

## Architectural Framework

### For The Design of Psychologically Supportive Patient Rooms

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#### ABSTRACT

Nowadays, the design of hospitals has encountered a big shift towards what is called psychologically supportive designs or healing environments that can affect health and wellbeing.

The environment is an important determinant of how people feel. There are evidences of the link between the environment, patient stress and health outcomes. Getting well is not limited to physical cure but it has also spiritual, emotional and environmental dimensions that must not be ignored. In this context the architect has a paramount role in the process of healing for patients.

This paper is an endeavor to point out the requirement of implementing rational concepts in hospitals design. The narrow functionalist view in hospitals design must change. Hence, enhancements are needed in architectural designs to act as a narrative made up of patients psychology and behavioral processes.

This research paper encompasses a new approach in the design of patient rooms' interior that consider all influencing factors satisfying healing environment simultaneously. Proposed interior designs and treatments for patient rooms are herein introduced from an architectural point of view to leave echoes of positive feelings on patients and thus evoke healing.

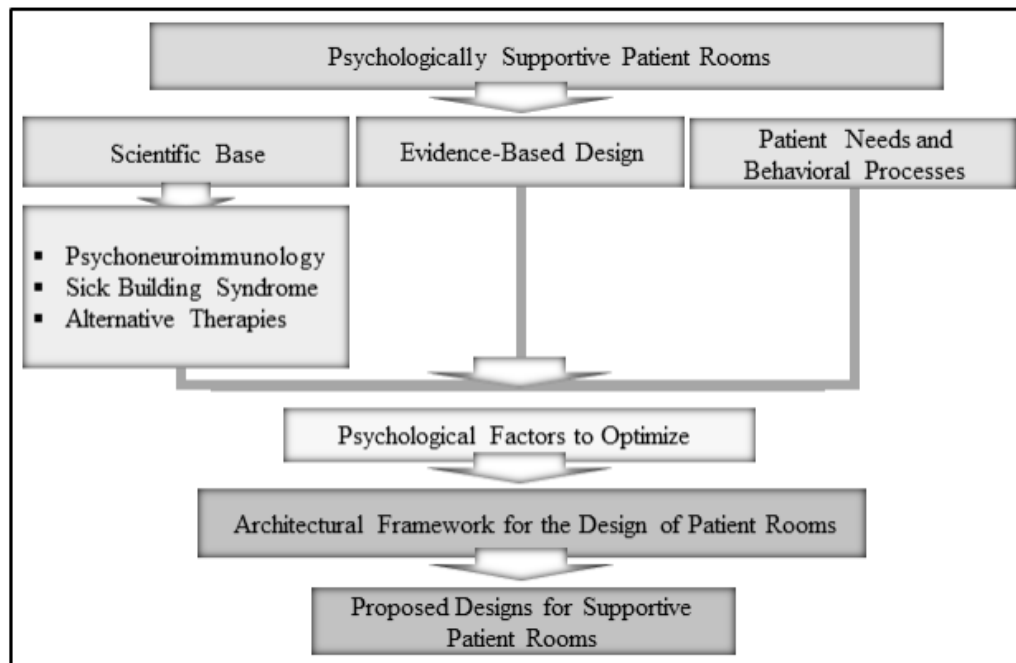
**KEYWORDS:** Supportive architectural design, Healing hospitals, Patient room design, Psychoneuroimmunology, Evidence-based design, Sick buildings, Alternative medicine.

#### OBJECTIVE

The aim of this research paper can be broken down into two objectives. The first is to carry out a review of the scientific facts that emphasis the idea of supportive design. Supportive design is a psychological, qualitative aspect that needs a rigid base to depend upon. The second is to introduce a holistic framework for the design of patient rooms as patients expend most of their curing and healing time in them. The framework represents an architectural interpretation for all collected factors affecting patient's psychology and hence the healing process. It deals with architectural treatments in patient rooms either externally in the form of walls, openings, floor or ceiling and internally as the ambient environment, the form of furniture and other interior design elements.

#### RESEARCH METHODOLOGY

The methodology applied in this research paper begins with a background of healing and supportive environments. An introduction to the philosophy of psychoneuroimmunology, sick building syndrome, and alternative therapies are displayed to give the concept of supportive design its scientific base. Ultimately, a holistic architectural framework for the design of patient rooms based on evidence based design and patient needs will be introduced with some rationally proposed designs. The full scheme of research methodology is shown diagrammatically in figure (1).



**Figure 1:** Methodology applied in the research

## 1. INTRODUCTION

The power of architecture in the healing process is nowadays overlooked. Unlike curing, healing is concerned with aspects of health that are psychological. There is a big connection between the mind and body. The mind affects the autonomic, endocrine and immune systems [1] which in turn provide the machinery of healing [2].

An example of mind-body connection is how the body responds to stress. It is the central point of psychologically supportive design which is associated with the surrounding environment. Most patients experience considerable stress in hospitals. It is considered an unseen factor making the difference between recovery and relapse [3]. It is the body's obstacle in healing.

The impact of the physical environment is of a greater importance in hospitals than in any other space as the less competent the person is the greater the impact of environmental factors on him [4]. Thus, patients under circumstances of illness and pain will be easily affected by environmental stimuli.

Recently stress reducing factors associated with the architecture and interior designs of hospitals are taken into consideration during hospital design. Factors like natural light, pleasant views, artwork and even color can have the potential to transform a stressful environment to a therapeutic one [5]. Ulrich [6] introduced the theory of supportive design which emphasized the importance of these factors and others in creating indoor environment that encourage healing. New concepts of interaction between the environment and healing had been thought for and had been considered in design.

Promoting healing can be achieved by either reducing negative environmental factors or by adding positive factors. It is also necessary to design the physical environment based on the behavioral characteristics and needs of people to achieve healing [7].

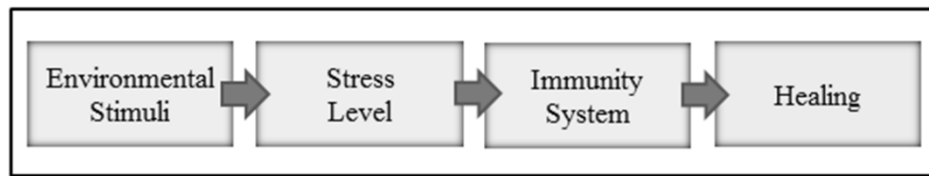
For decades, the design of hospitals concentrated on creating spaces that are functional and that support medical and technological needs. Nowadays this approach has been shifted towards psychologically supportive hospitals that act, more over their traditional function, as a catalyst for the patients healing process.

More than 2000 years ago the ancient Roman physician Galen recognized the healing aspect that can be provided by the environment [8].

In the 19<sup>th</sup> century Florence Nightingale [8] addressed the provision of factors like color, natural light and elimination of excessive noise as they play a central role in patient's healing . A pavilion type hospital with penetration of sunlight, great circulation of fresh air and appropriate temperature was proposed [9].

## 2. SCIENTIFIC BASE FOR THE DESIGN OF SUPPORTIVE PATIENT ROOMS

The design of supportive patient rooms contains many qualitative factors that is said to affect patient's recovery. In this research paper the scientific base for these assumed factors are herein discussed which verifies these



**Figure 2:** Effect of surrounding environmental stimuli on healing

assumptions. A brief discussion of psychoneuroimmunology, sick building syndrome, alternative therapies and evidence based design; all indicate the effect of the surrounding environment on patient's psychology and identify the role the architect can help in patient's healing and recovery.

### 2.1. Psychoneuroimmunology

Psychoneuroimmunology refers to the study of the relationship between the mind and the immune system [10]. It addresses the importance of stimulating the immune system by positive stimuli coming from the environment [11].

In hospitals, patients experience considerable stress from illness and from physical-social environment. Stress can have suppressive effects on immune system [12].

Our brain and our nervous, endocrine and immune systems are interacting as in figure (2). What we are seeing around us can change our biochemistry. Hormones are released in response to stress which can control the patient's immune system. A fully functioning immune system is integral to timely and effective healing [13]. High stress may cause slow healing process [14].

Architecture, interior design and landscape in hospitals would eventually impose what we see and think about and can affect our mood and behavior. Designs can be stressful or restful for patients and thus affects health outcomes.

### 2.2. Sick Building Syndrome (SBS)

Sick building syndrome is an indoor air quality related disease, which stimulates the nerve system, skin and respiratory system and can cause many symptoms [15].

It affects negatively physical health which is related to psychological well-being because the human body is one interactive biological system [16].

The cause of SBS is usually related to several factors, physical and chemical. Poor architectural design may be a contribution to physical factors including inadequate ventilation, poor indoor air quality, temperature and humidity, noise and poor or inadequate lighting [17].

Because of the nature of hospitals, their architectural design presents an extraordinary challenge in SBS prevention.

### 2.3. Alternative Therapies

Alternative therapies, other than medical ones, may heal and comfort, if not cure. They include many types; one of them is mind-body therapies that can be incorporated in the ambient environment of any hospital. They include music therapy, light therapy, art therapy, naturopathic therapy, aromatherapy, distraction therapy and color therapy. Follows are abbreviated view of these therapies.

#### 2.3.1. Music therapy

Music therapy or psychoacoustic therapy uses music to heal. Suitable music causes the brain to release dopamine, the feel-good hormone which prevents depression. The sounds of rain, birds and waves for example are integrated with lower anxiety [18].

#### 2.3.2. Light therapy

Providing natural lighting is good for healing. It increases serotonin levels which is a neurotransmitter linked to positive feelings and happiness [18]

Chronobiology is the science of biological rhythms as daily light cycles, seasonal changes and their effect on people's psychology [19]. Working with the natural cycles of light and dark positively impact sleep cycles [20] as poor sleep leads to increased stress. Architects can surely control luminance intensity naturally and artificially by rational indoor design of patient's rooms.

### **2.3.3. Art therapy**

The arts validate emotions and contribute to the healing process [20]. Art works, as works containing natural images, can have positive effects. They can decrease anxiety in patients and increase tolerance to pain [21]. Architects role is, therefore, to select proper indoor art work.

### **2.3.4. Naturopathic therapy**

One of the main principles of naturopathic therapy is the healing power of nature. Architecture designs distance people from nature in artificial buildings. Bringing nature indoors is known in architecture as biophilia. Ulrich compared the positive effects of viewing natural scenery on patients' recovery from surgery to patients exposed to a view of a brick wall [22]. There are extensive evidences showing that patients who have access to nature heal more rapidly [18]. Architecture designs bringing nature indoor are a must.

### **2.3.5. Aromatherapy**

Aromatherapy promotes physical and psychological health by making use of selected outdoor plants spreading vapor of essential oils found in the flowers and leaves of various natural plants [23]. It is used to relieve pain, improve mood, promote relaxation and alleviates stress [24]. Thus, it increases sleep quality and promote healing.

### **2.3.6. Distraction therapy**

Engrossing environmental distractions cause a great pain reduction [25]. Visual and acoustical stimulation can serve as a diversion to make painful procedures more bearable [26].

### **2.3.7. Color therapy**

Color is fundamental factor in the design of hospitals as it affects human psychologically and physiologically [27]. Many researches talked about the effect of color on recovery [28].

When color is transmitted through the eye, the brain releases hypothalamus hormone which affects mood [29]. Ulrich et al [30] recommended the consideration of color in the design of patient rooms. Special colors can arouse people, whereas others can give people a sense of calmness and thus reducing stress which affects patients' sleep [31].

Hospitals now tend to borrow colors from nature. Green and blue for example produce relaxing and calming effects [18]. The selection of appropriate colors and their mix out is one of architect's jobs.

### **2.3.8. Geometry therapy**

In a recent study by the author [32], it has been shown that the geometrical features of hospitals architectural design and even rooms design would have a positive effect on patients healing. The use of pyramids shapes in the design is expected to help largely in healing.

## **3. EVIDENCE- BASED DESIGN (EBD)**

A full analysis of hospitals design comprises a tremendous number of items to be under investigation and needs further research work. In the present work, investigation on optimum design of hospitals will be confined to the design of patients' rooms. It is important to use evidence based design as the theoretical concept to design psychologically supportive patient rooms.

Evidence based design refers to guiding design decisions by scientific evidence in order to promote health and wellbeing [33]. EBD can be briefly defined as: "basing decisions about the built environment on credible research to achieve the best possible outcomes" [34].

According to evidence based design the integration of all senses helps to complete the highest potential of an environment to heal [35, 36]. The main principles that can positively impact patient outcomes are views of nature, fresh air with ventilation, increased light, the use of colors and applying proper geometry.

#### 4. PATIENT'S NEEDS AND BEHAVIORAL PROCESSES

A supportive patient room is one that evokes feelings of calm and relaxation. There is a vast array of components that make up a patient room. In order to design a supportive room, patients' needs and behavioral processes have to be fully studied as illustrated in figure (3). If hospitals design is changed in accordance with patients' ergonomics and psychological needs, it will improve healing.

##### 4.1. Privacy, personal safety and security

People feel discomfort, anger and anxiety when their privacy is exposed beyond their desires. A balance between privacy and social interaction is required. Auditory and visual isolation are main factors of privacy. Meanwhile, patients also need a sense of personal safety and security; knowing who's entering the room, reducing falls and reducing infections.

##### 4.2. Personal space and accessibility

Patients are in rooms with associated equipment. Adequate space around the bed should be available for physicians, nurses and portable machines to be maneuvered [37]. The design of patient rooms should be easily reachable by nursing and medical staff. Also the room its self must be designed to have easy means by which the patient can access to his personal need whenever required.

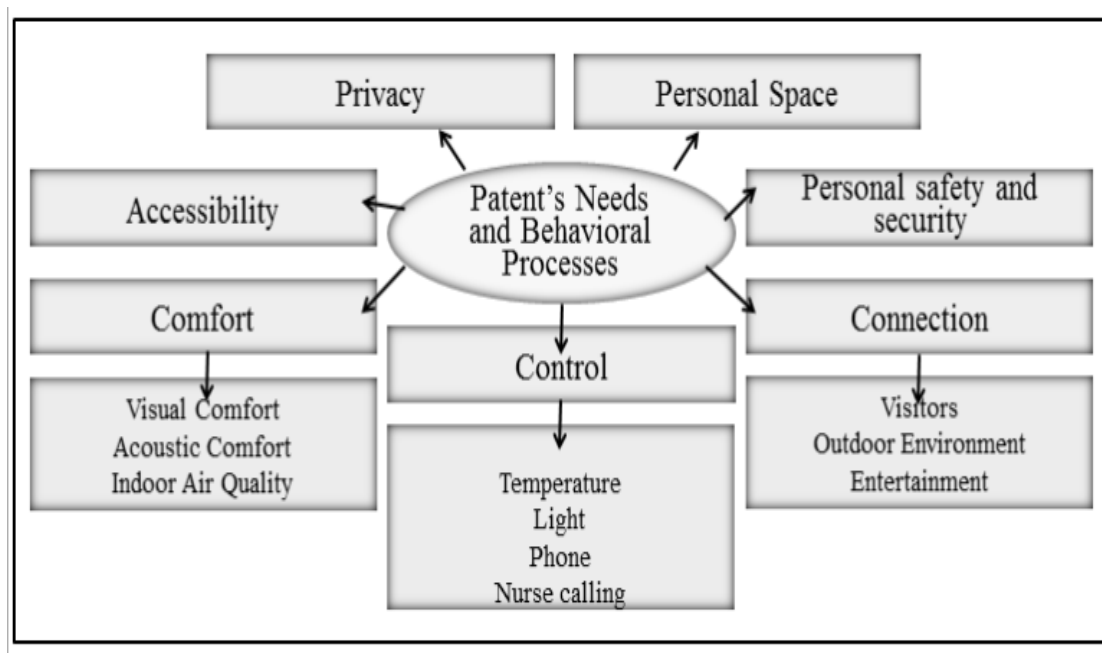


Figure 3: Patient's needs and behavioral processes

##### 4.3. Comfort

Three items are essential to produce a calm and comfortable place for patients to aid them to sleep and relax. These items include visual comfort, acoustical comfort and indoor air quality.

Visual comfort considers daylight factors, luminance intensity and their effect on people. Choi et al. [38] showed that there is a significant relationship between indoor daylight environments and patients' length of stay.

Moreover, materials with quality as glare can cause visual impairment and they must be used carefully in patient rooms.

As regards acoustic comfort, high noise levels have serious impact on patients. The negative effects of noise are associated with patients' recovery [39], increased stress [40] and its effect on quality and quantity of sleep [41]. The control of air quality inside rooms is of paramount importance. The air must be fresh to ensure sufficient clean oxygen, to prevent possible infection through respiration, and to prevent any polluting particles, including dust and dirt particles, from polluting sterilized equipment or medications

#### 4.4. Control

Personal control means the ability to adjust environmental conditions to prevent feelings of powerlessness that can ratchet stress levels. Control devices should be located for ease of patient construability [18]. Proximity to nursing, excluding sunlight, controlling lighting, adjusting temperature, minimizing noise and accessing phones and personal computing devices are all important.

#### 4.5. Connection

The traditional approach in which friends and family had to abide by strict visiting hours is nowadays changing. A strong sense of connection to visitors is needed. Family support is linked to higher patient satisfaction scores which urges us as architects to create family zones in patient rooms encourages visitors to be part of the healing process.

### 5. FRAMEWORK FOR THE DESIGN OF PATIENT ROOMS

In order to give a framework for the design of patient rooms, we have to know a lot of information about these rooms as in figure (4). This information must include the types of patient rooms, people using the rooms as patients, doctors, nurses, family and friends , and furniture and medical equipments.

The framework must include the components of the architecture space from walls, openings, floor and ceiling to produce a calm, relaxing and safe space together with the surrounding ambient conditions. The main aim of the framework is to optimize many issues related to patients' needs and to correctly design the ambient environment in order to reduce stress in patient rooms.

The proposed framework in the form of architectural design tactics is illustrated in table 1 depending holistically on all previously discussed parameters

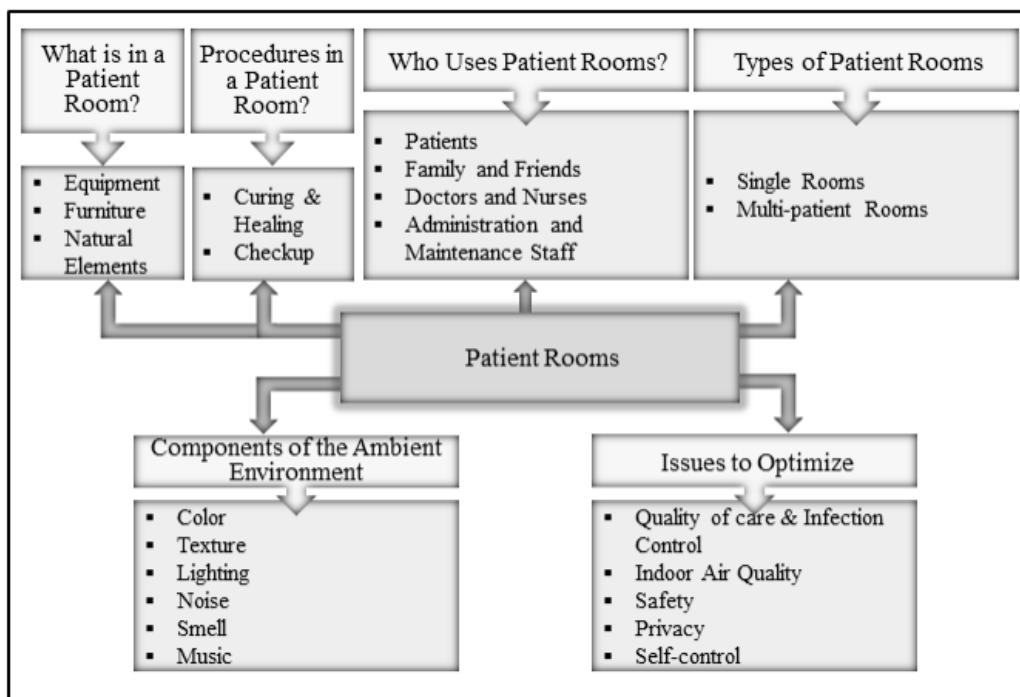


Figure 4: Framework for the design of patient rooms

**Table 1:** Architecture Design Tactics

PARAMETER	DESIGN TACTICS
COLOR	<ul style="list-style-type: none"> <li>▪ Selection of colors should emphasis the palette of the natural environment with soft tones</li> </ul>
NATURE	<ul style="list-style-type: none"> <li>▪ Direct access to natural views through windows or terraces.</li> <li>▪ Using natural elements as water, trees, bushes ..etc..</li> <li>▪ Using natural materials as stone and wood.</li> <li>▪ Natural simulation using naturalistic artwork on walls and ceiling.</li> </ul>
NATURAL LIGHT	<ul style="list-style-type: none"> <li>▪ Use suitable windows to admit natural lighting.</li> <li>▪ Work within natural cycles of light and dark.</li> <li>▪ Use skylights and light wells where required.</li> <li>▪ Provide shading devices to control natural lighting and glare.</li> </ul>
POSITIVE ATTRACTIONS	<ul style="list-style-type: none"> <li>▪ Provide users with points of focus.</li> <li>▪ Use artwork, aquariums and waterfalls to evoke feelings of calm.</li> </ul>
PRIVACY	<ul style="list-style-type: none"> <li>▪ Single bed accommodation is preferred.</li> <li>▪ Patient private zone should be provided.</li> <li>▪ In wards visual barriers can be used to ensure privacy.</li> </ul>
PERSONAL SPACE	<ul style="list-style-type: none"> <li>▪ Sufficient space around the bed to accommodate most activities at the bedside, including the use of equipment and the maneuvering of wheel chair.</li> </ul>
SOCIAL CONNECTION	<ul style="list-style-type: none"> <li>▪ Easy access between patients and visitors with available space for hosting them.</li> <li>▪ Multiple seating arrangements from single chairs to clusters of seating.</li> <li>▪ Provide overnight accommodation for patients.</li> </ul>
ACCESS-ABILITY	<ul style="list-style-type: none"> <li>▪ Wheel chairs should be integrated in seating arrangements.</li> <li>▪ Accessible entry doors.</li> <li>▪ Enough turning space for wheelchair.</li> <li>▪ For portable patient lift or stretcher enough additional space is needed.</li> <li>▪ Accessible route to bathroom must be provided.</li> </ul>
PERSONAL SAFETY AND SECURITY	<ul style="list-style-type: none"> <li>▪ Handrails to facilitate moving and prevent falling.</li> <li>▪ Using non slipping floors.</li> <li>▪ Preventing infection.</li> <li>▪ Providing a cone of vision where patient can see entering people for security reasons.</li> </ul>
VISUAL COMFORT	<ul style="list-style-type: none"> <li>▪ Provide blinds to adjust natural light intensity.</li> <li>▪ Control glare.</li> <li>▪ Provide general lighting, examination and treatment lighting, night light and bathroom lighting.</li> </ul>
ACOUSTICAL COMFORT	<ul style="list-style-type: none"> <li>▪ Working with room enclosures, finishes and systems to provide appropriate acoustics.</li> <li>▪ Use acoustical ceiling tiles, acoustical wall panels, reflecting panels and ceiling clouds.</li> </ul>
INDOOR AIR QUALITY	<ul style="list-style-type: none"> <li>▪ The orientation of windows and doors is important to ensure natural lighting and natural ventilation.</li> </ul>
PERSONAL CONTROL	<ul style="list-style-type: none"> <li>▪ Localize lighting control so that patient can adjust the desired Light.</li> <li>▪ Install adjustable internal window shading devices to control light and glare.</li> <li>▪ Localize heating and cooling temperature controls to adjust Temperature.</li> </ul>

## 6. PROPOSED DESIGNS OF PATIENT ROOMS

From previous overview of patients healing factors and the main functional medical and clinical requirements, it is evident that the role of architect, in patient room design, is substantial. The room design has to be dealt with from many directions. By way of example, three plans of patient rooms complying with the previously discussed parameters are designed and put forward as shown in figure (5). Despite they all attain the main concepts yet different designs are introduced showing that there is a freedom and flexibility for the architecture designer to produce creative designs and at the same time achieving healing spaces

In the three plans the four main zones are considered; the patient, family, clinic and bath zones. The patient is able to view any person entering the room and the visitors waiting outside when desired as the doors are glass and have dimmers controlled by switches on the headwall. The patients have smart T.V. for entertainment and connection with internet to follow up their daily activities and they can communicate easily with their family. At the same time, the visitors outside can watch the patient inside according to his desire. A view of colorful plants is within the patient's vision. The rooms are oriented so that the prevailing wind carries out the scent of the plants to the room taking in mind not to put irritating plants. There is flexibility in the room as the sofas can open to form comfortable sleeping areas for accommodation.

The proposed plans give all the requirements given in table 1. The plans act as a living system changing the static concept of a patient room. They provide a good biophilic design which interacts and affects the emotions and mood of patient. Interior shots for one these plans are introduced in table 2 to show the ambient factors coupled with the architectural factors to make the patient room a satisfactory healing space.

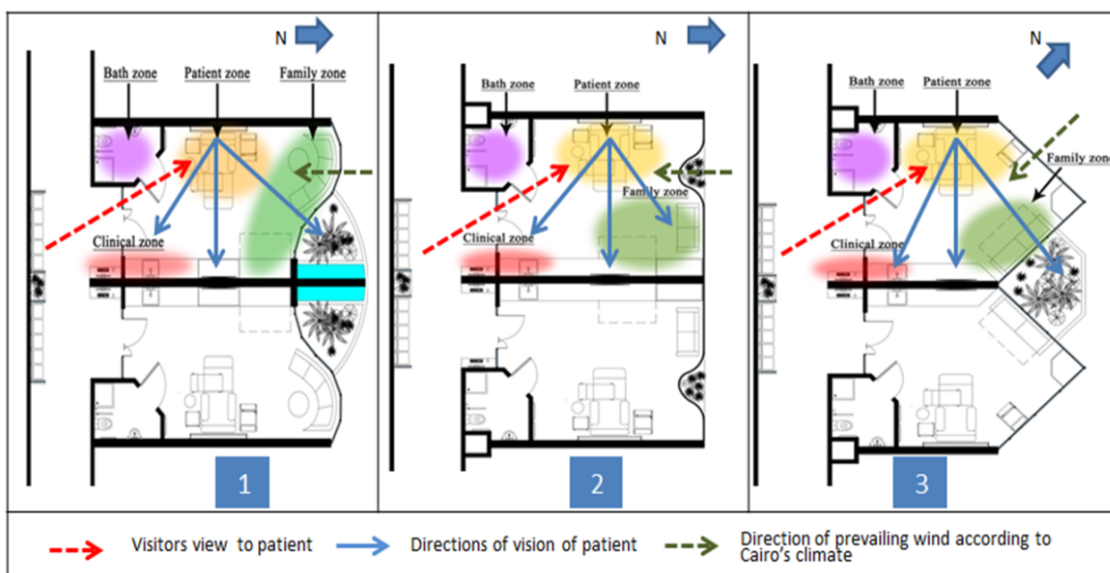
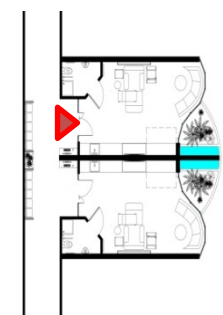

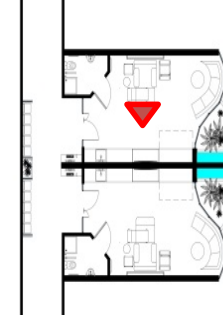

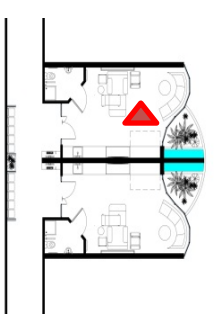
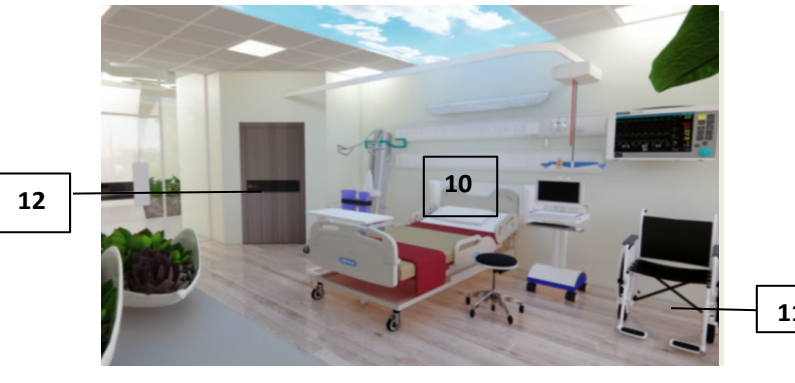
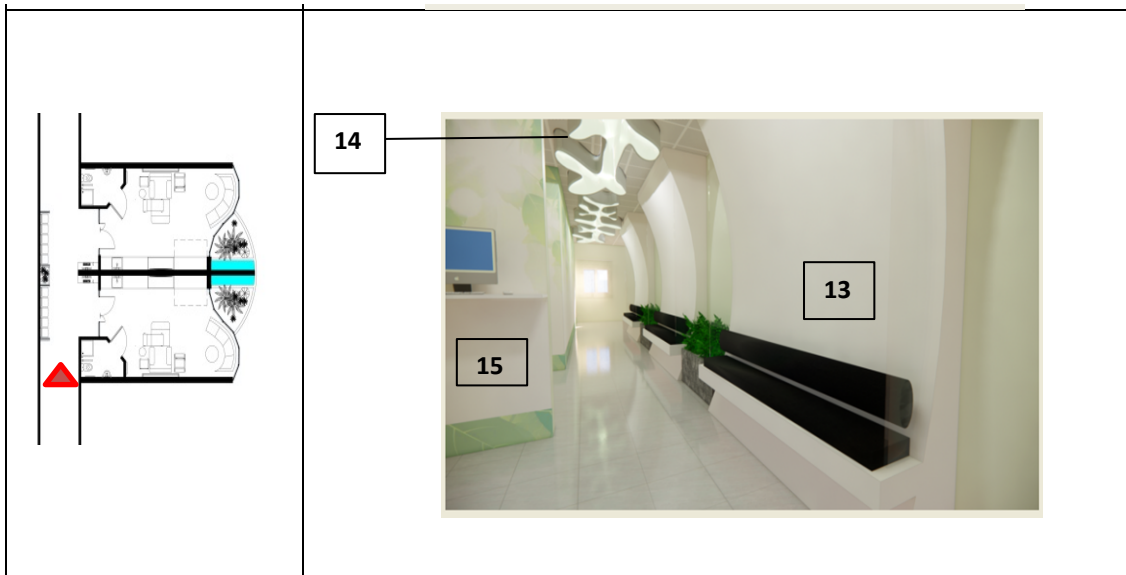


Figure 5: Three different patient room plans



**Table 2:** Descriptive Shots of the patient room from different directions



1. Window	There is a large window facing the north. It can affect healing through the natural lighting and ventilation. It provides, the colors one sees, the sound one hears and the odors one smells through the presence of different natural colorful scented plants. Windows can have any geometrical shape to couple with façade design and allow for best orientation as regards air and sun.
2. Nature simulation	Ceilings can be helpful in patient’s relaxation. By way of example, the ceiling is painted with a picture of clouds as a simulation for clouds from nature; this can cause relaxation for patients.
3. Patient ceiling lift	There is a lift hanged in the ceiling in order to help patient to move and avoid falling. It transfers a patient in an up and down motion using a motor but the caregiver must manually move the person along the track.
4. Aquarium	An aquarium in front of the patient acts as a distraction which can lessen pain.
5. Acoustical tiles	It is important in the room to control noise as it affects sleep and stress. There is a use of acoustical tiles in the ceiling and walls.
6. Water fall	An outside small waterfall creates a sound of water for relaxation.
7. Smart T.V.	A smart T.V. for entertainment and connection to internet
8. Family zone	The family zone is beside the patient consisting of adequate area for sitting for social connection.
9. Foldable bed	Acloset and drawers with a foldable bed for sleeping
10. Headwall	The headwall consists of all the switches the patient need to have control on lighting, viewing outside visitors through dimmers in glass, calling nurses or any other needs.
11. Wheel chair	A wheelchair is beside the patient with adequate space for maneuvering.

12. Bathroom	A bathroom is available with adequate furnishing suitable to patient.
13. visitors area	Extra seating for visitors is available outside from which visitors can see the patient through glassed door.
14. Indirect lighting	A false ceiling with indirect lighting is suitable to hospitals environment.
15. Doctors area	Doctors can check the patient status outside before entering the room and there is a nursing unit beside the door for hand washing and needed equipment.

## 7. CONCLUSION

This paper emphasizes that the rational use of the surrounding physical environment is a powerful way to positively engage all senses of patients as an antecedent to healing. There are many aspects of space that have a measurable impact on healing. It is important to adopt a holistic approach during design of any hospital to produce the desired psychologically supportive design. Architects should seek designs with environments that are more comfortable for patients. This is linked with faster patient recovery and improved emotional wellness. Special attention should be given to patients' room design as it represents the patients' world to live in and react with.

## 8. RECOMMENDATIONS

When talking about human health, an involvement of different fields related to medicine, psychology, architecture and environmental engineering are needed in hospital design to participate in the healing process. The recommendations in this context are, thus, two folds. First, the architects should design hospitals bringing nature indoors, i.e. applying the concepts of biophilia. Second, further work and more research should be carried on the psychological effect of the surrounding environment on patients. There must be a revolution in architecture towards what we can call neuro-architecture and there must be a connection between neuro-scientists and architects during all the phases of design.

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