

THESIS

EMERGENCY ROOM DESIGN

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WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY REEM A. TAHER ENTITLED HOSPITAL EMERGENCY ROOM DESIGN BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF ART.

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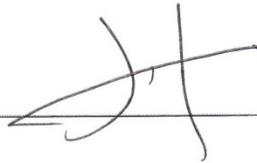
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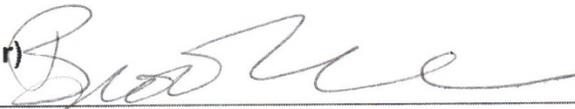
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Acknowledgement

“I am a success today because I had a friend who believed in me and I didn't have the heart to let him down...” -Abraham Lincoln.

I dedicate this thesis to my lovely parents who continuously support me with their prayers. To my loyal husband Faisal, that supported me step by step along the way in my practical and educational journey. I would also like to thank everyone that helped and provided me with all the materials and support that I needed to accomplish this research.

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Thesis statement:

Skin is the interface between inside and outside, and between public and private realms. A building's skin transcends beyond its exterior into interior walls and partitions as well. The development of the building skin elaborates these transitions.

This proposal studies the areas beyond the skin in buildings, and especially the continuity between public and private areas within hospital emergency care units, and how those progressions can be improved for users.

Abstract:

This research presents an interior design study on the continuation of the architectural skin through to interior walls and partitions. The extension of the exterior skin must develop an inner transition between the public and private areas that is both accommodating and beneficial to the needs of its occupants.

Within health care facilities, in particular, the interaction of these transitions is very critical. There are several physical areas that can influence and promote well-being, healing, and relieve stress in both patients and caregivers, such as: waiting rooms, nurse stations and examining rooms. The concept of creating a cohesive environment that ultimately enhances the healthcare program requires a strategic approach to the ultimate design process. Consequently, interior design factors are constantly evolving in response to the growing trend in the health care industry in which it caters to the expectations of both patients and facilitators alike.

In this regard, the analyses of the ER department at Sibley memorial hospital, Georgetown ER department in Washington DC, and INOVA hospital in Alexandria, VA provide convenient evidences of project success or failure. Similar studies are made considering their size, location, and satisfaction with the program and process.

This research proposal is redesigning the Kennedy Health Systems Emergency Unit located in Cherry Hill, NJ. The design will address the general issues that influence the operations and Emergency Room design.

Introduction:

Skin is a multi layered, multipurpose organ that shifts from thick to thin, tight to loose, lubricant to dry, across the landscape of the body. Skin is a knowledge gathering device and responds to heat, cold, pleasure, and pain. It is also represents a transition between our outsides and insides. It lacks definitive boundaries, following continuously from the exposed surface of the body to its internal cavities. It is both living and dead, a self repairing, and self replacing material, with an exterior which is senseless, while its inner layers are flush with nerves, glands, and capillaries (Lupton2002, 29).

Skin is my source of inspiration for this project. In a building, skin provides the interaction between the inside and outside, as well as the public and private spaces. My fascination and interest in this proposal lie within the study of the continuance of skin beyond exterior walls into interior walls and partitions; the creation of the extension to the exterior skin; and the development of these transitions in an emergency unit while providing a healing, comfortable, and functional environment.

According to Daniel E. Williams, the three elements of a building skin are: floor, wall, and ceiling. The corresponding structural elements are the foundation, column, and roof. Each has its own finish and its own impact on the flow of energy and the flow of circulation inside the space (Williams 2007, 116). The

relationship between privacy and healing is very important. It is related to the patients' physical and psychological situation. It is very difficult to feel secure in new places, especially when pain is involved. Without privacy, the patient will feel insecure, which will affect the process of healing. Privacy plays a central role on the healing environment. Old models of healthcare design rarely address the concept of privacy. While stress can suppress the immune system, privacy and feeling secure reduces stress and helps the process of recovery.

The old healthcare design models relied on large spaces with curtain dividers between beds to insure the ease of access and patient observation. It was practical for the staff members, but frustrating for patients. This way of arrangement does not provide the patient with enough privacy in order to feel secure. The undesired amount of sound or crying from the nearby patient will increase the anxiety level with in other patients.

In emergency rooms patients experience a lot of pain, and an unfamiliar, complex, environment. All these feelings are beyond their control, which make it a high load environment. Even for doctors, these situations can cause stress and affect their direct attention and the ability to make the right decision for critical injuries. These areas experience a variety of social density and different emotional moments.

The challenge to provide the ideal level of privacy in health care design is much greater than for most other elements. Each user of these spaces has his or her individual needs and individual characteristics. Patients, doctors, nurses, and visitors all experience a variety of physical and emotional responses, which

directly affects their relationship to the healing process. Privacy in healthcare environments varies greatly among facilities. Patients always require documentation security while at the same time expect to be able to develop some level of intimacy between themselves, and the medical staff, family, and friends. The medical staff also needs to be provided an environment that can promote intimacy in the workplace.

Color, light, and sound are the three critical design components which are important to the privacy in the healing environment. When applied properly in the design, those components help in transforming the space into a source of healing medicine. Dark and small rooms are not comfortable and they tend to cause depression and anxiety. On the other hand, bright rooms are more welcoming and relaxing.

Choosing the right color is very important in designing an emergency unit. Research has shown that the red color has a stimulating effect on the sympathetic nervous system, and increases the blood flow to the muscles. This accelerates heart and respiration rates and raises the blood pressure. On the other hand, a cool color such as blue stimulates the parasympathic nervous system, which produces a relaxing effect on the body.

Colors can also be used to indicate the level of privacy in a certain space. Because warm colors are related to activities and interaction; they are used in designing more public spaces. On the other hand, cool colors are associated with

relaxing and passive activities, they are used in designing private areas. The color combination formed in nature is the most pleasing of color schemes.

A patient's first impression of any medical facility is formed in the reception area. The design should reflect confidence by emphasizing care, comfort, and way-finding. The latest trend is designing healthcare lobbies, reception areas, and waiting rooms to look more like hotel lobbies rather than the traditional sterile and boring spaces, thus, allowing patients to deal with their pain or grief with more confidence.

Incoming patients and visitors must know where they are expected to go. Floor patterns, signs, and color coding should guide them to important areas such as the lobby, reception, and waiting rooms. This provides control on the circulation of the design. Waiting areas should allow some controlled interaction between patients when needed, in order to reduce stress and anxiety. On the other hand, allowing others to have their individual privacy provides control, social support, and positive distraction at the same time.

Key Design Considerations:

A successful design should be engaging with users needs and very clear in way-finding. The following elements are essential keys for designing the emergency room space. Natural light is an important element in improving our overall immune system. A good balance of natural and artificial light provides fascination because it is constantly changing in direction, intensity, and color.

Cool white fluorescent light is commonly used in offices, schools, and hospitals. Studies have shown that they increase fatigue, irritability, eyestrain, and headaches more than full spectrum fluorescent light. Additionally, they produce several harmful forms of radiation (Rosemary and Julie2005, 146).

Privacy is usually associated with lower light levels. Public areas require more lights for visual clarity and way-finding, while other areas require lower levels of light to encourage interaction and provide a sense of security within patients, their family, and friends.

Sound is also similar to light. The more private the area is, the more sound or noise is unwanted. Excessive noise is a primary source of stress, making it difficult to focus, and is important to avoid in private areas, and especially in operating and decision-making rooms (Emergency room and Julie 2005, 124). It is more common to use curtains between beds in ER rooms because of their ease in circulation but they are not recommended for privacy needs. Patients are unlikely to share their private information and critical conditions with another neighbor patient. That is why individual rooms with acoustical barriers are preferred.

The goal of designing any space is to enable better performance. Whether or not emergency unit design has a better effect on the users and staff is determined through the result of overall performance in the ER unit and the areas of collaboration between the patient and staff members. Less people in waiting areas, and less people in pain, is a good sign for a successful healing space.

Designing these spaces should also consider future needs. The initial arrangement of furniture and equipment in areas such as staff rooms, patient rooms, and waiting areas should allow for the ability to change and rearrange to accommodate future needs of the space. A successful design strategy should fulfill the needs of the current space and users, while allowing for improvement - and flexibility to meet future needs (Krik and Sheply 2010, 120).

Design Thinking:

The power of healing can come from a comforting environment that is often rendered by the smallest of design enhancements. Simple little details such as: special-needs ADA seating can be stressful and unwelcoming to patients and medical staff alike. A warm and welcoming atmosphere, a relaxed staff, and a well prepared space that is designed to easily handle the worst emergency scenario can allow a patient to mentally relax, which has been shown to promote the healing process (Leibrock 2000, 257).

Inspirations:

Some modern design trends tend to turn the waiting room into a hotel-like lobby area. Alternatively, I am looking forward to designing a more responsive space, which is derived from a truly insightful understanding of the hospital emergency unit as a whole, both from human and medical perspectives. My design will serve the current purpose of the area, while being capable of adapting to changing circumstances and future requirements of the space. It will consider the potential for growth and expected changes in healthcare delivery systems. One such example of the new design innovations in healthcare is the “no waiting room” emergency department seen at Ball Memorial Hospital in Muncie, Indiana, where each examining room has its own family waiting area that creates more privacy and security for the patient and his or her companions. As a result of my research, I found that this is a good way to reduce the number of people waiting in pain during normal conditions. However, potential problems arise on heavy flow days or when there is large accident, as an inappropriate volume of patients can be left awaiting a vacancy of beds (Emergency room and Julie 2005, 154).

The consideration of positive destruction in the emergency unit is very important. Having several artwork displays with appropriate lighting and colors will help the patients to relax and forget a little about pain. The patient should not feel lost or forgotten in the waiting room. The patient should know that he is the point of embrace.

Design Analysis:

Typology

Project one:

Emergency Department at Sibley Memorial Hospital

1. Site analysis

The hospital is located in northwest Washington, D.C. The Dalecarlia Reservoir is at the north; the Cleveland park community is at the south; Macarthur

Boulevard is on the west; and Massachusetts Avenue (Westmoreland Circle and American University) are on the east side.

The location is easy to access by car or public transportation.

The department is located on the first floor of the hospital. Patients can be (Figure dropped off at the Emergency entrance, accessible from Loughboro Road.

Sibley is a 328-bed, non-profit, full service community hospital. The approximate number of visiting patients each year is 30,000 patients (<http://www.sibley.org/>)

2. Program analysis and adjacencies:

The Department is divided into two areas. The major treatment area has 15 beds and is always open. There is a separate Fast Track area for minor

complaints that is designed to get patients treated and discharged faster. Fast Track has 5 treatment areas and is open from 11AM to 11PM daily. This hospital is part of the John Hopkins health system.

The waiting area at the newly added emergency department is very spacious and welcoming. A large volume of natural light is allowed in through the large ceiling-to-floor façade windows. The hospital follows a new strategy where a patient is not allowed to wait more than thirty minutes. An examining room should be available during that time. The flooring color helps by directing the patients to path they should follow. The artificial lights in the waiting area follow a grid pattern with the wood ceiling, making them less obvious, and generally giving the area a hotel lobby atmosphere.

The examining rooms are not far away from the waiting area and all the equipment is stored in bins. The nurse station is centered and surrounded with the examining rooms, some of which have curtain dividers.

3. Points of interest:

- The natural lighting is very positive. It provides a cheerful feeling to the environment and helps in the healing process.
- The limit of thirty minutes reduced the number of people waiting and helps to create a relaxing environment.
- The new materials used for flooring and flooring color help in way finding and create a welcoming atmosphere.

Project Two:

Emergency Department at INOVA Alexandria Hospital

1. Site analysis:

The emergency department is located in the first floor accessible from the N. Howard street and the N. Gaillard street. It is surrounded with a large variety of residential and commercial buildings. It is also very close to the campus of the Northern Virginia community college. It was renovated in 2007.

Program analysis and adjacencies:

INOVA Alexandria Hospital is a 318-bed community hospital that provides around-the-clock emergency service and it also provides 24 hour access to imaging and lab service (<http://www.inova.org/patient-and-visitor-information/facilities/inova-alexandria-hospital/index.jsp>)

The newly renovated area is very welcoming, nice looking, and well organized, see figure 10. However, the only problem is in the waiting room. An interior design with this level of structuring should have a better layout than to encourage the clutter of rows of light weight chairs to be scattered about by patients and their companions in the waiting area.

2. Points of interest:

- The patient rooms are designed with warm colors and styled in such a way that they look like hard wood, but are not. It gives patients the feeling that they are still at home.

Project Three:

Emergency Department at Georgetown Hospital

1. Site analysis:

Georgetown hospital is located on Reservoir Road N.W, Washington DC. It is surrounded with a number of schools and a large residential area.

2. Program analysis and adjacencies:

The hospital is a not-for-profit, acute-care teaching and research hospital with 609 beds (<http://www.georgetownuniversityhospital.org/>). The newly renovate area in the emergency department is better than it was the waiting room is regularly renovated and improved,. Although they had their recent renovated but the waiting room is still in need of redesign. The chairs are not comfortable

and there aren't any children waiting area. The chairs arrangement allows only one or two people with wheelchairs to sit at the left side of the seating area.

3. Points of interest

- The hospital gives a lot of attention to the ability of renovation and improvement in its areas.

Design Proposal

Concept:

As stated in the introduction, skin is the largest and most functional organ in the man body. Skin collects feelings from the outside and is able to transmit into the body; they in return are reflected, allowing individual personal responses to environmental factors. In order to translate that in to a design, a close study of skin structure and skin patterns in relation to its function was made. Different layers of skin represent the different layers of privacy. The connection between the nerve system and skin is the relation between the space, function, and its users.

Site selection and analysis:

Selecting a successful site for an emergency unit is very important. It should be located near by a residential area with high density of occupants. Being close to a large hospital is a plus if the patient needs to be admitted. Using an ambulance for transportation will not be necessary.

In this proposal, the emergency unit project is located in a newly added extension by the Cherry Hill Kennedy Systems Hospital, NJ. Nearby the location there is a high school, church, college and a shopping center. The location is very easy to access and has a plenty of parking spaces. A bus stop is also available just by the exterior gate. It is also well identified from all approaches. Illuminated signs are recommended to ensure the visibility at night.

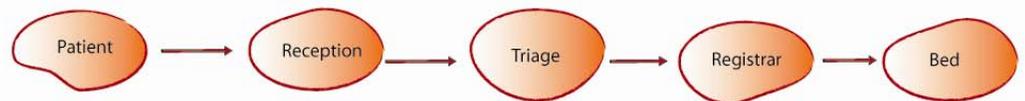
The total internal area of the project is 4,550 square feet that serve 45,000 patients per year.

Program study:

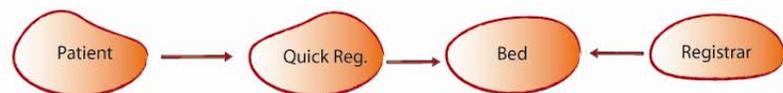
Designing ER space revolves around the major functional areas of the department. After studying carefully the patient flow in the ER department, research shows that the center of all activities is the nurse station in order to fully observe all patient examining rooms.



Normal Intake Flow :



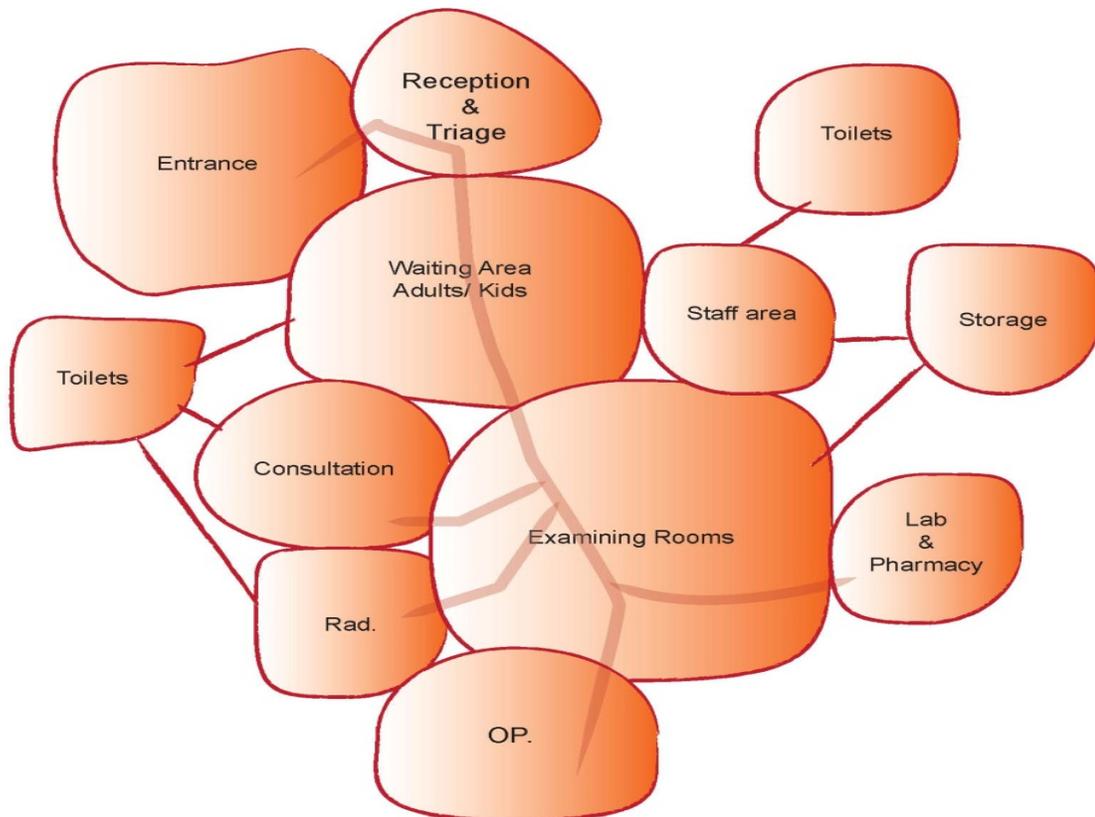
High Impact Intake Flow :



(Figure 1) Diagram showing the critical areas in the ER unit and the daily patient flow.

Functional relationships:

An emergency unit is composed of the following main functional areas: entrance, reception, triage area, examining rooms, consultation area, operation rooms, imaging /lab rooms, staff area, administration and associated workstations. See figure 2.



(Figure 2) Bubble diagram illustrating major area adjacencies and relations.

The ambulance should have a separate entrance that leads directly to the examining rooms. Medical imaging should also have a direct access to the incoming patient. The car parking, operating rooms and the medical records are considered ready access areas. The other areas like the pharmacy, and storage rooms should be available for access when needed.

By following the sequence of the previous diagram the patient will progress smoothly during his visit to the ER unit, and the chance of their being becoming lost or misguided will be minimized. When designing a waiting room area there are several things that should be considered such as:

- Natural lighting should be maximized
- There should be a separate children waiting area with suitable furniture including TV/ video and well observed by the staff.
- The use of art, murals, natural scenes, and photographs should be considered.
- Restroom facilities and changing rooms should be close and easy to find
- Light refreshment area should also be available in or near the waiting area
- Telephone and internet access should be provided.
- Proper and clear signs for way finding are a must.

Design Requirements:

Lighting:

It is essential to provide natural lighting in all parts of the emergency unit.

Light should be distributed evenly on all areas with attention to examining rooms where each one should have a power output of 30,000 lux illuminate a field size of at least 150 mm and be of robust construction. Lighting should follow the United States building standards codes.

Lighting controls and dimmers should also be considered with in the design in order to promote energy efficiency. Corridors and doorways should also be properly lighted to avoid unexpected accidents. (Emergency room and Julie 2005, 143)

Sound control:

Clinical care areas should be designed to minimize the transmission of sound between adjacent treatment areas. The sound levels should confirm to the United States standards and world health organization guidelines.

Soothing music or rhythmic natural sounds like waterfalls, fish tanks, and bird songs can also be used as a positive distraction to reduce stress and promote relaxation; as well, they can also block unpleasant ambient sounds. (Leibroch 2000, 196)

Air conditioning:

The emergency unit should have a separate AC system from the rest of the hospital in order to provide rapid change in circulation to provide fresh air as possible.

Wall and floor coverings:

Hospital beds, stretchers, ambulance trolleys and wheelchairs cause damage to walls when they get into contact. These areas of contact should be reinforced and protected with buffer rails or similar materials. Bed stops should be fitted to the floor to prevent headboard from damaging the wall behind and equipment.

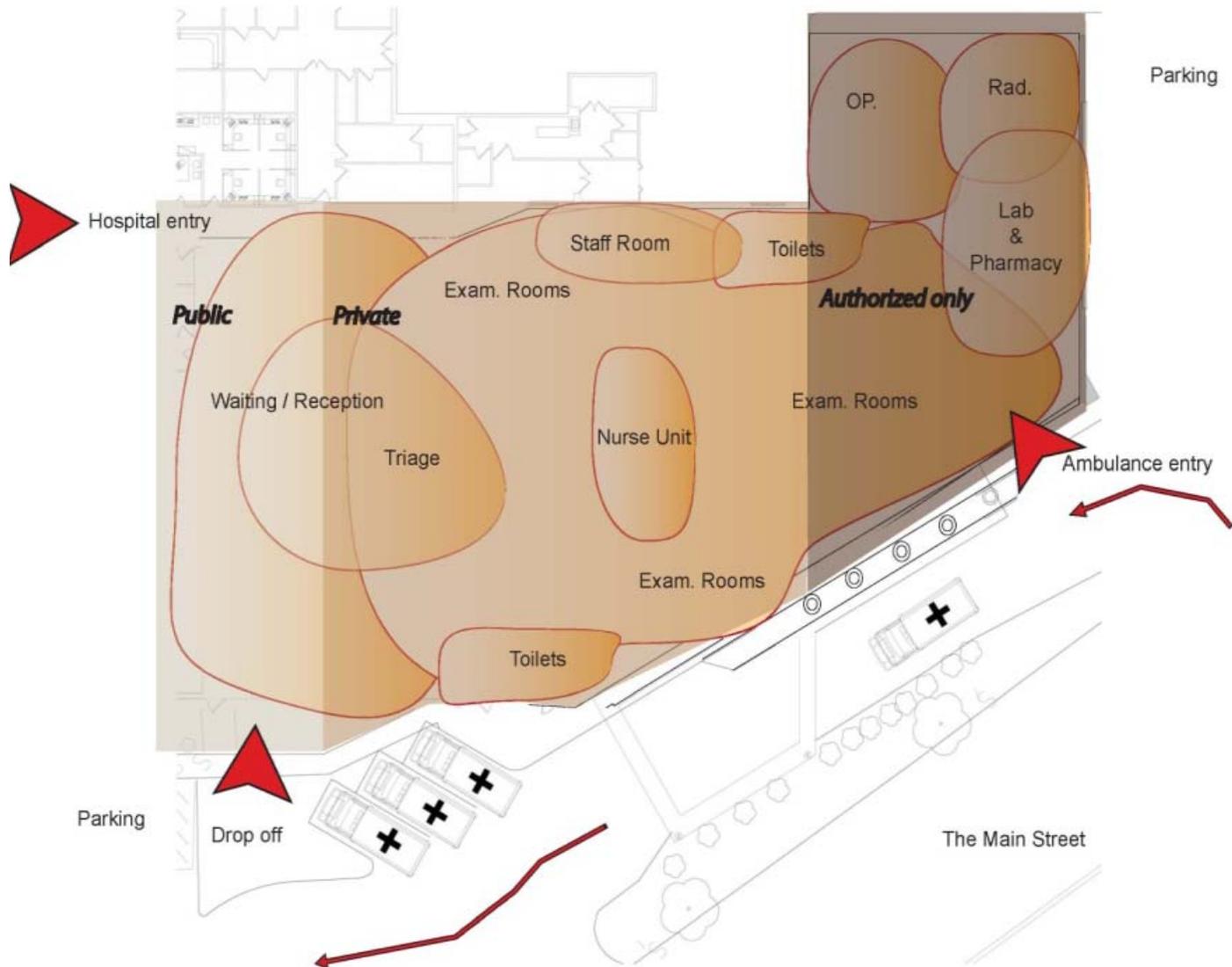
The right materials and colors should be chosen to reduce noise and direct movement. Special ramps may be applied when there are different floor levels for people with special needs. Flooring material should be durable, easy to clean and impermeable to water and body fluids, and highly slip resistant. It also should be shock absorbent to optimize staff comfort and facilitate the movement of beds.

Doors and corridors:

All doors should be in a sufficient size to accommodate a full hospital bed with attached intravenous flasks with ease. Corridors should be minimized to optimize the use of space. If they are necessary, their width should allow the cross passage of a hospital bed and a linen trolley without difficulty. Standard corridors should not be used for equipment storage, or patient waiting.

The existing plan layout, shows the narrow corridors of the emergency unit, and the small waiting area hat seats only 24 person. With different layout the area would be more utilized.

In the proposed plan layout, the program is re arranged in order to get the best benefit of the space and its function.



(Figure 3) Proposed plan layout.

Conclusion:

This proposal is produced with the input of many experts that have experienced the emergency unit activities, and an extensive research on the space requirements and patient flow within stereotypical emergency units in the United States. With this new understanding of hospital emergency unit, I'm looking forward to designing the relaxing and patient friendly emergency care unit of the future. In order to design effective health care facilities for the future, designers must be familiar with the latest industry developments, building requirements stemming from these trends, and the latest research findings on the impact of building designs on ER.

In this approach the program is inspired by the system of the human skin and the relationship between its layers. Some of the skin characteristics are applied to the space in order to achieve the best performance of the environment. Elasticity, pores, cracks are representing the spaces in the emergency unit while the core is the staff area and nurse unit. Skin is responsive to the exterior and interior elements. As well as the emergency unit, it is responsive to the current situation. It is flexible to accommodate sudden and various numbers of patients at any time.

Elasticity is applied to the patient waiting area. The healing rooms are the cracks those open to receive patients and treat them.

This application provides a patient friendly environment that improves the healing process with respect to the patients' situation and their family.

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Taher Reem

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(Figure 3) Proposed plan layout, Taher Reem.