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A Comparative Study of the Level of Compliance with the Standards of the Green Hospitals in Teaching Hospitals of Yazd City

Mohammad Kazem Rahimi ¹⁰, Negin Habibi ²⁰, Hasan Jafari ^{1*0}

¹ Health Management and Policy Research Center, Department of Health Care Management, School of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

² Student of Health Care Management, School of Public Health, Shahid Sadougi University of Medical Sciences, Yazd, Iran

*Corresponding Author: Hasan Jafari, Ph.D., Health Management and Policy Research Center, Department of Health Care Management, School of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran. Tel: + 98-3531492209, Email: Jafary_h@yahoo.com

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Abstract

Background: A green hospital is a hospital that improves people's health by continuously reducing environmental consequences and eliminating its harmful effects. Therefore, in recent years, the concept of "green hospital" has been created due to sustainable development with the aim of controlling costs and protecting the environment.

Objectives: The purpose of this study was to determine and compare the level of compliance with the standards of green hospitals in teaching hospitals in Yazd.

Methods: This descriptive-applied study was conducted in 2022. A standard checklist was used to collect data. This checklist included 11 areas and 96 questions. For data analysis, frequency and percentage were used in SPSS v26 software.

Results: The level of compliance with the standards of green hospital was 75.88%, the highest score was related to Shahid Dr. Rahnamon Hospital (80.55%) and the lowest score was related to Shohadai Mehrab Hospital (70.13%). The waste water management variable was obtained with 61.3% as a priority for improvement, and the highest score was obtained in the area of hazardous consumables (90.73%).

Conclusion: It seems that the teaching hospitals of Yazd had an average status in the field of environmental protection and controlling costs and pollution as well. Therefore, in order to comply with the standards of green hospital, a comprehensive planning is required regarding the 11 studied areas, so that in addition to focusing on their strengths and improving them, also covering the weaknesses and bringing them to an acceptable level is recommended.

Keywords: Green Hospital, Standard, Sustainable Development, Environment

1. Background

Unplanned and unsustainable development (especially rapid industrialization) has put a lot of pressure on all aspects of the environment (air, water, soil, health, etc.). The day will come when the customer prefers to buy products produced by an organization committed to the environment.¹

Today, environmental issues and concern for sustainability, encourage more effective and efficient use of energy, water and materials that are currently used, and prevent any waste.²

In Iran, in line with environmental protection according to the 50th principle of the constitution, "protecting the environment, in which today's generation and their descendants should have a social life, is considered a public duty. Therefore, economic and other activities that are associated with environmental pollution or irreparable destruction are prohibited"³. There are many laws and declarations globally; For example, in the article of the Stockholm Declaration, it is stated that "man has the fundamental rights to have freedom, equality and suitable living conditions in an environment that allows him to live with dignity and happiness. He officially protects and improves the environment for the present generations and is in charge of the future".⁴

Hospitals consume more energy and water and produce more waste than other industries, and in order to control costs and environmental pollution, they must prepare guidelines to conserve energy, water and to use more nature-friendly products. In this regard, a set of management actions are needed that allows the organization to identify, evaluate and control the impact of its activities on the environment and ultimately improve its environmental performance.⁵

Therefore, in recent years, the hospital industry affected

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by sustainable development created the concept of "green hospital".³ A green hospital is a hospital that improves people's health by continuously reducing environmental consequences and eliminating its harmful effects.⁶ Also, it sees the environment as a part of its service quality processes and by using effective approaches in each dimension such as management, water, energy, construction, waste, medicine and shopping, it seeks to avoid hazarding itself and others.⁷

One of the important features of using the "green productivity for hospitals" strategy is that it emphasizes economic efficiency along with environmental efficiency while paying serious attention to the category of health economics. It also uses tools and techniques of green productivity to minimize the environmental pollutants caused by the process of providing services. Therefore, green productivity methodology has been used in different hospitals around the world⁸ as well as green hospital standards that are making an organized and coordinated effort to introduce environmental protection programs within an organization.⁵

In a study titled Green Hospital Criteria, it was shown that green hospital criteria are a suitable model for establishing an applicable health system in accordance with the principles of the environment, and in order to save resources and energy, they lead to increasing competition, productivity and reducing costs.⁹

There are seven models for managing the green hospital, each of which has its own dimensions. There are a lot of overlaps among these models, which shows the great importance of some aspects of the green hospital. The existing models included Best Environmental Practices in Health Sector (BEPHS) (11 dimensions), Green Guide for Health Care (GGHC) (6 dimensions), United States Green Building Council in Leadership Environmental and Energy Designing (USGBC LEED) (7 dimensions), ISO14000 (11 dimensions), Pan American Health Organization (PAHO) (10 dimensions) and Global Green and Healthy Hospitals(GGHH).¹⁰ Therefore, with the development of systems, the implementation and evaluation of green hospital, various methods were presented, and the common point of all these methods was the three areas of optimal consumption of water, energy and less waste production.³

In this regard, the results of Ferenc et al.'s study showed that the plan of hospitals to become greener is one of the appropriate ways to reduce costs and improve the hospital environment for patients and employees.¹¹ Also, by applying green standards, the Children's Hospital of Pittsburgh, America, has benefited from the effects of green building design with a 19% reduction in deaths and a 50% reduction in electrical energy and other benefits of it.¹² According to a study titled "Green Hospital: A Necessity, Not an Option" (2020), it was observed that green hospital strategies reduce building operating costs

by 8.9% and also increase building value by 7.5%, and the relationship between improved indoor air quality and positive health effects on illnesses, including asthma, flu, and headaches, improved from 13.5% to 87%.¹³

2. Objectives

According to what has been said, hospitals around the world are trying to innovate in the field of patient care while maintaining high quality standards.¹⁴ As a result, due to the lack of sufficient documentation and studies related to the status of hospitals in Yazd city in terms of achieving the goals and standards of the green hospital, this study was conducted with the aim of determining and comparing the level of compliance with the standards of green hospitals in teaching hospitals of Yazd city in 2022 based on 11 related areas.

3. Methods

This descriptive and applied study was conducted crosssectional in teaching hospitals of Yazd city. The statistical population included all the teaching hospitals of Yazd city (Shahid Sadouqi Hospital, Shahid Dr. Rahnamon Hospital, Afshar Hospital and Shohadye Mehrab Hospital), which were investigated by census. To collect data, a checklist was used, including 11 fields and 96 items, which had been previously used by Teymurzadeh in 2019.³ The areas of this checklist were: environmental management systems (14 questions), kitchen, laboratory, laundry room (13 questions), waste management (10 questions), bathroom and toilet (2 questions), energy management (7 questions), hazardous materials (9 questions), water management (6 questions), wastewater management (14 questions), air pollutants (11 questions), external uses of water (3 questions), and environmentally friendly purchasing (7 questions) which make up a total of 96 questions. In order to complete the checklist, after entering the hospital, the researcher completed the dimensions of the checklist and collected data through observation. If for any reason the researcher could not obtain the desired information through observation, the information was obtained through questions from the quality improvement units, environmental health and occupational health departments.

After collecting the data, it was entered into SPSS26 software and frequency and percentage were used to analyze the data. For each question, it was possible to answer one of three options in the form of yes (3), no (1) and to some extent (2); If the average score of the studied hospital in each dimension is less than 50% of the total score of that dimension, the condition of the hospital is unacceptable, if it is between 50 and 75%, the condition of the hospital is average, and if it is above 75%, the condition of the hospital is considered acceptable.

4. Results

After collecting data and analyzing the results, it was found

Shahid Dr. Rahnamon				80.55							*	
Afshar hospital			74.65					*				
Shohadaye mehrab hospital				70.13					*			
Total				75.88							*	
Table 2. Status of Teaching Hospitals in Yazd based on Green Hospital Standards												
Hospital	Environmentally friendly purchase	External uses of water	Air pollutants	Wastewater management	Water management	Energy Management	Energy Management	Bathroom and toilet	Waste Management	Kitchen, Iaboratory, Iaundry room	Environmental management system	
Shahid Sadoughi	71.42	55.55	66.66	64.28	72.22	92.59	76.19	83.33	80.0	69.23	74.65	
Shahid Dr. Rahnamon	85.71	77.77	78.78	64.28	72.22	92.59	100.00	100.00	86.66	79.48	80.55	
Afshar	85.71	66.66	72.72	69.04	66.66	88.88	71.42	66.66	80.00	66.66	74.65	
Shohadaye mehrab	90.47	66.66	63.63	47.61	61.11	88.88	80.95	83.33	70.00	66.66	70.13	
Total	83.32	66.66	70.44	61.30	68.05	90.73	82.14	83.33	79.16	70.50	75.88	

Unacceptable

Table 1. The General Status of the Studied Hospitals Based on the Standards of the Green Hospital

Percent

74.65

that the level of compliance with the standards of Green Hospital is acceptable in only one hospital and average in the other three hospitals (Table 1).

Based on the above results, in the environmental management system standards, the status of most teaching hospitals (3 hospitals) was acceptable and only one hospital had an average status. In terms of kitchen, laboratory, and laundry standards, the condition of most hospitals (3 hospitals) was average, and only one hospital had an acceptable condition. In terms of waste management standards, the status of three hospitals were acceptable and only one hospital had an average status. In terms of bathroom and toilet standards, the condition of most teaching hospitals (3 hospitals) was acceptable and only one hospital had an average condition. In terms of energy management standards, the status of most hospitals was acceptable and only one hospital had an average status. In terms of the standards of hazardous consumables, all the teaching hospitals studied were in an acceptable condition. In terms of water management standards, all hospitals were placed in average status. In terms of wastewater management standards, the condition of most hospitals was average and one hospital had an unacceptable condition. In terms of air pollution standards, the condition of most hospitals was average and only one hospital had an acceptable condition. In the standard of external water use, the condition of most hospitals (3 hospitals) was average and only one hospital had an acceptable condition. In the environmentally friendly purchase, the condition of three hospitals were acceptable and only one hospital had an average condition.

5. Discussion

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Hospital name

Shahid sadoughi

In this study, the average score of the teaching hospitals of Yazd based on compliance with the standards of Green Hospitals was 75.88% (acceptable). In terms of Green Hospital standards, the score obtained for affiliated hospitals of North Khorasan University of Medical Sciences was 67.41%. (average condition)⁵. Also, in the study of Ebadi Azar et al. entitled "Evaluation of Green Hospital Dimensions in Teaching and Private Hospitals Covered by Tehran University of Medical Sciences", the studied hospitals obtained 59.5% (average status) of the total scores. In this regard, the "Leadership" dimension was ranked highest and "water management" was ranked lowest.¹⁵

Hospital status

Average

Acceptable

Among the reasons for the non-alignment of the results of these three studies, it can be pointed out that the current study was conducted in 2022 and in a more recent time period. Investigating the issue of Green Hospitals in Iran and establishing the standards of them are relatively new issues. In the past years, the establishment of Green Hospitals in the investigated hospitals had probably a worse situation, which with the passage of time and creating concern for sustainability among the senior managers of the hospitals and in general, all organizations have moved towards establishing a green management system.

The findings of the current research regarding the environmental management system for teaching hospitals affiliated to Yazd University of Medical Sciences were 79.16%, which was consistent with the study conducted in hospitals affiliated to North Khorasan University of Medical Sciences⁵ (74.38%).

The results of a research titled "Achieving Green Hospital Standards in Yazd Teaching Hospitals in 2013" showed that in the environmental management system, environmental protection strategies is overlooked in macro principles due to the lack of agreement between the orientation of the teaching hospitals policies and the nature and scope of the consequences. The current environment was hospitals. This issue can be caused by the fact that no management system based on environmental standards has been implemented in any of the teaching hospitals in Yazd. In addition, the absence of special annual environmental goals and also the lack of control of operations and activities related to environmental aspects were also observed in Yazd hospitals.¹⁶ After implementing the environmental management system in hospitals, Duputie (2002) found this system to be an efficient way to reduce environmental effects and decrease costs in energy consumption by 20% and water consumption by 15%.¹⁷ Management and leadership for green and healthy hospitals is needed in order to change the organizational culture in long term to realize the commitments of the society and the hospital staff and to create public policies that lead to the promotion of public health.⁵

Environmental management provides the natural needs of an organization as long as sustainable development of the environment is provided, therefore environmental management is a prerequisite for sustainable development.¹⁸ This means that environmental health, safety and sustainability are the main priorities of an organization, which can be achieved through training, goal setting, accountability and combining these priorities in all external communications and relations.

The findings of this research regarding the standard management of hazardous materials for teaching hospitals affiliated to Yazd University of Medical Sciences is 90.73% (acceptable situation), and its results are in line with the study conducted by Arzamani (76.72%). The acceptable status of the standards of hazardous materials is due to the existence of a comprehensive directive from the Ministry of Health and Medical Education and its notification to hospitals across the country regarding the standard disposal of hazardous materials and the training of personnel related to these substances. Many chemicals used by the healthcare sector are used for specific and unique healthcare purposes, for example, chemotherapy for cancer or disinfectants. Meanwhile, a growing number of hospitals are replacing some of the most dangerous substances with safer alternatives without compromising the quality of patient care.8 By addressing the category of chemicals in health programs, the health sector can not only protect the patient, but also ensure the health of its employees and take an active role in the safe management of chemicals.5

Healthcare service centers are one of the community service centers that have a tremendous impact on the environment. Production of hazardous and non-hazardous waste, release of air and sewage pollutants, if not managed properly, leads to air, water, and soil pollution.¹⁴

The current situation regarding wastewater management is 61.3%, which is obtained as a priority for improvement. The condition of most of the examined hospitals (3 hospitals) is average, and one hospital has an unacceptable condition. Also, the results of Taleshi et al.'s study (2013) showed that insufficient attention to environmental protection strategies, lack of sufficient education in the field of environment, inappropriate management of waste materials, and insufficient budget allocation for wastewater management and the release of pollutants into the air are among the most important obstacles in achieving the standards of Green Hospitals in teaching hospitals of Yazd city.¹⁶

In a 2020 study conducted by Yang et al. on the quality of gray water for drinking purposes, they concluded that if safe water is available, this type of water should preferably not be used for drinking purposes, but the use of this type of water in industries and agriculture is recommended, which results in saving water resources.¹⁹ In the discussion of waste management variable, the point obtained for Yazd teaching hospitals was 79.16%, which was in an acceptable state. This amount in Arzamani's study was 61.65% (average condition), which is the third priority for improvement in the hospitals covered by North Khorasan University of Medical Sciences.⁵ This rate in Ebadi Azar et al.'s study was (2015) 56.7% (average condition).¹⁵

In a previous study, it has been stated that due to the disordered state of hospital waste and the dangers caused by infectious waste, the way they are handled and disposed should be given more attention. It has also been pointed out that the lack of knowledge of hospital personnel and managers about the problems of hospital waste and the lack of sufficient capital to provide safe equipment are major problems in hospital waste management.²⁰ Based on the research results of Arimura et al., (2008) the effective role of this set of standards in reducing the production of harmful substances and the optimal use of natural resources has been pointed out.²¹

In the discussion of the water variable, the score obtained for the teaching hospitals of Yazd was 68.05% and as a priority for improvement, the condition of all hospitals was average. Regarding this variable, in the research of arzamani et al., the condition of the studied hospitals was average (52.12%). Previous studies also showed that water consumption in Iranian hospitals is 1.35 and 1.63 times the standard.^{22,23}

Also, in terms of water protection, the medical centers of Rasht city with a score of 34% are not in a suitable condition for establishing a Green Hospital in the region.⁷ The results of Carpenter's (2010) study in United States (US) hospitals showed that the establishment of Green Hospital standards has improved the protection of water resources, so that after 24 months of implementing an environmental management system, the effects of substances released on the indoor air of hospitals decreased by 66%.²⁴

Carliner and Guenther (2011) in their book titled "Comprehensive Environmental Health Program for Hospitals and Health Systems" state that when water is available in abundance, hospitals are often great consumers in their various operational dimensions. For example, in the US, 70% of hospital water consumption is used in processes ranging from mechanical equipment to sanitary wastewater transfer. About 30% is used for drinking, preparing food, bathing and washing hands. In general, there are few valid measures of global water consumption in health care.⁸

According to the present study, the score obtained for the variable of energy management was 82.14% (acceptable situation), which was in a better situation than other variables. This score was obtained for affiliated hospitals of North Khorasan University of Medical Sciences 69.86% (average condition) and the results of these two studies did not match. This inconsistency might be due to the evaluation study conducted in seven teaching and non-teaching hospitals in five cities, while the present study only examined four teaching hospitals in one city. According to the study of Jabarvand et al., the amount of electricity consumption in Farabi Hospital was 13.2 times the standard per active bed-day and 44.1 times per square meter of infrastructure.²⁵

It can be seen that in terms of energy management standards, the status of most teaching hospitals is acceptable and only one hospital has an average status. Studies have shown that there are no special annual environmental goals and uncontrollable operations and campaigns related to environmental aspects have also been seen in hospitals.⁷ Based on the research results of Terrados et al., (2007) the exploitation of renewable resources, solar energy and biomass were introduced as a tool for designing a sustainable energy model in line with business management.²⁶

In a study entitled "Preferential Purchase Compatible with the Environment", the average status of this factor in the studied hospitals was found to be 83.32% (acceptable status), where the status of three hospitals were acceptable and only one hospital had an average status. In the study of Ebadi Azar et al., (2016) in 19 affiliated hospitals of Tehran University of Medical Sciences, this rate was 62.3% (moderate condition).¹⁵ In the study of Arzamani et al., the score obtained for this variable was 78.1% (an acceptable condition).⁵

In this regard, the hospitals were in a good condition. Based on the results of the Arzamani's research, it will be very appropriate to implement a sustainable purchasing program that takes into account the environmental impact and human rights in all aspects of purchasing from production to packaging and final disposal.⁵

6. Conclusion

According to the findings of the research, it seems that the studied hospitals have a relatively good situation in terms of meeting the standards of the green hospital. Of course, the level of compliance of these hospitals based on the 11 investigated areas was in good condition in some cases and in bad condition in other cases. The areas of environmental management system, waste management, bathroom and toilet, energy management, hazardous materials and environmentally friendly purchasing had an acceptable status. Consequently, while maintaining the position of these hospitals in relation to the areas of Green Hospital, it is necessary to take appropriate measures for the continuous improvement and advancement of these factors in a dynamic manner. But in the continuation of the water management situation, the kitchen, laboratory, laundry room, sewage management, air pollutants and external water use in teaching hospitals were not in a good condition and had an average condition. Therefore, the findings of this research emphasize that in these areas, attention should be given to fix the weak points and finally upgrading them to the appropriate level.

In general, according to the weaknesses and strengths of each hospital, these hospitals have the possibility to cover their weaknesses by using their strengths while investing in their advantages and strengths (factors that are in an acceptable state) and using their existing capacities and further improving them and trying to bring the status of all factors to an acceptable level.

In order to properly manage green hospital standards and save energy and resources, medical centers should do a comprehensive planning regarding the 11 studied variables. It is worth mentioning that careful planning in water consumption management, sewage management and external water use is a priority. In order to do so, the training and commitment of managers as well as the personnel in the implementation of programs is important, and self-evaluation and obtaining national and international certificates of the green hospital can also help and pave the way.

6.1. Suggestions based on Research Findings

- Hospitals can form a Green Hospital Committee to evaluate and make policies in the field of developing Green Hospital standards, as well as communicating with regional medical centers in order to use the experiences of these centers in this field's standards.
- The hospital should record accurate statistics such as the amount of energy, water consumed, the waste production and the purchases of the departments, as well as the registration of production pollutants. They should also provide the necessary infrastructure to record these cases (such as providing separate electricity meters). This will facilitate the incentive and punishment systems in the hospital and also provide adequate and appropriate supervision.
- Due to the average status of the surveyed hospitals in terms of wastewater management, the hospitals should use special filters in the way of wastewater

disposal and also measure the volume of wastewater discharged from the hospital.

- To improve energy management, use cooling and heating systems with the lowest amount of water and electricity consumption. Currently, the largest amount of energy consumption in hospitals is done by these systems. Hospitals should also allocate a budget to insulate hot water pipes to prevent energy waste along the way.
- To control and manage water consumption, it is better to use faucets with perlator with the right combination of water and air to reduce water consumption. It is also better to use pedal or eye valves in bathrooms.
- In order to use water properly and optimally, hospitals can purify the water used in the laundry room and other units and then it can be used for green spaces irrigation and other possible applications.

Research Highlights

What Is Already Known?

The lack of sufficient documentation and studies related to the status of hospitals in Yazd city in terms of achieving the goals and standards of the green hospital.

What Does This Study Add?

The educational hospitals of Yazd had an average status (75.88% acceptable) in the field of environmental protection and as a result of controlling costs and pollution.

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Author Contributions

MKR, HJ and NH contributed as the main authors with the concept of planning the study. MKR, HJ, and NH contributed in the study design. NH gathered data. MKR and HJ performed the statistical analysis and interpreted the data. MKR, HJ and NH wrote the manuscript. All authors read and approved the final manuscript.

Conflict of Interest Disclosures

All authors declared that they have no conflict of interest.

Ethical Approval

A permission to conduct the research was obtained from the research ethics committee of University (IR.SSU.SPH. REC.1401.062).

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