

## Going Green in Healthcare

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Received: February 19, 2019

Accepted: March 23, 2019

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**ABSTRACT:** Pollution is one of the most significant issues which is affecting the environment. Nowadays, Green Hospital concept has gained popularity for reducing the negative impact on the environment. The review focuses on the rating system LEED, which measures the sustainability of different buildings including the hospitals, illustrated by Kohinoor hospital, Kurla west in Mumbai. The review captures the design and the benefits of the green hospital concept which includes well-enriched rooms, comfortable rooms, beautiful garden, natural ventilation, alternative energy, water harvesting, green roofs and fresh air. The concept of Green hospital stresses upon managing Bio medical waste properly in order to escape health and ecological hazards. Waste is generated in huge amounts and green hospital concept focuses on categorization, collection, storage, and safe disposal of the waste. This paper discusses about the challenges in implementing the green hospital concept and encourages this approach so as to be inclined towards greener planet.

**Key Words:** Green Hospital, LEED, Biomedical Waste Management, Environmental Pollution

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### 1. Introduction

Pollution is amongst the most significant issues affecting our environment. Nurses, physicians, hospitals and health systems are also becoming the center of attraction for the environmental problems and its solutions. Hospitals around the world change their management process into better services and viable functioning, ensuring to minimize the negative effect on the surroundings. Green Hospital Concept is one such practice which is gaining popularity day by day.

United States Environmental Protection Agency defines green building as, "the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high performance building". The United States Green Building Council (USGBC) developed Leadership in Energy and Environment Design or LEED is most widely used Green building rating system in the world which helps to measure the sustainability of different buildings including hospitals. LEED provides a framework to create healthy, highly efficient and cost-saving green buildings. LEED certification is a globally recognized symbol of sustainability achievement. LEED ratings are classified into four categories: LEED-certified, Silver, Gold and Platinum; Platinum being the highest rating. Buildings are rated in five key areas in order to achieve LEED certification, the key areas being: sustainable site development, water savings, energy efficiency, material selection and indoor environment quality.

About 28 hospitals in the United States have Gold and Platinum LEED certifications. Kohinoor Hospital in Mumbai – a 150-bedded multispecialty hospital – became the first hospital in Asia and second in the world to achieve LEED platinum certification under Indian Green Building Council.

Due to the innumerable impact on the environment, only solution is to design and construct a green building. To encourage the green hospital concept, leadership is imperative at all levels which makes clear the prime targets of an organization and help in promoting environmental health, security and sustainability. It can be done through priming, target setting, liability which can be persuaded in a health system.

Basically there is no specific model for green hospital but there are some dimensions for the achievement of the goals. Establishing a green hospital includes acquiring eco-friendly products and resources.

#### 1.1 DESIGN OF GREEN HOSPITAL

Designing a sustainable architecture is a complex venture that forces function to follow both design and quality. Designers of a healthcare facility are required to look at every facet of human life.

Pleasant behavior from staffs, architecture design, well-enriched rooms, comfortable rooms, beautiful garden, natural ventilation, alternative energy, water harvesting and green roofs and fresh air are the key features of Green Hospital concept. Patients and staff are susceptible to infection entering the hospital through wide range of infected patients. Green practice will ensure the property of revolting or resisting such pathogens. Construction materials emit hazardous compounds and harbor infectious mold like fungi and bacteria. Materials like manufactured wood, adhesives, floor coverings emit (VOCs) volatile organic compounds and also PVC (Polyvinyl chloride or vinyl) products in wall and floor coverings adds to the emission of hazardous additives. Patients admitted in hospital due to illness and patients with depressed immune system will have significant reactions to such facilities. Usage of floorings that do not emit/absorb/release indoor pollutants such as VOC (volatile organic compound) and dust. Good indoor air quality can be achieved by planting plants of indoor species that are free from allergic components which produces oxygen and also by incorporating courtyard spaces. To attain Green Hospital target, sustainable healthcare waste management plays an important role. It includes protecting the resources and the reduction of waste and energy which includes controlling of the disposal of harming factors and recycling or reprocessing the reusable items. Green hospital concept incorporate effective siting of hospital near public transportation, by substituting fuel vehicles to CNG or electric ones, motivating hospital staffs and patients for carpools and use public transportation. Natural lighting (sunlight) in the healthcare facilities is correlated with considerable reductions in medical costs and also brighter rooms in the hospitals contribute to stress reduction.

## 2. LITERATURE REVIEW

Health Centre is an essential and symbolic framework which is urgently required for promoting healthy lifestyle in people. Nowadays, hospitals takes environment into consideration as it gives contribution to the patients and whole society members. The proper management of non-medical waste in the health care sector is essential to promote healthy lifestyle. The management of non-medical waste can be done in the form of waste container as collecting and carrying the waste have direct impact on the patients' comfort and satisfaction. The barometer of patients' comfort are fresh air, temperature, and humidity in the health care sector. Planting trees is an effort to reduce bad smell which is caused by waste and garbage which can further increase the patients' satisfaction. It can be concluded that the health care waste management influences the patients' satisfaction. Nonetheless, the patients' satisfaction can be heightened if only their comfort level is raised up. (Suwasono, Suman, & Yanuwadi, 2013)

Green hospital concept prioritizes Patient's satisfaction and the authenticity of medical benefits. Sustainable or green hospital concept includes application of eco-cultural approach, green gate access concept for aged and disable people, low sustenance concept, minimizing the usage of energy resources, alternative energy usage, minimizing the negative environmental effect, and introducing eco-friendly parking lot area. (Setyowati, Rochma Harani, & Nurul Falah, 2013)

Medical health staff plays an important role in achieving sustainable or green hospital concept. The management of hospital waste includes reuse, recycling and disposal of the waste in an effective manner. Green hospital points to a hospital that see environment as part of their quality service. The Green hospital concepts includes characteristics such as strategic location, economical usage of water, the usage of fine materials. It has orientation for green commodities, non-toxic environment, green cleaning, and introduction of soothing gardens and reduction of waste. (Azmal, Kalhor, Dehcheshmeh, Goharinezhad, Heidari, & Farzianpour, 2014)

Patients and medical professionals travel from one place to another for appointments, pick up prescriptions and to get reports of tests; this way innumerable amount of fossil fuel is consumed. Transport sector is a major cause for greenhouse gas emissions and thus has a major negative impact on health. Alternative methods can be used such as usage of CNG or electric vehicles; by siting the health sector near public transportation infrastructure; By motivating staff to opt carpool services. Telemedicine is an effective way of reducing air pollution to a greater extent, by minimizing travel and transportation. (Dhillon & Kaur, 2015)

## 3. Bio - Medical Waste and Green Hospital Concept

Everyday huge amount of Bio Medical Waste is generated by the healthcare sector, management of which is an environmental concern. Green hospital concept includes proper waste categorization and lessening so that disposal expenses and environmental risks incurred are curtailed and prevented. Health care industries tend to dispose wastes in improper, careless and extensive manner. Inadequacy of segregation practices leads to mixing of infectious waste with general waste making it a major potential for infection.

Thus, inadequate bio medical waste management will result in environmental pollution; unfavorable smell; growth of vectors like rodents, flies, insects which may result in diseases like typhoid, cholera, hepatitis,

AIDS caused by contaminated infectious needles.

The bio medical waste may attract flies, insects, rodents, cats, dogs which are responsible for spreading communicable diseases like plague, rabies.

The improper management of bio-medical waste causes air and water pollution.

- Air Pollution

Air pollution can be caused in both indoors and outdoors environment.

- In-door air pollution: Bacteria present in the waste can penetrate and persists in the air for a long period of time in the form of spores. Poor ventilation services may result in sick building syndrome (SBS)
- Out-door air pollution: Outdoor air pollution can be caused by pollutants if discarded in open areas, bacteria will pollute the surrounding. Open burning of bio medical waste may lead to inhalation by people surrounding leading to respiratory diseases.

- Water Pollution

When the liquid waste is dumped into sewers and further in the water bodies, it may result in water pollution. Chemicals are extensively used in the health sector which is one of the reason for creating negative impact on the environment. Healthcare facilities can become eco - friendly by locating hospitals near public transportation routes, planting trees on the site, and by incorporating design components like day lighting.

### 3.1 Bio - Medical Waste Disposal

Medical waste management is an elaborated process and achievement in such sectors is very challenging. Green Hospital concept includes protecting the resources and the reduction of waste and energy which includes controlling of the disposal of harmful factors and recycling or reprocessing the reusable items. With appropriate waste sorting, it enables a large number of nonmedical waste to be recycled.

Health care industries tend to dispose wastes in improper, careless and extensive manner. Inadequacy of segregation practices leads to mixing of infectious waste with general waste making it a major potential for infection.

Regulating the proper usage of chemicals in healthcare sector can not only protect patients and staff, but can also implement the safety management of chemicals actively. Safer substitution of hazardous chemicals can be done which can help in lowering down the atmospheric effects of hospital.

Various methods which can control the drug wastes:

- Reducing the improper disposal of the medicaments;
- Reducing prescription of excessive drugs;
- Banning free sale of drugs.

Several waste management technologies are adopted which are economical, dependable, and under the authentic rules and regulations. Following strategies can be adopted for Waste minimization:

- Recycled glass and metals are used that can be easily sterilized and reused;
- Establish potent strategies in collaboration with the approved manufacturer of plastics for recycling;
- Generation of harmful chemical wastes can be prevented by Steam sterilization method, which is used for chemical disinfection.

Safe and proper disposal of waste includes four steps: Segregation, Collection and storage, Containment, Transportation and safe disposal.

Most of the hospital wastes are common and is not hazardous which can cautiously be disposed in municipal landfills but the rest of the infectious and hazardous waste can be major potential threat for health problems and infection.

Therefore the waste generated from the hospital have to be sorted out first. Waste segregation is carried out differently in different hospitals. Most of the hospitals apply three-colored container system for separating the waste.

- Black colored containers used for general waste
- Red or Yellow waste for infectious waste
- Safety box for sharp objects like needles, other disposable instruments.

However, Sharps are major concern for the healthcare workers as it may result in sharp needles injuries during the disposal which should be completely prevented. Distinct varieties of waste should be treated differently. Incineration is used when the waste is burned under controlled conditions. Autoclave uses principles of heat and pressure and is used for sterilizing surgical instruments. Non Incineration techniques involves safely disinfecting, burying and disposal of waste.

#### 4. BENEFITS OF IMPLEMENTING GREEN HOSPITAL CONCEPT

Green Building concept contribute to financial benefits that traditional buildings do not which includes energy and water savings, minimized waste, enhanced indoor environmental quality, higher employee's comfort and productivity and lower maintenance costs.

Research studies shows that stress release and healing is faster and complete when patients are exposed to natural settings than any other form of built environment.

Technology, is the main matter in setting of a healthcare institution. Noise has been identified with disturbed sleep. Headache, irritability and increased sensitivity to pain in patients may also lead to increased stress amongst staff. Therefore, noise is one of the source of stress in health care settings.

Reduced noise levels may result in:

- Better patient contentment;
- Sleep enhancement and;
- Lowered Blood Pressure.

Benefits of the day lighting in the green hospital will enhance the health status and well-being of the patient and thus will have a positive impact not only on the patients but also the workers. If the patients feel comfort with the hospital's condition and environment, quick recovery is seen in patient's health.

Green hospital concept may include welcoming atmosphere; a supportive environment; and an access to external areas. People coming to hospital are suffering from pain, discomfort, and anxiety. Boredom is a very typical complaint in the hospital which may lead to a loss of emotional support, social support, and behavioral control. The television is often the only thing that patient can have control on in almost every healthcare institution, they cannot control the thermal environment, lighting, or ventilation. Benefits of natural light and eco - friendly environment will contribute to lowering down the stress level.

##### 4.1 Kohinoor Hospital : A LEED Certified Platinum Hospital

Kohinoor hospital is a multi-speciality hospital in kurla west, Mumbai, India. It is Asia's first LEED Platinum Certified and NABH Accredited Hospital. For being counted in Platinum ranking, one must stretch around 52-69 points; and Kohinoor Hospital has acquired 54 credit points which place it on the slab of only LEED Certified platinum rated hospital in Mumbai, India.

At Kohinoor Hospital, recycled material is more than 40%. Scrap material was reused to build the foundation of the overhead tank. Frames, which helped to conserve trees, were constructed reusing the recovered wood. The construction of the hospital encloses a prominence on setting natural lights in all patient area, which promotes the reduced consumption of power. The built endorses the cool and aerated area formed by the large windows and open sky light that, too, enforce inward natural light.

The hospital has excelled at its creativity by producing more than 40% of water conservation through the execution of the water efficiency mechanism. This fruitful step fulfills the objective of water recycling and conservation. This system makes use of the unwanted water, flowing from different zones of the hospital, by preserving using disinfectants at the Sewage Treatment Plant. The water is then used again for flushing, cooling air conditioning towers, DG sets and for horticulture. In addition to regulate water flow, twofold flushes and urinal sensors are also used.

The installation of advanced internal and external electrical systems, which mechanically adjust the lighting levels required during the day and night time, has put it on the podium of prominence. The uninterrupted power supply system acts as a lifeguard by ensuring continued power supply as it effectively manages power outages and controls electricity blackout.

The hospital is well equipped with emergency systems such as public address system, fire hydrant system, fire alarm system along with smoke detectors, heat detectors and sprinklers. An emergency lighting is also set up for all exit signs and on escape routes. Going Green flags out integrated remedial approach which is strongly sustained by Kohinoor Hospital.

#### 5. Challenges faced while incorporating Green Hospital Concept

- The main problem for incorporating the green hospital concept is the awareness which is lacking in the medical fraternity.
- High cost perception
- Accelerated construction of healthcare framework will have a considerable load on the local and primitive building material supplies and their approach at far off their sustainable capacities.
- Most of the waste generated in hospital is hazardous waste having potential to damage both, its handlers and the environment and most of the healthcare industries in India don't have any system

for effective and secured disposal of the waste generated in the hospitals, which finds its way to the open bins on the roadside or is disposed into the water bodies.

- Transport sector is one of the reason for resulting in negative impact on health. When patients and medical professionals travel from one place to another for appointments and to collect tests results, it result in consumption of innumerous litre of fossil fuels.

## 6. Conclusion

The review concluded that green hospital concept can accelerate the curing process of the patients and can also minimize the negative impact on the environment. Green hospital concept uses eco-friendly resources and materials. Design and quality are the two main aspects which is to be kept in mind while designing green hospital concept. Green or sustainable hospitals utilizes resources like water, materials and area. With natural lighting, and improved quality of air will add to enhanced workers and better health status of the patients in the hospital. This article emphases on the various tools to achieve the concept of Green hospital.

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