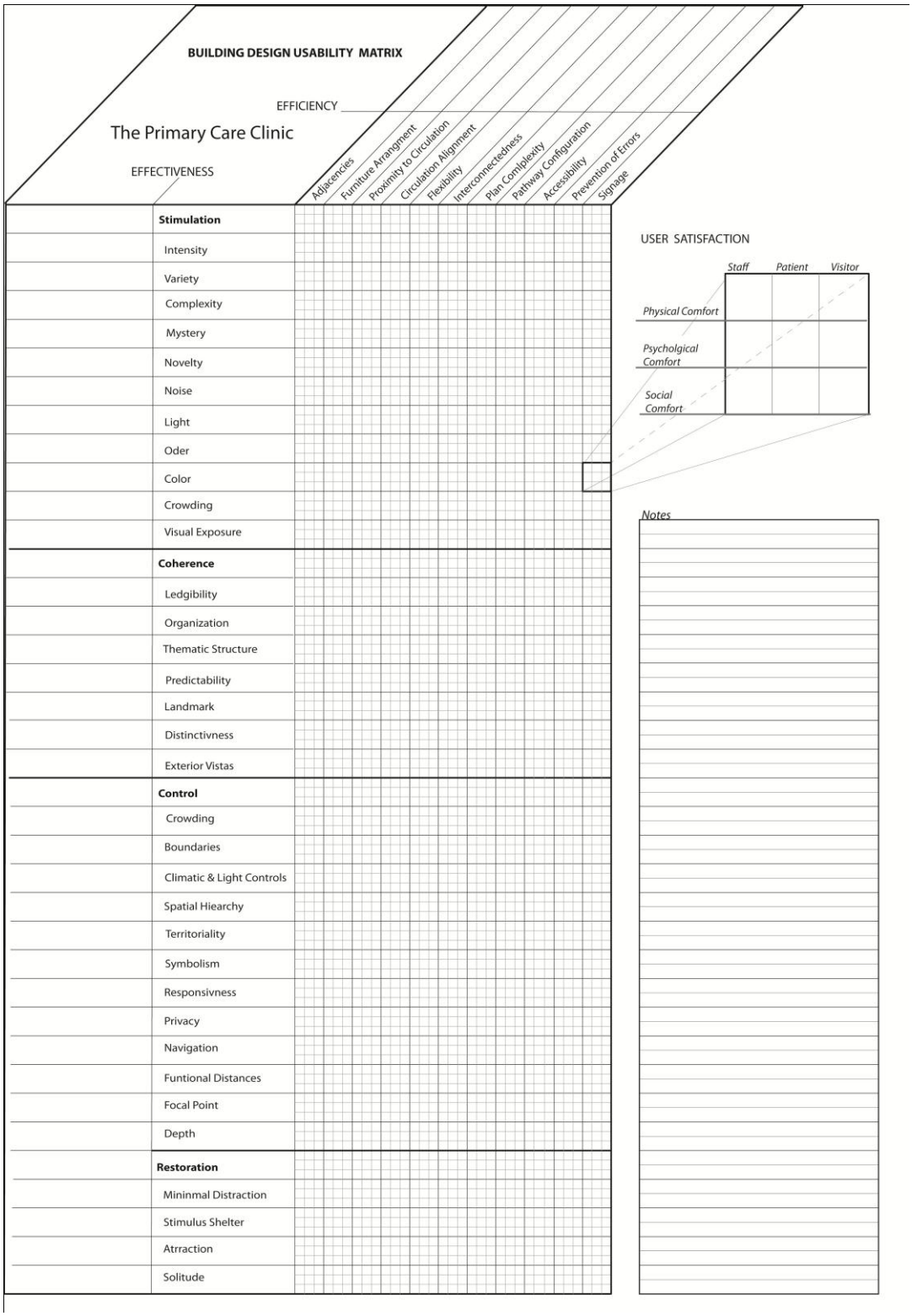

Table 15. The Usability Matrix

The Usability Matrix visualized the study's conceptual framework. In the matrix, the dimensions of effectiveness (y axis) and efficiency (x axis) multiply to create a user satisfaction unit. The user satisfaction unit subdivided into three additional subunits: physical comfort, social comfort, and psychological comfort in the y axis of the unit. These units were also divided in the x axis by user type (staff, patient, and visitor) (Table 15).

The data analysis and findings from each section in the original survey and Coding Analysis Tables were filtered into the matrix by asking questions about the design such as: "To what degree is the effectiveness of the (term in the y axis) in relation to (a term in the x axis) providing (physical/social/psychological) comfort for the (user type)?"

For example, when analyzing the usability of a waiting area, a question asked was: "To what degree are the boundaries set by the waiting chair clusters (furniture arrangement) providing psychological or social comfort to the visitors and patients. Through asking specific questions like the example provided, the Usability Matrix helped assess aspects of the clinic design that were addressed in healthcare design literature but may not have directly been applied to a primary care clinic design analysis.

The Usability Matrix also featured a row/column next to the psychosocially supportive design terms in the x and y axes to connect specific clinic design features to the psychosocially supportive design terms. By writing in the clinic design features next to the psychosocially supportive design terms in the x and y axes, the Usability Matrix

restructured itself to adapt to the specific design qualities of the area in the clinic being analyzed.

The Table 16 Building Design Usability Matrix frames the Check-in and Waiting Area sections findings of the design analysis within the conceptual framework. The black-colored units highlight issues already addressed in the original staff survey and the gray-colored units show areas where the survey was further developed in the revised survey. By coloring in units, the Usability Matrix serves as a checklist of potential usability design issues that can be applied to enhance the design. Matrices developed for other sections on the survey can be found in Appendix D. The final staff survey produced using the Usability Matrix can be found in the Building Design Usability Tool-Kit in Appendix E.

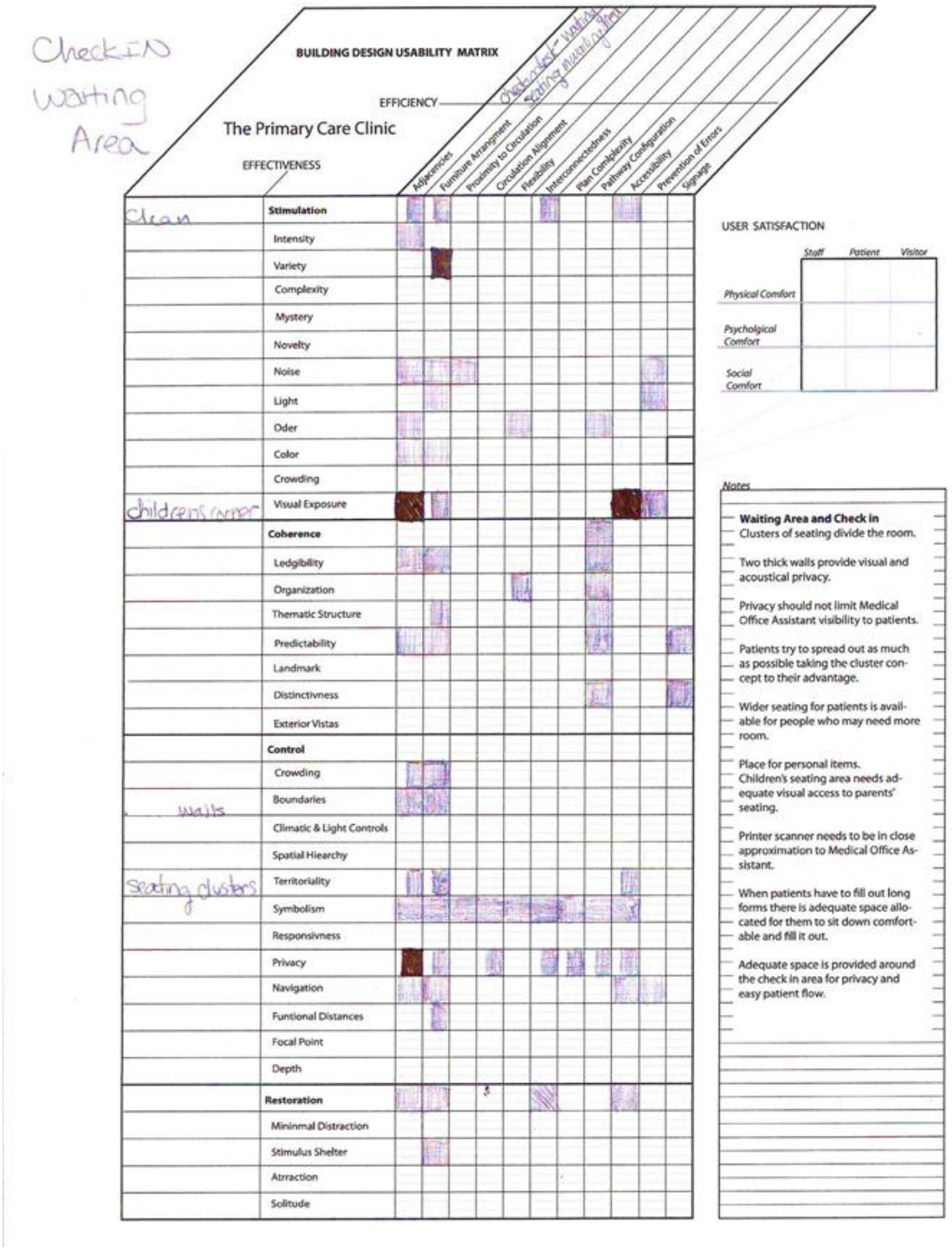

Table 16. Check-in and Waiting Area Usability Matrix

5. CONCLUSION AND DISCUSSION

5.1 Evaluation of Research Goals

The goal of this thesis was to develop appropriate design evaluation tools to evaluate the usability of a primary care clinic. The study intended to understand the systems and dynamics within a clinic environment and connect specific clinic design criteria to larger theoretical usability concepts in healthcare design. The Usability Matrix was an effective tool helping understand how the empirical research could fit within the building design usability concept developed in this study. A summary packet of the methodology and evaluation tools used to assess the built environment concludes this thesis (Appendix E).

5.2 Limitations

5.2.1 Behavioral Observation

An in-depth case study of one clinic produced a comprehensive design analysis methodology. The circumstances observed however strictly applied to one clinic design. Conducing behavioral observation in different types of primary care facilities can further elaborate this study.

5.2.2 Usability Matrix

In the current set up of the Usability Matrix, each colored unit does not necessarily correspond with one question of design feature. Colored units can apply to

more than one question in the survey or one colored unit can correspond to more than one design feature. The Usability Matrix can serve as a personal thinking/organizational tool however may be difficult to retrace and read. Further revision of the tool may allow this to be done.

5.2.3 Staff Survey

Thirty-eight design effectiveness terms times eleven design efficiency terms times three categories of user's satisfaction time's three user types yields a total of 3,762 potential usability indicators in a design. All potential units in the Usability Matrix have not been colored in and translated into the revised survey. Though some terms are not as applicable to a design as other terms, further analysis can always lead to more connections and design thinking. The survey can be further revised and adapted to specific features of the clinic case study. The survey can also be more specifically developed for patients or visitors in the clinic. The revised survey can however serve as a starting point to architects and design researchers for determining the building usability of a primary care clinic. The same methodology can be modified to create usability surveys for other the usability building typologies as well.

5.3 Future Research

There is still much more that needs to be investigated to address the topic of building usability. It is important to always be trying new paths. Each new design inquiry has to potential of offering something new to the table. The Building Usability

Evaluation Tool-Kit was developed to assist designer and researchers apply this research methodology to study the usability of their projects.

Furthermore, there is room for more development in the theoretical framework design. This study introduces a broad range of topics. Each psychosocially supportive design term can be further investigated in more depth. Creating standard graphics and representation techniques of these terms will further assist designers and researchers in their analysis.

This thesis has laid the foundation for some interesting work waiting to be done is this field. It is important to be constantly thinking of new and innovate ways to apply the concepts addressed in this thesis to a design as Albert Einstein once said, "Imagination is more important than knowledge."

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APPENDIX A

BEHAVIORAL OBSERVATION

Check-in Area

Objects	Interaction	Tasks	Spatial Attributes and Noted Behaviors
Large printer/scanner ID scanner Computer desk area	Patient/MOA (f) • Blood-work • New patient • Acute visit • Physical • Follow-up visit	Sign in Consent form Insurance card scan Walk to printer Print medication list Re-check emergency phone number and contact information	Counter space 11” HIPAA wall dividing space and providing privacy. HIPAA wall should not reduce MA visibility Larger printer/fax should be in a convenient location along with other tasking (extra walking).
	MOA/CMA (e)	MOA marks	
	Visitor/MOA (f)	Visitor comes to pick up referral Visitors pick up doctors notes Visitor comes in to arrange appointments	

Waiting Area

Objects	Tasks	Interaction	Spatial Attributes & Noted Behaviors
Children's corner	Wait	CMA calls out patients name	• Patients desire to be spread out. • Patients will also use the chair next to theirs. • Adults sit in seating that has strong visibility to the children's area. • HIPAA walls need to be able to provide privacy and still provide visibility to the MOA at the front desk.
Seating	Play		• Child size seating available
Double Seating	Read		• Area for magazines or purse
Computer desk			
Other seating clusters			• Patients will first disperse in each individual cluster then fill in the spaces.

Examination Room

Objects	Interaction	Tasks	Spatial Attributes and Noted Behaviors	Spatial Consideration for Patient Privacy
Glove container Scale Chair Computer desk Waste bag Patient exam bed	CMA/Patient (f) CMA/Provider (e)	CMA vital signs • Measure weight/height • Take blood pressure • Measure pulse • Take temperature • Respiration • Put gathered information into computer for doctor to see CMA prepares room /equipment for doctor (may need to go to supply room) and bring in EKG machine • Patient may change into given gowns	• Patient must have both feet on the ground and be in a upright position. • Patients' accompanying family members must have a place to sit. • Space for visitors accompanying patients. • Computer desk, gloves , and waste bag should be within close proximity for the CMA. • EGK machine area and supply storage should be in close proximity.	• Examination rooms should not in areas where there is a considerable amount of traffic flow. • Doors should open inward and behind patient examination chair.
Hand washing sink	Provider/Patient (f)	Acute Visit: 15 minutes Follow-up Visit : 15 minutes Physical : 30 minute		
Bio-hazardous waste	CMA	Cleans and preps rom for the next patient		
	Provider (e)	Writes EMR in examination room or office		
	Nurse/Patient (f)	Acute Visit: 15 minutes		
	Provider/ Visitor	Patient support		

Bariatric Room/Procedure Room

Objects	Interaction	Tasks	Considered Spatial Attributes	Spatial Consideration for Patient Privacy
Surgical tray	Provider/Patient (f)	Procedures • Biopsy-(sample tissue) • Incision and abscess drainage • Suturing • Labeled specimen container taken to lab to be processed. • Certain specimens are tracked.	• Well designed storage rooms which 7" shelving allowing maximizing storage capacity. • Storage must be within reach of nurses and staff. • Equipment requires visual organization and indexing • Centrally located among all providers.	• Exam rooms should not be in areas where there is a considerable amount of traffic flow. • Doors should open inward and behind patient exam chair. • Room should be wide enough for provider and CMA to operate on the patients and through away utensils when necessary.
Waste bin	CMA/ Provider (f)	• CMA giver sterile equipment to doctor • CMA labels and sets tray for the provider.	• Dust bin has to kept open at all time. • In order to accommodate CMA and medical provider, room could be wider.	
Bio-hazardous Waste bin				
Storage				
Surgical tray				

Lab Area

Objects	Interaction	Tasks	Spatial Attributes
Lab paper work	MOA/Lab Tech (f)	MOA drop off printed lab slip Lab Tech put printed information into computer software program.	MOA currently places lab slip on a HIPAA wall .
Computer desk Bio-Hazardous waste bin Shapes box Gloves Band-Aid Specimen container Syringe	Lab Tech/Patient (f)	Lab Tech put on hand sanitizer Lab tech wears gloves. Lab Tech takes syringe and finds vein on patient. Lab Tech takes syringe out collects blood work and places bandage of patient. Syringes in place in a sharps box which is discarded in the bio hazardous waste bin. Glover are remover and place in regular waste bin. Specimen is spun in centrifuge for 20 minutes . Send out back door for pick up.	Currently the order of tasks performed to not flow with the spatial distribution of the room. The room can be designed to accommodate the tasks in a circular more efficient flow.
	Lab Tech /Patients added on during the day.	Patients who are added to the blood work/lab schedule during the day sit in the lab waiting seating right outside the lab although the designated lab area is never used.	Patients wait out side the lab. Lab waiting area in never used to uncomfortable.

CMA/MOA Work Area/Check-out Station

Objects	Interaction	Tasks	Spatial Attributes
Patients holding medication print out behind one another Sticker box Computer station	Patient/ MOA (f)	Arrange next appointments Follow up visits Arrange blood work Prescribe medications Sticker box for children	Countertop Central location in front of main entrance hallway has limited privacy.

Provider's Office

Objects	Interaction	Tasks	Spatial Attributes
Computer Keypad	Provider/EMR	Review patient history before seeing patient .	Office's proximity to exam rooms Window/daylight

Billing/Nurse Triage

Objects	Interaction	Tasks	Spatial Attributes
Paper Desktop Fax machine Key board Telephone	Billing/ Main office (e)	Billing of patients visits sent over to Main office one day after. All electronic records printed out and entered into system.	More space in needed for paper work.
	Head Nurse/outside activities	Call next days appointments as a reminder. Follow up on no shows Solve issues regarding no shows i.e.. transportation of other barriers . Link patients to specialist connect patients to social workers or nutritionists.	

Sharps Room

Objects	Tasks	Interaction	Spatial Attributes
Needles	Pick up vaccines		Convenient location to exam rooms
Syringes	Store vaccines		
Refrigerator of vaccines			
Freezer Vaccines			

Closet

Storage Items		Spatial Attributes	Spatial Attributes
Infant measuring tape	Alcohol	• Proximity to exam rooms	Countertop
Blood sugar measuring kit	Urine cups		Central location in front of main entrance hallway has limited privacy .
Hydrogen peroxide	Lubricant jelly		
Thermometer probe covers	Iodine		
Pediatric aerosol masks	Sterile bowls		
Tissue rolls	Masking tape		
Gloves (latex and non latex)	Insulated cold packs		
Accu-Chek equipment	Catheters		
Swab sticks	Airways		
Bandages	Specimen collection devices		
Pillows			

APPENDIX B

CODING ANALYSIS

Check-in/Waiting Area

	Effectiveness	Efficiency	User Satisfaction
Tasks	**Ergonomic Details**	**Travel Distances , Access**	**Mental, Physical & Social Comfort**
General waiting	Counter top tall enough	Central edge or corner location	Provide privacy, personal space, and security HIPAA Wall dividing space and providing privacy.
Elderly Patients waiting		Easy access exam rooms	Larger seating for comfort and space
Children waiting	Children's corner does not have toys that can potentially spread infections	Enough space for children to move around, when desired	Children's corner has strong visibility to parent seating and MOA
Parents waiting		Seated close to children's corner	
New Patients waiting	No space for paperwork along with computer		
MOA attending Patient/Visitor	Space for paperwork	Location of fax machine in distance unlike insurance card scanner	Floor height, or chair height For visibility to patients HIPAA wall should not reduce MOA visibility
CMA attending	Electronic check in a future possibility.	More than one utilized entry from exam room area to waiting space	Welcome

Examination Room

	Effectiveness	Efficiency	User Satisfaction
Tasks	**Ergonomic Details**	**Travel Distances , Access**	**Mental Physical Social Comfort**
CMA/Patient Elderly Patients Children Parents New Patients • Patient may change into given gowns CMA vital signs • Measure weight/height • Take blood pressure • Measure pulse • Take temperature • Respiration • Put gathered information into computer for doctor to see CMA prepares room /equipment for provider (may need to go to supply room) and bring in EKG machine	• When taking blood pressure it helps to have both feet firm on the ground, (provide additional chair. • Doors should open inward and behind patient examination chair. • Computer desk, gloves , and waste bag should be within close proximity for the CMA.	• EKG machine corners in easily accessible location • Decentralized • Storage room should be decentralized • Even distribution of exam room throughout office • Children's weight measure in central location	• Patient should be able to see monitor/ or visualize the information being talked about. • Patients more often come as family. • Seating more than one individual should be accommodated for. • Exam rooms should not be in areas where there is a considerable amount of traffic flow.

Procedure/Bariatric Room

Tasks	Ergonomic and Design Details	Travel Distances , Access, Spatial Requirements	Mental Physical Social Comfort
Procedures (CMA, Provider, Patient) • Biopsy-(sample tissue) • Incision and apsis drainage • Suturing • Labeled Specimen container taken to lab to be processed	• Equipment requires visual organization and indexing • Dust bin has to kept open at all time during a procedure.	• Central or corner location for easy access to all staff • Close proximity to lab area if possible	• Examination rooms should not be in areas where there is a considerable amount of traffic flow. • Doors should open inward and behind patient examination chair.
• CMA gives sterile equipment to doctor • CMA labels and sets tray for the provider.		Room should be wide enough for provider and CMA to operate on the patients and throw away utensils when necessary.	
• Storage	• Well designed storage rooms which 7" shelving allowing maximizing storage capacity. • Storage must be within reach of nurses and staff • Although ample storage space is needed, placing storage on the wider side reduces the work area space. • Storage areas may be too high for some nurses to reach needed equipment with ease.	As long as small storage tray with necessary equipment for procedure is close to the work area the larger storage space does not need to be in immediate proximity to procedure work ware.	• Clarity and organization always helps

Lab Area

	Effectiveness	Efficiency	User Satisfaction
Tasks	**Ergonomic Details**	**Travel Distances , Access**	**Mental Physical Social Comfort**
MOA drop off printed lab slip Lab Tech put printed information into computer software program.	• Design drop off area for lab work paper. • Computer station located near drop off area. • Clinical location can be separate from lab personnel work station . • Bio-hazardous waste bin kept in the clinical zone. • Have hanger space /corner for personal items.	Central location , easy access to patients , connected to main waiting area .	• More comfortable chair (looks a bit scary especially for children). • Syringes may be prepared away from the patient or in front of the patient. (depending of preferences • Bio-hazardous waste been be kept away from the patients chair.
Lab Tech put on hand sanitizer. Lab Tech wears gloves. Lab Tech takes syringe and finds vein on patient. Lab Tech takes syringe out collects blood work and places bandage of patient. Syringes in place in a sharps box which is discarded in the bio hazardous waste bin. Glover are remover and place in regular waste bin Spin specimen for 20 minutes. Send out back door for pick up.		No need for separate lab waiting are, seldom get used, patients prefer to sit in open location and square footage will not allow for another such space. Smaller corner alcove with 2-3 chairs is adequate.	
Patients who are added to the blood work/lab schedule during the day sit in the lab waiting seating right outside the lab although the designated lab area is never used.			

Provider's Office

	Effectiveness	Efficiency	User Satisfaction
Tasks	**Ergonomic Details**	**Travel Distances , Access**	**Mental Physical Social Comfort**
Review patient history before seeing patient	• Personalized	Close to designated examination rooms Close proximity to nurses station Access to CMA and MOA	Private area
Take breaks			

Check-out Area

	Effectiveness	Efficiency	User Satisfaction
Tasks	**Ergonomic Details**	**Travel Distances , Access**	**Mental Physical Social Comfort**
Patient/MOA • Arrange next appointments • Follow up visits • Arrange blood work • Prescribe medications • Sticker box for children	• Countertop, can be of varying heights for visibility and patient choice.	Central location is in front of main entrance hallway.	Central location de limits privacy for HIPPA- design wider hallway in this areas and break up space for more privacy ? Sticker box can be made visible as a motivation for children instead of being placed in the back.
Patient • Patient Navigation		There is a way-finding issue for patients from the examination room to the specific check out station.	

Storage Closet

	Effectiveness	Efficiency	User Satisfaction
Tasks	**Ergonomic Details**	**Travel Distances , Access**	**Mental Physical Social Comfort**
CMA Items re-stored in examination room on a weekly and as need basis	Shelving should be not so tall to keep supplies within reach.	Proximity to examination rooms Decentralized, have proximity to examination rooms	

Sharps Room

	Effectiveness	Efficiency	User Satisfaction
Tasks	**Ergonomic Details**	**Travel Distances , Access**	**Mental Physical Social Comfort**
Pick up vaccines		Ideally central location	• Keep sharp room away from examination rooms/ patient traffic flow areas.
Store vaccines	Have room for filing cabinets, refrigerator, freezer		

APPENDIX C

STAFF SURVEY DATA

Check-in/Waiting Area

Check-in and Waiting	Mean	Max.	Min.	Standard Deviation	N
1. The check-in area provides privacy to patients.	3.12	5	1	1.11	17
2. The check in area provides strong visibility/ surveillance of the waiting space for the MOA.	3.12	5	1	1.11	17
3. The waiting space provides a variety of seating for the patients.	4.82	5	3	0.53	17
4. The children's corner has strong visibility to certain "parent chairs".	4.95	5	4	0.24	17
5. The children corner have strong visibility for the MOA?	4.17	5	2	1.01	17

Examination	Mean	Max	Min	Standard Deviation	N
1. Examination room is large enough to accommodate all tasks.	3.5	5	1	1.1	16
2. Patients often come with families in the examination room.	4.6	5	2	0.83	15
3. The examination room get too crowded when more than one patient is in the room.	3.67	5	1	1.29	15
4. Examination rooms around central check-in station area have limited privacy.	4.64	5	3	0.63	14
5. EKG machines are easily accessible when needed.	4.4	5	2	0.82	15
	4.07	5	2	0.96	15

Examination Room

Examination	Mean	Max	Min	Standard Deviation	N
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5. EKG machines are easily accessible when needed.	4.4	5	2	0.82	15
	4.07	5	2	0.96	15

What would you add or change in the examination room if you could	
Provider	"Spend more money to make them larger, by 2 ft."
	"We use a conference room if family conference."
	"Slightly bigger with one more chair for patient family ."
	"Slightly larger"
Medical Office Assistant	"Nothing, I think the are quite well set up."
Certified Medical Assistant	"Larger space, lower exam tables, more than one chair"
	"bigger rooms "
Registered Nurse	"larger"

Procedure/Bariatric Room

Procedure/ Bariatric Room	Mean	Max.	Min.	Standard Deviation	N
1. Procedure room is an adequate size for comfortable usage.	3.93	5	2	1.16	15
2. Shelving in the procedure room is not effectively positioned and designed.	4.64	5	3	0.63	14

What would you change in the Procedure/ Bariatric room if you could	
Provider	"more positioning of procedure tray mobility "
	"surgical lights"
Medical Office Assistant	"Nothing."
Certified Medical Assistant	"Make is longer vs. wider."
	"Sink and cabinets are not is most productive areas. Exam table should be more centralized in the room. Larger to accommodate the above. "
	"arrangement of stocked items."
Registered Nurse	"I would have a floor to ceiling cabinet- with enough room to organize supplies. I would be larger."

Lab Area

Labs	Mean	Max.	Min.	Standard Deviation	N
1. The patient chair in the lab rooms seems to be comfortable.	4.4	5	1	1.12	15
2. There is enough counter space to organize all my lab slips in the lab room.	3	5	1	1.73	15

What would you add or change in the lab room if you could ?	
Provider	"Allow a table to lie down in the room if reading."
Medical Office Assistant	"better check-in system"
Certified Medical Assistant	"Make it larger, better lighting and more POC area"
	"more counter space for draw station and processing "
Registered Nurse	"more counter area "

Communication Systems

Communication Systems	Mean	Max.	Min.	Standard Deviation	N
1. I communicate often with my co-workers via face to face conversation.	4.64	5	4	0.49	17
2. I communicate often with my co-workers via email.	4.75	5	4	0.45	16
3. I communicate often with my co-workers via phone.	3.53	5	1	1.46	17
4. I wish I could communicate more with my CMA, MOA, or provider.	2.65	4	2	0.61	17

How do you communicate most often with your co-workers and what do you think may help improve communication between them.	
Provider	"Either depends on patient flow or situation."
	"Doing time in EMR (electronic medical record)---- to fare?"
Medical Office Assistant	"None, its great."
	"Using all of the above tools using one of the 3 tools doesn't really need improving ."
Certified Medical Assistant	"the EMR website "
	"Face to face. Would help to have one central nurses station in stead of two separate."
Registered Nurse	"face to face"

Work Stations/Office

My Work Station or Office	Mean	Max.	Min.	Standard Deviation	N
1. I am satisfied with my work environment.	4.64	5	4	0.39	17
2. I feel organized.	4.59	5	4	0.51	17
3. My works space helps me be stay organized.	4.53	5	3	0.62	17
4. My work area is noisy.	2.81	5	1	1.42	16
5. My job is stressful.	3.41	5	1	1.37	17
6. My work environment contributes to my stress .	2.82	5	1	1.29	17
7. Providers, CMAs (Certified Medical Assistants), and MOAs (Medical Office Assistants) should work in the same room/ work station.	3	5	1	1.63	16

Please indicate why you agree or disagree with having Providers, CMAs work in the same work station.	
Provider	"Division of labor without distraction is important ."
	"Physician needs quite time to catch up, notes, billing, documentation."
	"A private area is needed when speaking with patient on the phone regarding the results, and patient questions. Also privacy is needed for documentation without unnecessary exposure to medical record."
	for better care and access communication
Medical Office Assistant	"The way the pods are set up now is perfect. As long as the providers office is within close proximity, as it is now, it makes it easier for the MOAs to access their provider."
	"I think when everyone works together there is a much better outcome."
	"I feel that could become overwhelming and also less private for personal patient information. Different areas also make it lass confusing and more structured."
Certified Medical Assistant	"Doctors and NPs should be kept separate from the MOA/CMA combo."
	"It helps to keep everyone on the same page and promotes team work. Improve quality care."
	"It would be too crowed and stressful "
Registered Nurse	"less walking, I hear 2-3 different ratio station at a time"
	"every one is better informed about what is going on"

Check-out Area

Check -out	Mean	Max.	Min.	Standard Deviation	N
1. Patients often get lost trying to find the check-out counter.	4.41	5	3	0.62	17
2. The central location helps patients orients themselves in the facility.	3.18	4	1	1.07	17
3. The central location and design limits patients' privacy.	3.41	5	1	1.33	17
4. The sticker box can be used as better motivation/ encouragement tools if made directly visible in the front area of the checkout corner.	4.82	5	4	0.39	17

What would you add or change in the check-out area if you could?	
Provider	"Separate check out not central would be more private, multiple patient tasks done at same site."
	"Not sure, separate check out for provider adds privacy but creates confusion ."
	"More clear direction signs for patients to orient themselves."
Medical Office Assistant	"Maybe Dr. ___ should change run #'s his patients always get confused where his check out is."
Certified Medical Assistant	"Better signage to direct patients to correct check out since we have more than one check out area."
Registered Nurse	"I do not know how to add privacy."

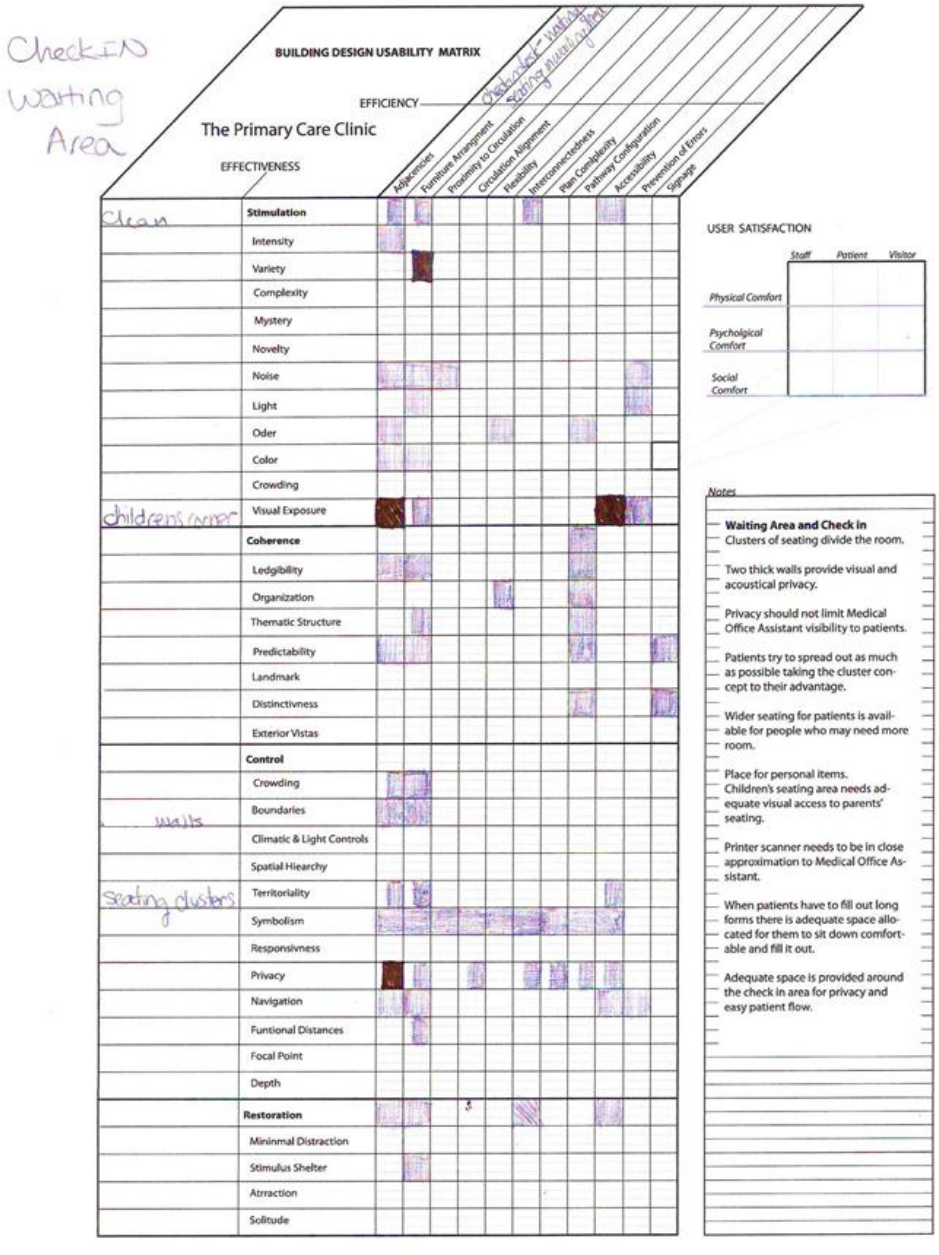
Storage Capacity and Locations

Storage Capacity and Locations	Mean	Max.	Min .	Standard Deviation	N
1. Storage areas would be better utilized if there were smaller decentralized unites dispersed between and in front of examination rooms.	3.13	5	1	1.2	16
2. The sharps rooms need to be centrally located.	3.31	5	1	1.4	16
3. The sharps room is often used.	3.62	5	1	1.2	16

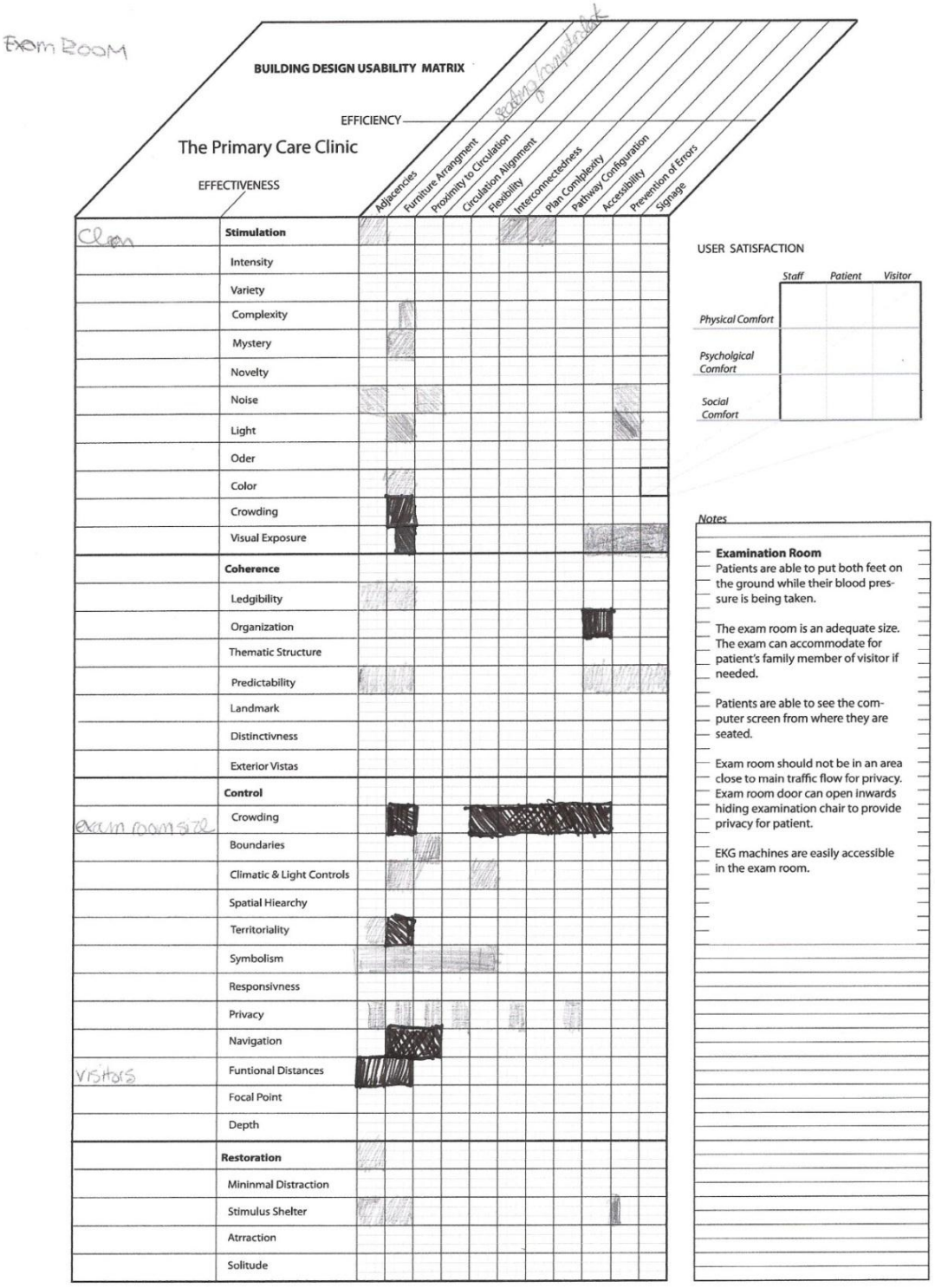
APPENDIX D

USABILITY MATRICES

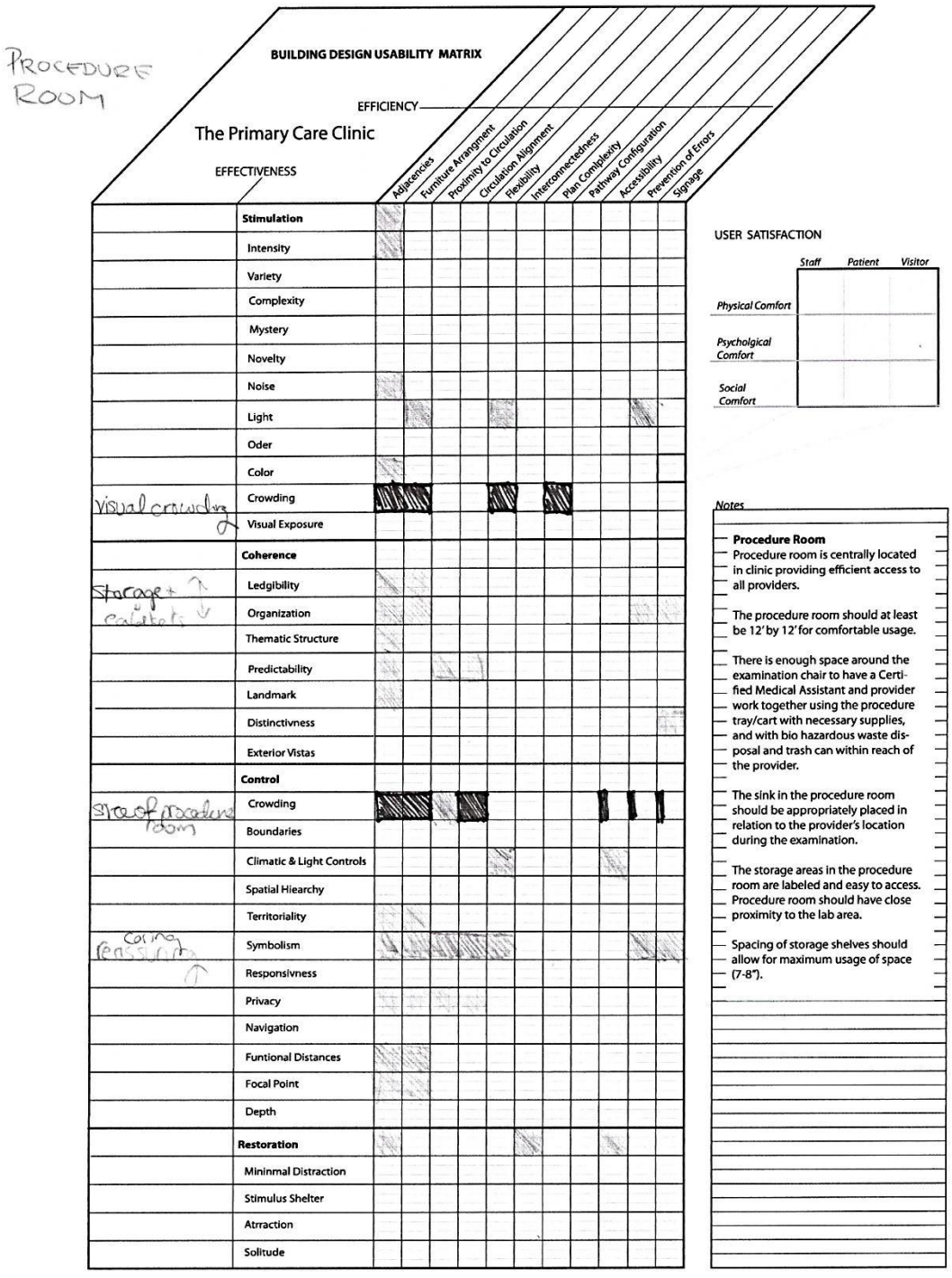
Check-in/Waiting Area



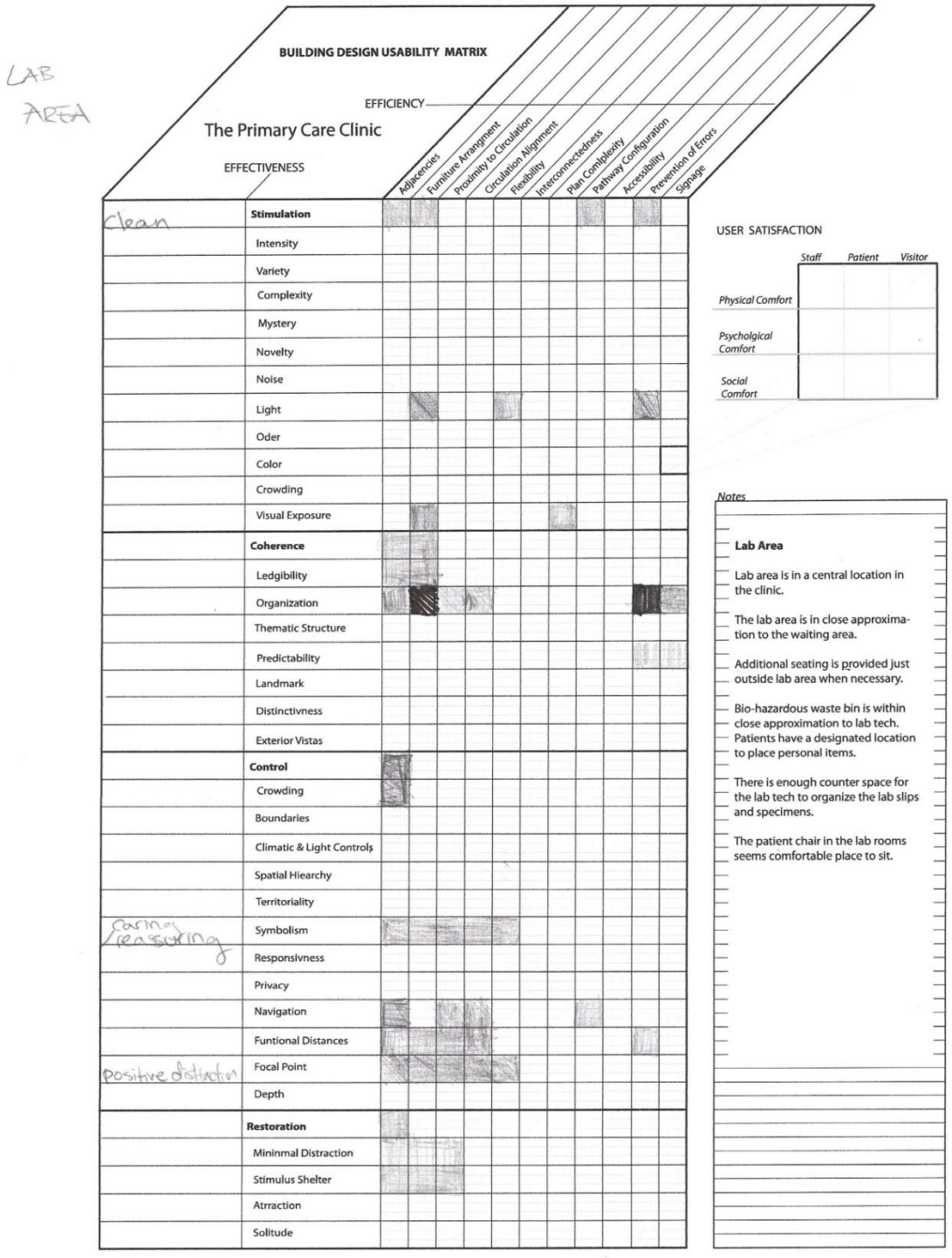
Exam Room


Exam Room
BUILDING DESIGN USABILITY MATRIX
EFFICIENCY
The Primary Care Clinic
EFFECTIVENESS
Adjacencies
Furniture Arrangment
Proximity to Circulation
Circulation Alignment
Flexibility
Interconnectedness
Plan Complexity
Pathway Configuration
Accessibility
Prevention of Errors
Signage
Clean
Stimulation
Intensity
Variety
Complexity
Mystery
Novelty
Noise
Light
Oder
Color
Crowding
Visual Exposure
Coherence
Ledgibility
Organization
Thematic Structure
Predictability
Landmark
Distinctivness
Exterior Vistas
Control
exam room size
Crowding
Boundaries
Climatic & Light Controls
Spatial Hiearchy
Territoriality
Symbolism
Responsivness
Privacy
Navigation
visitors
Funtional Distances
Focal Point
Depth
Restoration
Mininmal Distraction
Stimulus Shelter
Atrraction
Solitude
USER SATISFACTION
Staff
Patient
Visitor
Physical Comfort
Psycholgical Comfort
Social Comfort
Notes
Examination Room
Patients are able to put both feet on the ground while their blood pressure is being taken.
The exam room is an adequate size. The exam can accommodate for patient's family member of visitor if needed.
Patients are able to see the computer screen from where they are seated.
Exam room should not be in an area close to main traffic flow for privacy. Exam room door can open inwards hiding examination chair to provide privacy for patient.
EKG machines are easily accessible in the exam room.

Procedure Room



Lab Area


BUILDING DESIGN USABILITY MATRIX
EFFICIENCY
The Primary Care Clinic
EFFECTIVENESS
Adjacencies
Furniture Arrangment
Proximity to Circulation
Circulation Alignment
Flexibility
Interconnectedness
Plan Comlipexity
Pathway Configuration
Accessibility
Prevention of Errors
Signage
LAB AREA
Clean
Stimulation
Intensity
Variety
Complexity
Mystery
Novelty
Noise
Light
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Color
Crowding
Visual Exposure
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Ledgibility
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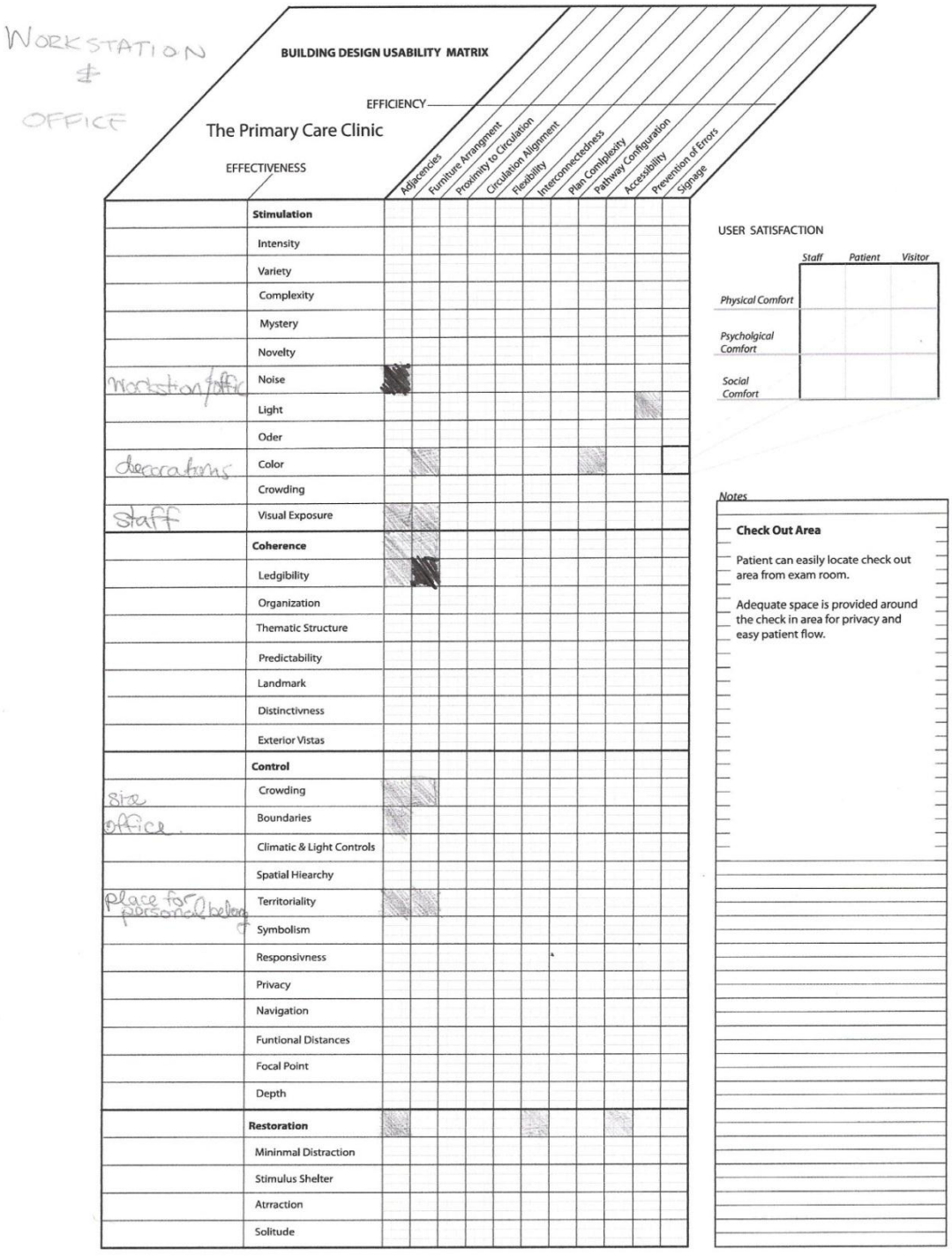
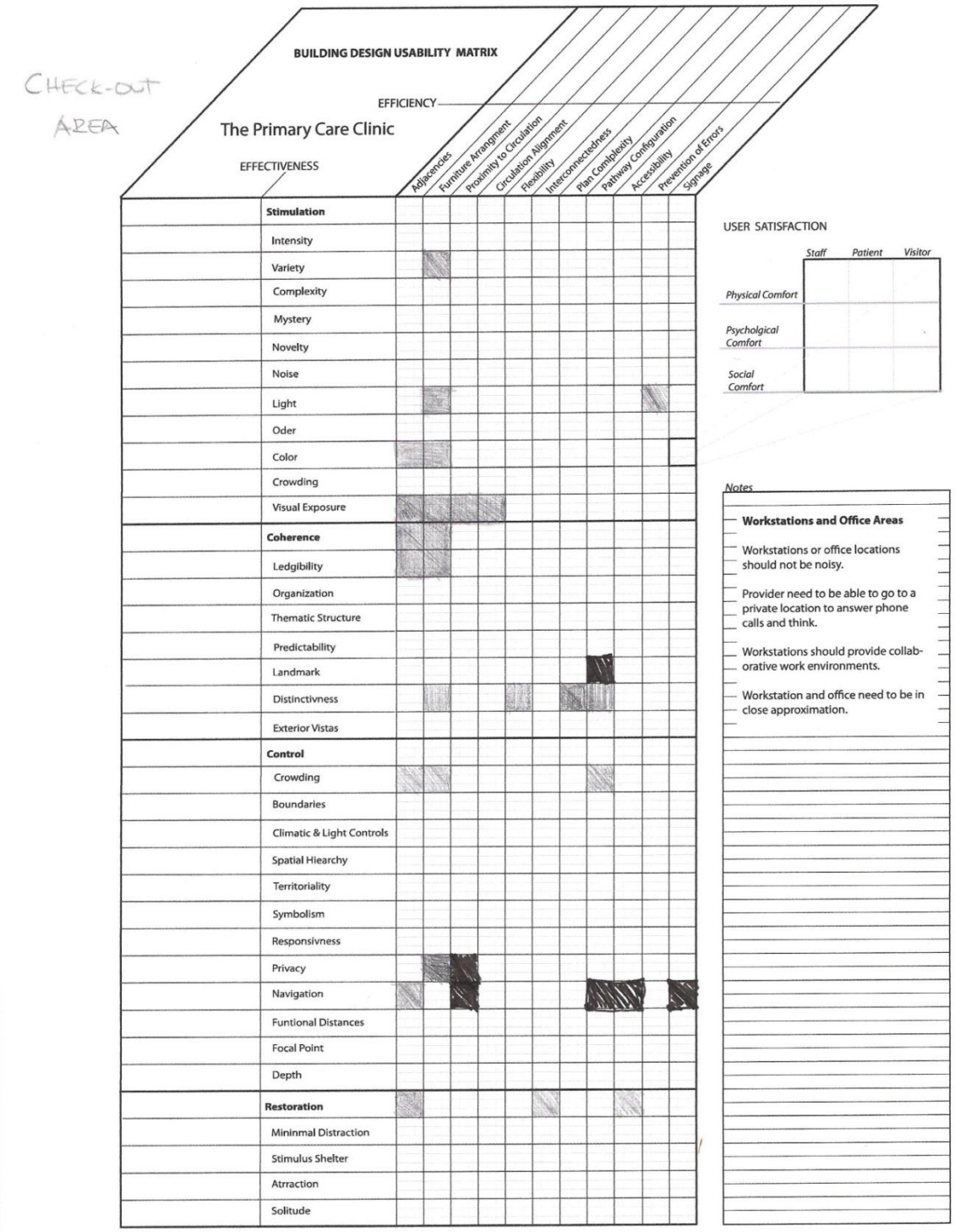
Stimulus Shelter
Atraction
Solitude
USER SATISFACTION
Staff
Patient
Visitor
Physical Comfort
Psycholgical Comfort
Social Comfort
Notes
Lab Area
Lab area is in a central location in the clinic.
The lab area is in close approximation to the waiting area.
Additional seating is provided just outside lab area when necessary.
Bio-hazardous waste bin is within close approximation to lab tech.
Patients have a designated location to place personal items.
There is enough counter space for the lab tech to organize the lab slips and specimens.
The patient chair in the lab rooms seems comfortable place to sit.

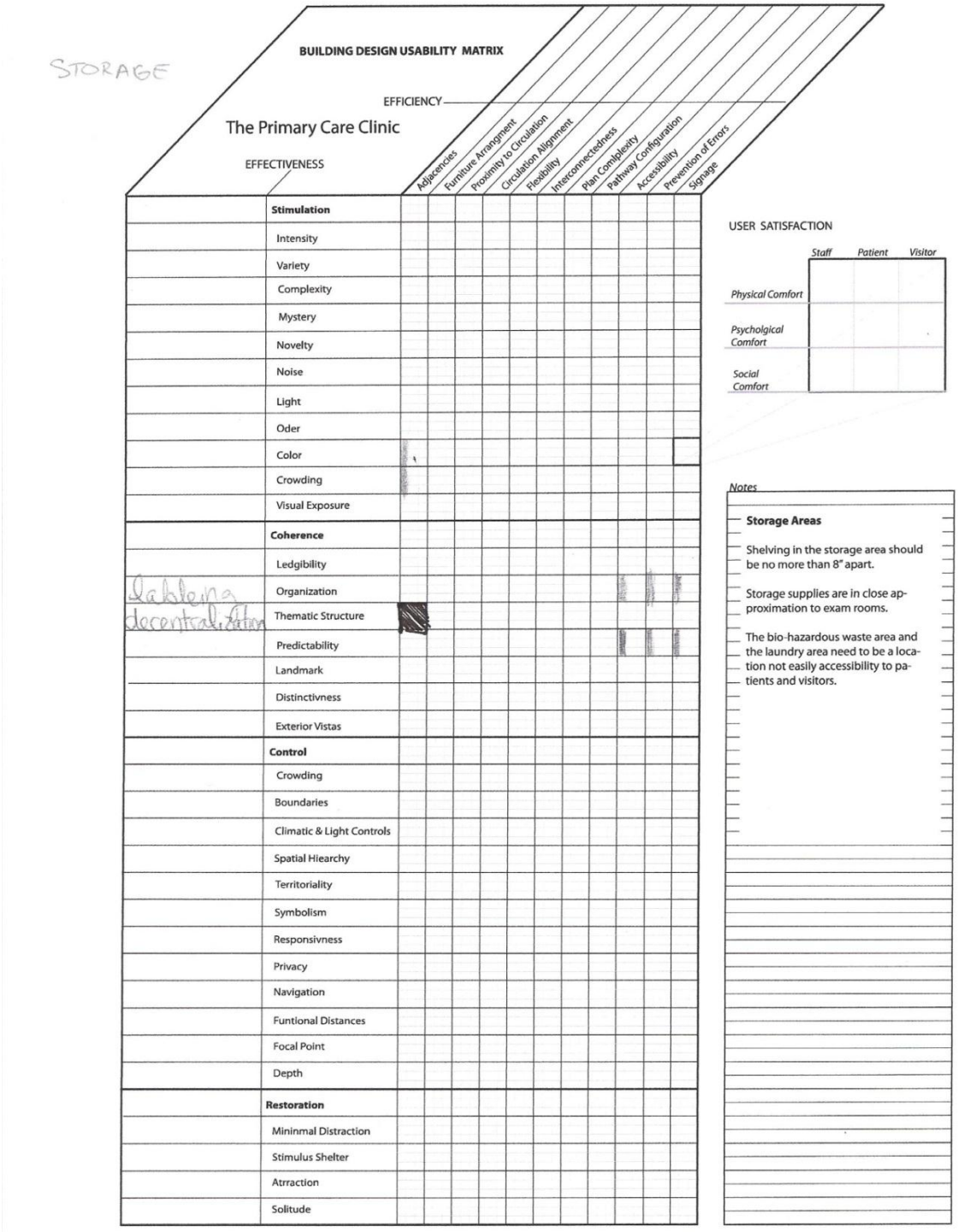
Work Stations and Provider's Office



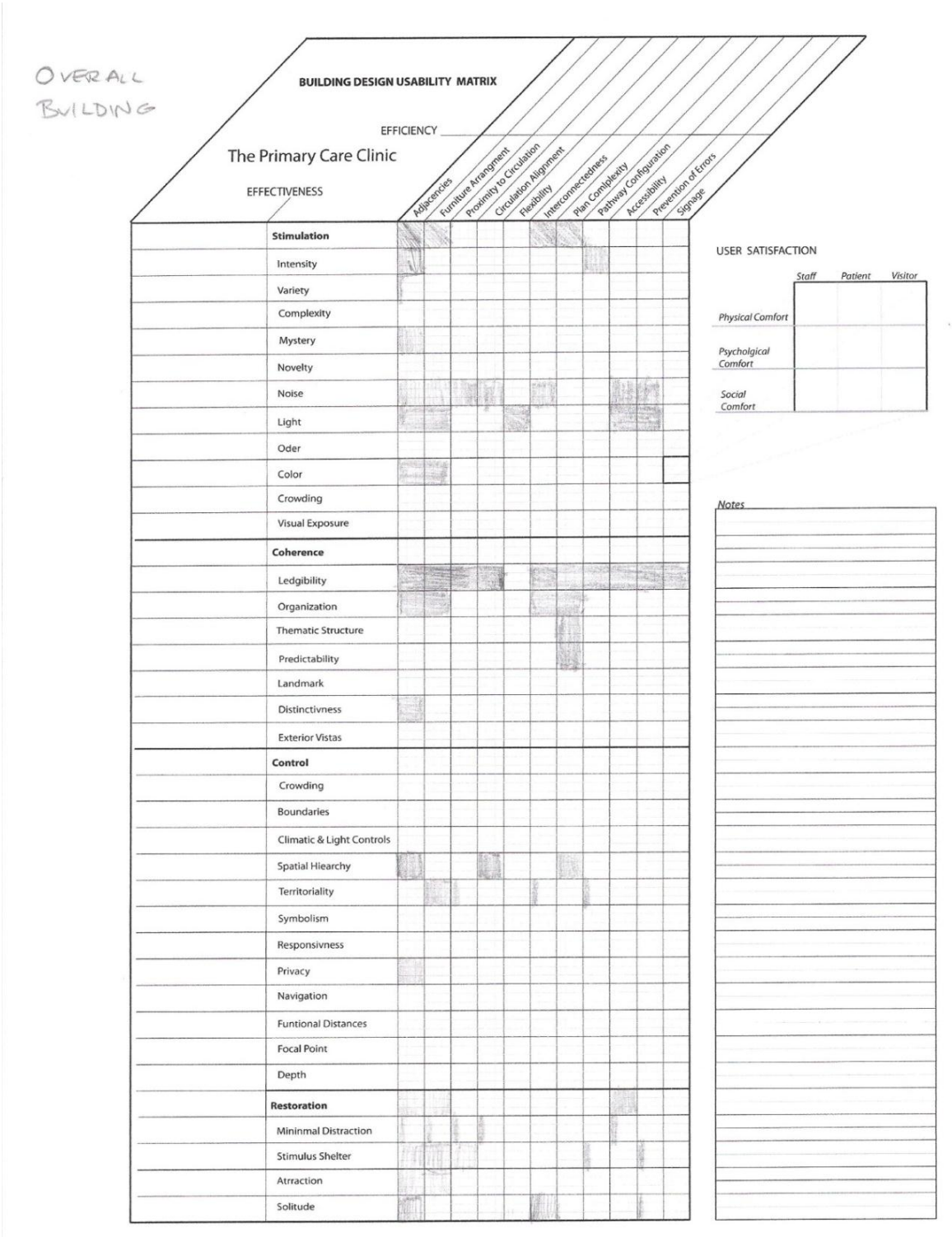
Check-out Area



Storage Areas



Overall Building Layout



APPENDIX E

BUILDING USABILITY EVALUATION TOOL-KIT

The Building Usability Evaluation Tool-Kit is in a separate PDF file associated with this thesis.