



Investigatinon of Green Hospital Standards in Jiroft Hospitals

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ABSTRACT

Introduction: The International Standard Organization created a set of specified standards titled ISO 14000 in 1996 which includes numerous advisory documents related to the environment management, environment supervision, environmental performance evaluation, ecologic labeling, life cycle evaluation and environmental aspects.

Materials and Methods: This is a descriptive-analytical cross sectional study. The population being studied includes the managers and the staff of Jiroft hospitals. The required data are collected using standard questionnaires of environmental management system from 118 managers and staff in various sections of Jiroft hospitals.

Results: The results of the study show that the laboratory, laundry and kitchen condition, water management, contaminants management and spreading to the air, as well as environmental strategies in attaining green hospital standards in Jiroft hospitals, in accordance with ISO 14000, are suitable and at the optimum level.

Conclusion: Hospital and health systems can improve their economic and moral situations in the society by helping to attain the goals of the millennium development in the field of health and stability as well as green economic.

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Introduction

Nowadays, organizations need a type of performance assessment system to expand development and stability in the competitive arena. Applying performance assessment systems in hospitals is considered as an important priority since it can increase the service quality and lead to accountability transparency. Hospitals throughout the world attempt to create innovation in the field of

patient care, however, maintaining high-quality standards is necessary. In executing this innovation, hospitals affect the natural environment; therefore, to decrease the damage to patients, the surrounding societies, environment, hospital managers always design managerial plans on energy maintenance, proper disposal of medical waste, and safe pharmaceutical management ^{1, 2}. These plans have been introduced as green hospital. Green and healthy

hospital is the one which improves people's health through the constant decrease of environmental consequences and improving its part against the illnesses. Green Hospital knows the connection between human's health, environment and demonstrates this knowledge through the type of control, strategy, and operation³⁻⁵. Through investing in safe buildings, green purchase and executing a stable operation, hospital and health systems, in addition to confronting climate changes, can improve stability, equality and maintaining the environment⁶.⁷ Hospitals, clinics, and doctors' offices have been established as organizations which aim at controlling and treating illnesses and keeping people healthy. Therefore, they have the responsibility of maintaining the environment^{8,9}. Improper management, high-risk garbage production, air spreading and disposed sewage can lead to soil, water, and air pollution^{10,11}. Improperly refinement, storage, transfer or management, can have negative effects on human's health and the environment. In Brazil, the execution of solid waste management plan in health units is mandatory¹². For the proper management system of the waste material, it is necessary to join many factors such as collective health, economic situation, social aspects, discipline, and hospital management in the system^{13,14}. One of the most important and basic steps in developing a plan or executing risk and cost analyses about solid waste management is to know the quantity and characteristics of the materials¹⁵. Environmental innovations in this setting include reuse and recycling plan¹⁶. There are many tools for improving the environmental effects of an organization and its connections which are optional approaches. The stable hospital plan at Massachusetts Lowell University began in 1100 to present a technical scientific guideline to the medical industry for choosing products and promoting actions of occupation and health and environment safety Sustainable Hospital Program (SHP). The complete aggregation of occupational, environmental and safety health is a comprehensive solution to the health stability¹⁷⁻¹⁹.

To attain green hospital approaches, Environmental Management System (EMS) helps companies to reduce the negative effects on the

environment while ameliorate their economic effectiveness²⁰.

In Iran, the majority of the problems is accompanied using a considerable development in the medical care section, with little compatibility or lack of compatibility with advice and strategy²¹. There are nearly no training courses on hospital waste management and hazardous waste²². The provided training courses were ineffective or inappropriate. One of the specific obstacles to attaining the environmental management system is training. Training is a key factor throughout the execution of EMS and it may change attitude and behavior among managers and staff²¹.

Shabani et al explored and compared the existing patterns green hospital in the world. This study has been conducted in a comprehensive overview by searching on the corporate sites and validated domestic and foreign electronic databases to identify green hospital types²². As well as, Jongwutiwes et al, has been known the role of environmental education to improve the level of awareness of staff and hospital managers as the most important and fundamental step in the process of establishing and maintaining an environmental management system in hospitals²³.

By implementing the environmental management system, good health facilities can prevent pollution and potentially adjust the effects of their products and services life cycle. As a step to support stable development in the society, executing environmental systems is vital²⁴. Therefore, considering the importance and significance of this issue, the present study investigates the presence of green hospital standards on improving Jiroft hospitals performance. Current study, investigates the presence of green hospital standards in accordance with ISO 14000 standard in Jiroft hospitals in order to improve the performance of them. Finally, based on the obtained results, the condition of Jiroft hospitals in attaining green hospital standards in accordance with ISO 14000 will be identified and presented more precisely and comprehensively.

Materials and Methods

Research Questions

The main purpose of the study is investigating and analyzing the condition of Jiroft hospitals in attaining green hospital standards in accordance with ISO 14000 in the year 2016.

Based on the purpose, the following research questions were presented:

1. How is the environmental management system in Jiroft hospitals?
2. How is the situation of the laboratory, laundry, and the kitchen in Jiroft hospitals?
3. How is the hospital solid waste management in Jiroft hospitals?
4. How is the energy management in Jiroft hospitals?
5. How is the dangerous and infected waste material management in Jiroft hospitals?
6. How is the water management in Jiroft hospitals?
7. How is the sewage management in Jiroft hospitals?
8. How is the contaminants management and spreading to the air in Jiroft hospitals?
9. How is the outlet water management and use in Jiroft hospitals?
10. How is the material management and environmentally preferable purchase in Jiroft hospitals?
11. How are the environmental strategies in Jiroft hospital?

Methodology

Analyzing Research Results

In this study, the main data collection tool was using standard questionnaires²⁵. The statistical population of current work is the managers and employees of three hospitals in Jiroft city in summer 2015 to winter 2016. The sampling method was as probable and categorized randomized. A scale for research variables was designed using SPSS 22 and the data was analyzed. In this section, each of the variables will be investigated using one sample t-test and each of the results will be analyzed.

Data collection

The following two data collection methods have been applied in the present research study:

1. Library method: to collect information on the theoretical principles and research literature, the researcher has used library resources, such as books,

persian and english articles, internet sources and similar resources.

2. Field study: Since the present research study is descriptive, the instrument used in the study is field method and through standard questionnaires.

Data collection instruments

To collect the information and data on theoretical principles, literature and hypothesis testing, data mining have been generally used in the present study. The method used for collecting information on the related literature was note taking. The needed data for model testing was obtained using field method through distributing and collecting questionnaires from the study sample.

Statistical Population and Sample

The statistical population contained a group of people or units that had at least one common characteristic. With regard to the spatial domain of this study, attempts were made to choose a population which leads to accurate and reliable results. Based on the place and time of the study, the population included 118 hospital managers and staff of Jiroft hospitals in 2016.

Sample is a part of the studied statistical population chosen in a pre-determined way, and some inferences about the whole population could be obtained from the sample. Regarding the place, time, and the importance of the sample selection in the obtained results of the study, simple random sampling was used so that all the studied persons had an equal chance to be selected. Finally, the sample of study was randomly chosen from the hospital managers and staff of Jiroft hospital in 2016. The participants closely faced the challenges, difficulties and the realities of the population.

A common way to determine the sample size is Cochran formula. It is presented using the following equation:

$$n = \frac{\frac{Z^2 pq}{d^2}}{1 + \frac{1}{N} \left(\frac{Z^2 pq}{d^2} - 1 \right)} = \frac{\frac{1.96^2 \times 0.5 \times 0.5}{0.05^2}}{1 + \frac{1}{118} \left(\frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} - 1 \right)} \approx 90$$

(1)

Based on the determined sample size, 90 questionnaires were distributed among the managers

and the staff of the sample. It is worth mentioning that 84 of the initially distributed questionnaires were returned, out of which 80 questionnaires were considered to be appropriate for the analysis.

Kolmogorov-Smirnov test which is shown as K_s is a way for consistency of a theoretical distribution of empirical information²⁶. This test is a type of goodness of fit test³, and compares observed cumulative distribution function with theoretical cumulative distribution function (normal).

Results

1. The first research question

In the confidence level of more than 95% and measurement error of less than 5% with the degree of freedom ($df = 79$), the significant amount of the variable of the environmental management system is $p = 0.000$. The obtained mean for this variable is 2.304 which is significant based on the expected mean which is equal 3. Furthermore, since the obtained mean is smaller than the expected mean¹², it can be claimed that environmental management system in Jiroft hospitals in attaining the green hospitals standards in accordance with ISO 14000 is not suitable enough or at the optimum level.

2. The second research question

The obtained mean for the variable of the laboratory, laundry, and kitchen condition is 3.06 which is significant based on the expected mean which is 3. Furthermore, since the obtained mean is bigger than the expected mean, it can be claimed that laboratory, laundry, and kitchen condition in Jiroft hospitals in attaining the green hospitals standards in accordance with ISO 14000 is suitable enough and at the optimum level.

3. The third research question

The obtained mean for the variable of hospital solid waste material is 3.02. Furthermore, since the obtained mean is bigger than the expected mean, it can be claimed that hospital solid waste material in Jiroft hospitals in attaining the green hospitals standards in accordance with ISO 14000 is suitable enough and at the optimum level.

4. The fourth research question

The obtained mean for the variable of energy management is 2.16 which is significant based on the expected mean which is 3. Since the obtained mean is smaller than the expected mean, it can be claimed that energy management in Jiroft hospitals in attaining the green hospitals standards, in accordance with ISO 14000, is not suitable enough or at the optimum level.

5. The fifth research question

The obtained mean for the variable of dangerous and infected waste material management is 2.47 which is significant based on the expected mean that is equal 3. Furthermore, since the obtained mean is smaller than the expected mean, it can be claimed that dangerous and infected waste material management in Jiroft hospitals in attaining the green hospitals standards, in accordance with ISO 14000, is not suitable enough or at the optimum level.

6. The sixth research question

The obtained mean for the variable of water management is 3.03 which is significant based on the expected mean that is equal 3. Furthermore, since the obtained mean is bigger than the expected mean, it can be concluded that water management in Jiroft hospitals in attaining the green hospitals standards in accordance with ISO 14000, is suitable enough and at the optimum level.

7. The seventh research question

The obtained mean for the variable of sewage management is 2.805 which is significant given the expected mean which is 3. Furthermore, since the obtained mean is smaller than the expected mean, it can be found that sewage management in Jiroft hospitals in attaining the green hospitals standards in accordance with ISO 14000, is not suitable enough or at the optimum level.

8. The eighth research question

The obtained mean for the variable of contaminants management and spreading to the air is 3.03 which is significant according to the expected mean that is equal 3. Furthermore, since the obtained mean is bigger than the expected mean, it can be claimed that contaminants management and spreading to the air in Jiroft hospitals in attaining the green hospitals standards, in accordance with ISO

14000, is suitable enough and at the optimum level.

9. The ninth research question

The obtained mean for the variable of outlet water management and use is 2.79 which is significant based on the expected mean that is equal 3. Furthermore, since the obtained mean is smaller than the expected mean, it can be concluded that outlet water management and use in Jiroft hospitals in attaining the green hospitals standards in accordance with ISO 14000, is not suitable enough or at the optimum level.

10. The tenth research question

The obtained mean for the variable of material management and environmentally preferable purchase is 2.45 which is significant given the expected mean that is equal 3. Furthermore, since the

obtained mean is smaller than the expected mean, it can be claimed that material management and environmentally preferable purchase in Jiroft hospitals in attaining the green hospitals standards in accordance with ISO 14000 is not suitable enough or at the optimum level.

11. The eleventh research question

The obtained mean for the variable of environmental strategies is 3.96 which is significant given the expected mean that is equal 3. Furthermore, since the obtained mean is bigger than the expected mean, it can be claimed that environmental strategies in Jiroft hospitals in attaining the Green Hospitals standards in accordance with ISO 14000 is suitable enough and at the optimum level.

The following Table 1 demonstrates the overall analysis of variables in the research questions:

Table 1: Analysis of variables in the research questions.

Variables	Mean \pm SD	P-Value
Environmental management system	2.30 \pm 0.22	0.000
Laboratory, laundry, and kitchen condition	3.06 \pm 0.46	0.003
Hospital solid waste material management	3.02 \pm 0.25	0.001
Energy management	2.16 \pm 0.25	0.000
Dangerous and infected waste material management	2.47 \pm 0.26	0.000
Water management	3.03 \pm 0.32	0.001
Sewage management	2.80 \pm 0.32	0.010
Contaminants management and spreading to the air	3.03 \pm 0.41	0.005
Outlet water management and use	2.79 \pm 0.42	0.027
Material management and environmentally preferable purchase	2.45 \pm 0.29	0.000
Environmental strategies	2.96 \pm 0.42	0.000

Discussion

Organizations, of any type, are constantly interested in creating accurate environmental attitude through controlling the consequence of their services and products on the environment. Since, consequences such as the ever-increasing environmental pollution as well as decreasing of natural resources and energy crisis have caused green hospital design to play an important role. It is done by increasing the efficiency of the building, saving energy consumption, and generally being aligned with environmental standards. Observing safety in clinical laboratories to protect the staff and patients' health, the equipment and facilities of the laboratory as well as the environment is of the highest importance. Neglecting the safety in the clinical

laboratories can be very costly. The occurrence of safety accidents in laboratories can have secondary results, such as losing reputation, decreasing the number of clients and consequently the income, negative effect on keeping the staff, and finally increasing the expenses regarding the legal issues and insurance. Due to the constant progress of technology, human community is suffering from numerous problems. Duty of architects is providing mental and spiritual well-being of people in society. One of the areas being neglected is hospital environment. People are hospitalized for various reasons. Nowadays, hospitals have adopted an approach which has changed them into medical care centers accompanied with innovation and conscientious care of patients, where the high

standards of quality are present in accordance with current expenses. Since hospitals manage their expenses while paying purposeful and conscientious attention to patients, adopting this approach seems to be effective. Furthermore, the managerial approaches in today's hospitals have pressured the environment enormously. This has increased the hospital expenses, and also has had a serious effect on the increase of illnesses in society. In other words, hospitals have become entangled in a managerial paradox.

Therefore, to control the environment in recent years, various formations and organizations have been pressuring the medical centers for protecting energy and appropriate disposal of medical waste. However, these social and governmental pressures have caused the increase of expenses and superficial control. In the meantime, some hospitals have adapted the "Do No Harm" approach, which is doing what is harmless not only for patients but also for their surrounding societies and environment. The main task of the hospital is health improvement. Performing this task is affected by various factors; including observing the environmental hygiene standards and neglecting which can cause problems for the hospital in performing its mission. This point is important that any new approach for environmental management includes systems to guarantee permanent success, and needs a continuous process of refinement and improvement in this regard. This environmental management system should include specific purposes, timing, personal responsibility for pursuing projects and other time-taking and practically long chances. This managerial plan should also include improving environmental conditions for the future of strategic planning or other predictable tools. In this method, the environmental management system can be a part of greater goals of organization which new needs and specific obstacles can get more attention. With regard to the constant increase of population and subsequently producing more waste material, creating the accurate management system for disposing is inevitable. Hospital waste forms a considerable amount of produced waste. Given

the fact that hospital waste is normally infected, attaining a fixed, management model seems highly crucial. The results of this part of study confirmed with the study of Shabani et al and Jongwutiwes et al^{22, 23}, but in conflict with the results of the investigation of Tudor et al²¹.

Medical waste management (MWM) is an important general health concern throughout the world. One of the first essential steps in the process of developing a reliable plan for garbage management is the need to comprehend the quantity and quality of the garbage. Furthermore, medical waste is a special group of waste which is highly dangerous due to the infected or toxic features. Neglecting the management and control of the medical waste in different phases of production, storage and collecting, transporting, and final disposal will cause numerous problems. Therefore, the environment and human's health will be subject to serious danger. Hence, planning medical waste management is done for the purpose of preventing the undesirable effects on human's health and the environment. Askarian et al in his study concluded that effective waste management in hospital could reduce health risks and increase environmental protection, which is consistent with the results of this study²⁷.

Conclusion

Suggestions Based on the Study Results

1.To perform an accurate policy and necessary plans, the hospital management acts in such a way that has logical, effective and suitable ideas and suggestions for staff. Therefore, it can strengthen the spirit of consultation, trust and cooperation in organization, and by doing this, facilitates attaining the organization goals by increasing motivation.

2.Insufficient attention to the strategies of maintaining the environment, lack of enough training about the environment, improper management of waste material, and insufficient allocation of budget for sewage management and contaminants spreading in the air are among the obstacles for attaining the green hospital standards in Jiroft training hospital. It is suggested to increase running constant training courses related

to environmental issues for all the staff and managers of educational hospitals in Jiroft. It is also recommended to prioritize designing managerial strategies using various models and execute them for attaining green hospital standards.

3. Given the problems of Iran hospitals, it is suggested that policies and national policies make more balance in allocating a suitable budget in different branches. The suitable budget can surely lead to better performance in attaining the green hospital standards in accordance with ISO 14000.

4. It is suggested that hospital managers concur on the necessity of implementing a strategic plan which is equipped with an accurate decision-making system. These managers should also be committed to the strategic priorities and hospital goals.

5. Concerning the high number of hospital construction in the country, and modeling in energy consumption and environment, familiarity with green hospital architecture principles seems essential. Therefore, it seems necessary to create the requirements for basic training on stable architecture and designing stable medical centers at the academic and professional society of engineers to create this new approach in country.

Suggestions for further studies

To guide for future research studies done by other researchers in this domain, the following suggestions are proposed:

1. It is recommended that this research is conducted with other statistical population which may yield different results due to the economic and social characteristics of the members of that population.

2. It is suggested that the effects of other variables at the hospital level, such as the economic condition, be investigated accompanied using the factors studied in this research.

3. To obtain more precise and more reliable information, it is also proposed that future research studies use other instruments for data collection like interviews which is more flexible.

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Conflict of interest

The authors of this article declare that there is no conflict of interest.

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References

1. Zhu Y, Wu J, Zhuge L, et al. Research on the evaluation standards of efficient operation of green hospitals. *Chin Health Resour.* 2012; 2(4): 23-31.
2. Jafari N, Ebrahimi AA, Mohammadi A, et al. Evaluation of seasonal and spatial variations of air quality index and ambient air pollutants in Isfahan using geographic information system. *Journal of Environmental Health and Sustainable Development.* 2017; 2(2): 263-72.
3. Rastegari N, Ebrahimi AA, Karimi H, et al. Existence of microbial species in vermicomposts derived from mixed sesame crust and cow manure treatments. *Journal of Environmental Health and Sustainable Development.* 2017; 2(1): 229-34.
4. Gholizadeh A, Gholami M, Ebrahimi AA, et al. Performance evaluation of combined process of powdered activated carbon-activated sludge (pact) in textile dye removal. *Journal of Environmental Health and Sustainable Development.* 2016; 1(3): 141-52.
5. O'Callaghan A, Laking G, Frey R, et al. Can we predict which hospitalised patients are in their last year of life? A prospective cross-sectional study of the gold standards framework prognostic indicator guidance as a screening tool

- in the acute hospital setting. *Palliat Med.* 2014; 28(8): 1046-52.
6. Ahmadzadeh S, Asadipour A, Pournamdari M, et al. Removal of ciprofloxacin from hospital wastewater using electrocoagulation technique by aluminum electrode: optimization and modelling through response surface methodology. *Process Saf Environ Prot.* 2017; 109: 538-47.
 7. Hoseini K, Babaei F, Ebrahimi AA. Biodegradation of linear alkyl benzene sulfonate by sequencing batch reactor in sanitary wastewater. *Journal of Environmental Health and Sustainable Development.* 2016; 1(3): 167-74.
 8. Roberts GL. Shades of green: the evolution of hospital sustainable design standards. *Health Facilities Manage.* 2011; 24(11): 45-52.
 9. Alizadeh M, Mirhoseini SA, Dolatabadi M, et al. Evaluation the effect of landfill leachate on the surface water quality: A case study in Tonekabon landfill. *Journal of Environmental Health and Sustainable Development.* 2018; 3(1): 472-80.
 10. Manga VE, Forton OT, Mofor LA, et al. Health care waste management in Cameroon: A case study from the southwestern region. *Resources, Conserv Recycl.* 2011; 57: 108-16.
 11. Hossain MS, Santhanam A, Norulaini NN, et al. Clinical solid waste management practices and its impact on human health and environment—A review. *Waste Manage.* 2011; 31(4): 754-66.
 12. Moreira A, Günther W. Assessment of medical waste management at a primary health-care center in São Paulo, Brazil. *Waste Manage.* 2013; 33(1): 162-7.
 13. Chaerul M, Tanaka M, Shekdar AV. A system dynamics approach for hospital waste management. *Waste Management.* 2008; 28(2): 442-9.
 14. Ahmadzadeh S, Dolatabadi M. Removal of acetaminophen from hospital wastewater using electro-Fenton process. *Environ Earth Sci.* 2018; 77(2): 53.
 15. Diaz LF, Eggerth L, Enkhtsetseg S, et al. Characteristics of healthcare wastes. *Waste Management.* 2008; 28(7): 1219-26.
 16. Arya N, Zigby J. Greening health care. *Alternatives Journal.* 2005; 31(3): 16.
 17. Baker DW, Gazmararian JA, Williams MV, et al. Functional health literacy and the risk of hospital admission among medicare managed care enrollees. *American Journal of Public Health.* 2002; 92(8): 1278-83.
 18. Kokko S, Green LW, Kannas L. A review of settings-based health promotion with applications to sports clubs. *Health Promot.* 2013; 29(3): 494-509.
 19. Savolainen K, Pykkänen L, Norppa H, et al. Nanotechnologies, engineered nanomaterials and occupational health and safety—A review. *Saf Sci.* 2010; 48(8): 957-63.
 20. Dellit TH, Owens RC, McGowan JE, et al. Infectious diseases society of America and the society for healthcare epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clin Infect Dis.* 2007; 44(2): 159-77.
 21. Tudor T, Noonan C, Jenkin L. Healthcare waste management: a case study from the National Health Service in Cornwall, United Kingdom. *Waste Manag.* 2005; 25(6): 606-15.
 22. Shaabani Y, Vafaeenajar A, Hooshmand E. Investigation and comparison of available models for green hospitals. *Journal of Healthcare Management.* 2016; 7(1): 15-26.
 23. Jongwutiwes N, Thiengkamol N, Thiengkamol T. Development of hospital environmental management model through paic process. *Mediterr J Soc Sci.* 2012; 11(3): 303-9.
 24. Sammalisto K, Brorson T. Training and communication in the implementation of environmental management systems (ISO 14001): a case study at the University of Gävle, Sweden. *J Clean Prod.* 2008; 16(3): 299-309.
 25. Arzamani M, Sedghi S, Nasiripour AA, et al. Standard evaluation of green hospital in medical centers of north khorasan university of medical sciences in 2016. *Manage Strat Health Syst.* 2017; 2(2): 118-29.
 26. Singh L, Bhardwaj A, Deepak K, et al. Occupational noise and hearing conservation of industrial workers in casting and forging industry

in Northern India. *Int J Hum Geogr Environ Stud.* 2009; 1(1): 45-53.
27. Askarian M, Heidarpoor P, Assadian O. A total

quality management approach to healthcare waste management in Namazi Hospital, Iran. *Waste Manage.* 2010; 30(11): 2321-6.