



# Green Hospital Standards in the Teaching Hospitals of Urmia University of Medical Sciences: Compliance Status and Providing Solutions

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## Abstract

**Background:** A Green Hospital is a hospital that sees the environment as a part of its service quality processes and reduces environmental risks by applying effective measures in all dimensions, including management, water, energy, and waste. This study aimed to investigate the status of Green Hospital standards in the teaching hospitals of Urmia University of Medical Sciences (UMSU).

**Methods:** This descriptive study was conducted cross-sectionally on eight teaching hospitals associated with UMSU in 2022. The information collection tool was the Green Hospital Checklist, which consists of seven dimensions: energy, waste management, architecture, water, chemicals, supplies, and medicine. Data were collected through field observation and interviews with hospital executives. Descriptive statistics were used in SPSS 22 software for data analysis.

**Results:** According to the results, among the eight hospitals covered by UMSU, four hospitals in the energy consumption dimension, two hospitals in the architecture dimension, one hospital in the waste management dimension, six hospitals in the chemicals dimension, and five hospitals in the medicine consumption dimension met 50% or more of the Green Hospital standards. Regarding water conservation and purchasing supplies, no hospital met the Green Hospital standards. Only one hospital met more than 50% of the Green Hospital standards overall.

**Conclusion:** Considering that the score obtained from the studied hospitals was lower than the desired level, identifying the challenges of achieving standards in implementing Green Hospital programs is paramount. Implementing these standards requires creating a green management team and planning for the seven studied variables.

**Keywords:** Implementation of standards, Green Hospital, Environmental management

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## Introduction

We live in a time when public health and environmental crises are emerging and intersecting. Nowadays, consequences such as increasing air and environmental pollution and energy crisis have caused the protection of natural resources to become one of the most important concerns of human beings (1). A Green Hospital is a hospital that promotes people's health by continuously reducing environmental consequences and eliminating its contribution to the burden of diseases. A Green Hospital recognizes the connection between human health and the environment and demonstrates this recognition through its management, strategy, and operations. Following the international system, this hospital should be able to manage hazardous hospital waste, hygienically

treat hospital wastewater, use the resulting water in its green spaces, and save fuel and energy by implementing different recycling plans. It should take special measures to address issues related to noise pollution and control of the circulation air outside the hospital (1,2).

Hospitals consume more energy and water and produce more waste than other industries. To control costs and environmental pollution, they must prepare guidelines to conserve energy, water, etc (3). One of the ways to achieve this goal is to implement and establish Green Hospital standards. A Green Hospital considers the environment as an integral part of its service quality processes (4). Various variables have been defined regarding the implementation of the Green Hospital system, each of which includes standards that hospitals and the health



system can implement. Most hospitals start with two or three variables and plan to achieve them. These variables include leadership, chemicals, waste, energy, water, transportation, food, medicine, architecture, and purchasing (5).

According to Ferenc's study in 2010, hospitals that implement green hospital practices can reduce costs and improve the overall environment for patients and staff (6). In another study carried out in 2010, Carpenter and Hoppszallern investigated the relationship between a sustainable environment and green hospitals in the United States. The study concluded that energy efficiency was the primary and most crucial factor for hospitals to adopt green standards (3).

Designers' attention to discussions on sustainability in architecture and creating a context in which architecture is designed most beautifully and beneficially, causing the least damage to the environment, has become one of the major topics in architectural design (7). The Green Hospital system should be considered a green package with a holistic approach to the healthcare sector. Stepping into the field of designing and implementing Green Hospitals, in addition to complying with the aforementioned fundamental principles of green architecture, requires coordination with organizations that have the authority to determine the standards and criteria necessary for the establishment of Green Hospitals so that all the designers and implementers of these types of functions and physical spaces have a coherent and unified approach in the discussions related to Green Hospitals while following cross-border contracts (8).

Hospitals worldwide strive for innovation in patient care while maintaining high-quality standards. Hospitals affect the natural environment by implementing these innovations. Therefore, hospital executives develop management plans for energy conservation, proper disposal of medical waste, and safe management to reduce harm to patients, the surrounding environment, and the natural environment. These plans are introduced as "Green Hospital." A green and healthy hospital is a hospital that promotes people's health by continuously reducing environmental consequences and eliminating its share in the burden of disease. The green and healthy hospital recognizes the connection between human health and the environment and shows this recognition through its management, strategies, and operations. There is no single and uniform model in the field of green and healthy hospitals, and many hospitals and health systems around the world have implemented measures to reduce their environmental footprint, contribute to public health, and save costs at the same time (1,2,9,10).

One of the essential features of using the "green productivity" strategy for hospitals is that it combines economic and environmental efficiency, taking into account the environment alongside the health and

treatment economy. Using green productivity tools and methods minimizes the environmental pollutants caused by service provision. Thus, the green productivity methodology has been used in different hospitals worldwide (11). Many activities in hospitals and centers that provide health and treatment services are carried out to preserve the environment (12).

In other words, based on their mission, these types of hospitals link their needs with environmental measures and show their commitment to the environment by taking preventive measures and active participation in developing and strengthening the society's environment and equality in health (9,13).

Considering the importance of creating green management in hospitals, in this research, we will examine how far service and treatment centers in Urmia city are from the establishment and implementation of Green Hospital standards.

### Methods and Materials

The present study is a cross-sectional study conducted in 2022 in 8 teaching hospitals covered by Urmia University of Medical Sciences (UMSU), selected using the availability sampling method. The data collection tool for this study was Reller's Green Hospital Checklist (2008), evaluated in Iran by Shaabani et al (1,7). This checklist examines the status and level of preparedness of hospitals and medical centers selected in this research to determine their status of energy consumption, waste management, water conservation, chemical use, medicine consumption, buildings, green architecture, and purchasing medical supplies. The checklist has seven dimensions, including energy (14 points), waste management (28 points), architecture (25 points), water (16 points), chemicals (9 points), supplies (7 points), and medicine (4 points), and with a total score of 103 points (Table 1). The checklist questions are two-choice (yes/no), and zero points are given for a "no" answer and 1 point for a "yes" answer. Each of the examined standards also has its separate score. Data collection in this study was done through direct observation and interviews with hospital executives and experts. Two independent researchers made the

**Table 1.** The dimensions of the questionnaire and the number of questions related to each dimension

Variables	Number of questions	Question numbers
Status of energy consumption	14	Questions 1 to 14
Status of green building and architecture	25	15 to 39
Status of waste management	28	40 to 67
Status of water conservation	16	68 to 83
Status of use of chemicals	9	84 to 92
Status of supply purchasing	7	93 to 99
Status of medicine consumption	4	100 to 103

observations, and if there was a difference in the results, the differences were resolved through a conversation between the two researchers. In this study, 17 people, including quality control executives, nursing executives, clinical governance managers, and environmental health experts, were interviewed, and the desired checklists were completed.

For data analysis, descriptive statistics such as frequency, percentage, mean, and standard deviation were used to measure the dimensions. Data analysis was done using Excel and SPSS version 22.

## Results

The results of the study showed that in the hospitals affiliated with UMSU, an average of 6.38 out of 14 energy-related items matched the Green Hospital standards. Also, an average of 8.7 out of 25 items related to green building and architecture, an average of 9.63 out of 28 items related to waste management, an average of 5 out of 16 items related to water conservation, an average of 5.28 out of 9 items related to using chemicals, an average of 2.13 out of 7 items related to purchasing supplies, and an average of 2 out of 4 items related to medicine consumption matched the Green Hospital standards. Based on these results, in the universities covered by UMSU, only the two dimensions of medicine consumption and use of chemicals, with more than 50% compliance with the Green Hospital standards, have been sufficiently met (Table 2).

The results of Table 3 shows that, among all the hospitals in Urmia city, in the field of energy consumption 45.5%, in building and energy consumption 35%, in waste management 34.3%, in water conservation 31.2%, in use of chemicals 58.3%, in purchasing of supplies 30.3%, and in medicine consumption 50% of the Green Hospital standards were met.

According to the results of Table 4, among the eight hospitals covered by UMSU, four hospitals in the energy consumption dimension, two hospitals in the building dimension, six hospitals in the chemicals dimension, five hospitals in the medicine consumption dimension, and one hospital in the waste dimension met 50% or more than 50% of the Green Hospital standards. No hospital met the Green Hospital standards in the water conservation and purchasing of supplies dimensions. Overall, only one hospital met more than 50% of the Green Hospital standards (Table 4).

## Discussion

Green Hospital standards are particularly important in sustainable management and hospital cost savings. Therefore, in this research, we determined the level of readiness of public hospitals in Urmia city to establish standards related to Green Hospitals. According to the results, it was shown that the studied hospitals and medical centers in Urmia were in unfavorable conditions in terms

**Table 2.** Mean and standard deviation of the number of items that met the Green Hospital standards in the hospitals of Urmia University of Medical Sciences

Number of items that met the Green Hospital standards				
Variables	No. of hospitals	Mean	Standard deviation	Total number of items
Energy consumption	8	6.38	1.4	14
Green building and architecture	8	8.75	3.8	25
Waste management	8	9.63	2.66	28
Water conservation	8	5	1.3	16
Use of chemicals	8	5.25	0.88	9
Purchasing of supplies	8	2.13	0.83	7
Medicine consumption	8	2	0.75	4

**Table 3.** Description of the hospital's status based on Green Hospital standards

Variables	Compliance with standards	Non-compliance with standards
	No. (%)	No. (%)
Status of energy consumption	51 (45.5)	61 (54.5)
Status of green building and architecture	70 (35.0)	130 (65.0)
Status of waste management	77 (34.3)	147 (65.7)
Status of water conservation	40 (31.2)	88 (68.8)
Status of use of chemicals	42 (58.3)	30 (41.7)
Status of purchasing supplies	17 (30.3)	39 (69.7)
Status of medicine consumption	16 (50.0)	16 (50.0)
Total	313 (100)	511 (100)
Total percentage	37.9	62.1

of their level of readiness to establish and implement the Green Hospital standards, which is consistent with the results of the study of Ebadi Azar et al (5) in 19 affiliated hospitals of Tehran University of Medical Sciences. Based on this, hospitals should pay more attention to Green Hospital standards and include them in their plans and strategies. Among the selected hospitals, hospitals G and H had the least suitable conditions for establishing and implementing Green Hospital standards, followed by hospitals C and E.

The results show that in terms of energy management, the medical centers of Urmia city are in unsuitable conditions for establishing a green hospital, which should be considered a priority for improvement. In addition, the absence of particular annual environmental goals and, consequently, the lack of control of operations and surveys related to environmental aspects were observed in these hospitals. According to the results of research conducted by Terrados et al on regional energy planning with strategy planning tools in Spain, exploitation of renewable resources, solar energy, and biomass were introduced as tools for designing a sustainable energy model in line with business management. These tools can be used in these hospitals for energy management (14).

**Table 4.** The percentage of compliance with Green Hospital standards in each dimension according to the investigated hospitals

	Score of each variable	Hospital A		Hospital B		Hospital C		Hospital D		Hospital E		Hospital F		Hospital G		Hospital H	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Energy	14	8	57	6	42.8	7	50	7	50	6	42.8	5	35	8	57	4	28
Building	25	14	56	10	40	8	32	6	24	9	36	14	56	4	16	5	20
Waste	28	11	39	10	35.7	9	32.1	14	50	7	25	12	42.8	8	28	6	21
Water	16	7	43	6	37.5	4	25	6	37.5	5	31.2	5	31.2	3	18	4	25
Chemicals	9	6	66	5	55.5	6	66.6	4	44.4	6	66.6	5	55.5	4	44	6	66
Purchasing of supplies	7	3	42	2	28.5	2	28.5	1	14.2	3	42.8	1	14.2	2	28	3	42
Medicine consumption	4	3	75	2	28.5	2	50	3	75	1	25	2	75	1	25	2	50
Total score	103	52	50.1	41	39.8	38	36.8	41	39.8	37	35.9	44	42.7	30	29	30	29

The study found that the waste management services and treatment centers in Urmia were not suitable for establishing Green Hospitals. This finding was also supported by the study of Ebadi Azar et al. The lack of knowledge among hospital staff and managers about hospital waste problems and the insufficient provision of disinfectants are major challenges in hospital waste management. A study highlighted the important role of implementing standards in reducing waste production and effectively utilizing natural resources (5).

According to the results regarding water conservation, Urmia’s medical centers are unsuitable for establishing Green Hospitals. Farrokshahi’s study, titled “Examining the accreditation standards of the Green Hospital model in the selected social security hospital of Kermanshah,” also showed that water consumption in Iranian hospitals is 30.1 times higher than the standard (15). The results of Carpenter and Hoppszallern’s study in hospitals in the United States showed that the establishment of Green Hospital standards improved the protection of water resources, and after 24 months of implementing an environmental management system, the effects of the released substances on the indoor air of hospitals decreased by 66% (3).

Additionally, regarding the use of chemicals, the health centers of Urmia were in better condition compared to the other Green Hospital standards. According to the results of the research conducted by Chiou and Chen, using environmentally friendly materials instead of harmful materials and determining measurement criteria to reduce and eliminate hazardous chemicals and improve their management, as corrective measures for hospitals are of utmost importance. It is also necessary to monitor and evaluate their work in the future (10).

In terms of medicine consumption, the medical centers of Urmia, with a score of 50%, compared to 58.6% in the study of Ebadi Azar et al, were in relatively suitable conditions for establishing Green Hospitals; in the study of Arzamani et al (2017), the score of 73.21% was obtained (5,16). However, reducing over-prescription, minimizing improper disposal of pharmaceutical waste, promoting

medicine take-back by the factory, and ending medicine stockpiling are some of the issues that should receive special attention.

The results showed that in terms of green building and architecture, the medical centers of Urmia, with a score of 35.5%, were in very unsuitable conditions for establishing Green Hospitals. The buildings of more than half of the hospitals in this study (62.5%) were over 20 years old. The building situation was also consistent with Ebadi Azar and colleagues’ study (5), which reported 53% over 20 years old. Regarding purchasing hospital supplies, medical centers in Urmia, with a score of 30.3%, need to be in suitable conditions for establishing Green Hospital. According to the results of Arzamni and colleagues’ research, it would be appropriate to implement a sustainable purchasing program that considers the effects on the environment and human rights in all aspects of purchasing, from production and packaging to final disposal (16).

The results of Arzamani and colleagues’ research are consistent with our findings. Looking at the difference in the scores of the studied hospitals regarding Green Hospital standards, it can be concluded that all of these hospitals need to be in a better position to establish Green Hospital standards (16).

Based on the research results, public hospitals in Urmia need to establish Green Hospital standards. The results showed that in the seven dimensions of the Green Hospital, including purchasing of hospital supplies, green building and architecture, medicine consumption, use of chemicals, water conservation, waste management, and energy management, the studied hospitals are not in suitable conditions for the establishment of Green Hospitals and these hospitals should do comprehensive planning regarding these seven variables; in particular, detailed planning in energy consumption management, purchasing of hospital supplies, water consumption management, building improvement, and waste management are necessary to properly manage Green Hospital standards and save energy and resources. In doing so, the training and commitment of executives as well as personnel in the implementation of programs is essential. In addition,



regarding hospital characteristics, such as the hospital's age and size, the number of beds, and the staff, nurses, and doctors, these hospitals are in unsuitable conditions for establishing Green Hospital standards (Table 4). Failure to establish adequate communication and training due to the lack of technology and sufficient financial resources means that the environmental system in hospitals is not reviewed adequately. Other important reasons include a lack of awareness regarding the importance and benefits of hospital programs for establishing Green Hospital standards due to unwillingness to cooperate and lack of necessary motivation and training among personnel. The study of Jongwutiwes et al also emphasized the role of environmental education in improving the awareness levels of hospital employees and executives as the most critical factor and an essential step in establishing and maintaining the environmental management system in hospitals (17). A limitation of this study was that hospitals did not readily provide information. The research team was able to obtain the necessary information by stating that it does not reveal the names of the hospitals.

### Conclusion

Some of the essential factors in implementing Green Hospital standards in Urmia hospitals include creating a green management team, proper waste management, and adequate budget allocation for the management of wastewater and pollutants released into the air. It is suggested that continuous training courses related to environmental issues be provided for all employees and executives of Urmia city hospitals to increase environmental awareness, develop management strategies with various models, and implement them to achieve Green Hospital standards in Urmia city hospitals as a priority for the management of these hospitals.

Through an integrated process, the Department of Environment and the Ministry of Health, Treatment, and Medical Education of Iran should require universities of medical sciences and hospitals under their coverage to have detailed plans regarding the management of water consumption, waste, and energy and the improvement of hospital buildings. Because hospitals profoundly impact the environment, they should take fundamental measures to reduce their waste disposal and the high costs of using energy and water.

Hospital executives must pay attention to the health of employees and patients for optimal implementation of Green Hospital standards because health employees are the front line for optimal implementation of environmental and green experiences aimed at improving safety and quality, reducing costs, and protecting the Green Hospital system.

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### Authors' Contribution

**Conceptualization:** Yousef Shaabani, Leila Vali.

**Data curation:** Yousef Shaabani, Maryam Okhovati.

**Methodology:** Maryam Sarkhosh.

### Competing Interests

None.

### Ethical Approval

The current research was approved by the Ethics Committee of Kerman University of Medical Sciences (R.KMU.REC.1401.172).

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