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Assessment of environmental health indicators in hospitals in southern Kerman, Iran: A cross-sectional study (2021)

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ABSTRACT

Hospitals are fundamental components of healthcare systems and play an important role in providing medical care, preventing disease, and protecting population health. Monitoring environmental health indicators in hospitals is essential for identifying deficiencies and improving healthcare environments. This study aimed to assess environmental health indicators in six teaching hospitals affiliated with Jiroft University of Medical Sciences in southern Kerman Province, Iran. This descriptive-analytical, applied, cross-sectional study was conducted in 2021. The study population consisted of six teaching hospitals affiliated with Jiroft University of Medical Sciences, and all hospitals were included using a census sampling method. Data were collected using the checklist of the National Evaluation Program of Public Hospitals (Health and Hygiene Department), which consisted of 99 questions with a maximum score of 1,180 points. The overall environmental health status of the six hospitals varied across the evaluated domains. Water and wastewater health and occupational health were among the least favorable domains, whereas patient health and infection control showed comparatively better performance. Hospital C had the highest overall score (1,144 points), while Hospital F had the lowest overall score (974 points). The environmental health status of the evaluated teaching hospitals was generally at a moderate level. Particular attention should be given to water and wastewater management and occupational health. Regular assessment and targeted interventions may help address identified deficiencies and improve environmental health conditions in hospitals.

Highlights

- A comprehensive environmental health assessment covered all six teaching hospitals.
- Participating hospitals showed an overall moderate status in environmental health.
- Water, wastewater, and occupational health areas required the greatest improvement.
- Patient safety and infection prevention indicators showed the strongest performance.
- Findings guide priorities for stronger environmental health management in hospitals.

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1. Introduction

The primary responsibilities of governments toward their populations include ensuring security, providing education, and protecting public health. Health promotion and maintenance are fundamental components of public health and

play an important role in advancing health equity and social justice. The Ottawa Charter for Health Promotion emphasizes that health is influenced by a broad range of social, economic, and environmental conditions and identifies equity as a fundamental principle of health promotion (World Health Organization, 1986; Edwards, 2009). Accordingly, achieving and maintaining optimal health should be regarded as an important societal and public health priority. Health is a complex and multidimensional concept influenced by numerous determinants, including socioeconomic conditions, environmental factors, health-related behaviors, and the organization and performance of health systems (Edwards, 2009; Terris, 1994).

An effective and efficient health system is therefore essential for improving population health and reducing health inequalities. According to the World Health Organization (WHO), a health system comprises all organizations, people, and actions whose primary purpose is to promote, restore, or maintain health (Michel et al., 2021; Rifkin, 2014). Health systems extend beyond the provision of clinical care and include activities aimed at addressing the broader determinants of health and creating supportive environments for disease prevention and health promotion (Michel et al., 2021; Rifkin, 2014). Within this context, hospitals represent a critical component of healthcare systems and are central to the delivery of specialized and acute healthcare services. However, healthcare delivery in hospital settings is also associated with risks, particularly healthcare-associated infections (HAIs), which can adversely affect patient outcomes, quality of care, and healthcare costs (Muller et al., 2016; Storr et al., 2017). Environmental contamination within healthcare facilities can contribute to the transmission of pathogenic microorganisms and the occurrence of HAIs, highlighting the importance of environmental hygiene and effective infection prevention and control (IPC) practices (Muller et al., 2016; Tartari et al., 2022). Consequently, adherence to established hygiene standards and implementation of evidence-based IPC measures are essential for protecting patients and healthcare workers, improving the safety and quality of healthcare, and reducing the burden of preventable healthcare-associated infections (Storr et al., 2017; Tartari et al., 2022).

The World Health Organization (WHO) describes the health-promoting hospital as a healthcare setting that extends beyond the provision of medical treatment to actively promote the health of patients, healthcare workers, and the surrounding community. Hospitals play a critical role in the delivery of healthcare services and serve as important settings for health education, clinical training, and medical research. Their mission therefore extends beyond the diagnosis and treatment of disease to include the restoration and promotion of patients' health, the education and training of healthcare professionals, and the advancement of knowledge aimed at improving population health (Afshari et al., 2016; Whitehead, 2005). Accordingly, health promotion within hospital settings is a complex and multidimensional process that depends on the interaction of organizational, environmental, and individual factors (Johnson & Baum, 2001; Whitehead, 2005).

Failure to adequately address these factors may compromise the hospital's ability to fulfill its healthcare mission and provide a safe, high-quality care environment (Johnson & Baum, 2001).

Adherence to appropriate hygiene and infection prevention and control (IPC) standards is a fundamental component of safe and effective hospital care (World Health Organization, 2016). Inadequate implementation of such measures can contribute to the occurrence and transmission of healthcare-associated infections (HAIs), which remain a major challenge for healthcare systems worldwide (Allegranzi et al., 2011; World Health Organization, 2016). HAIs are associated with increased morbidity and mortality, prolonged hospital stays, impaired quality of care, and substantial additional healthcare costs (World Health Organization, 2016; Zimlichman et al., 2013). Evidence from different healthcare settings indicates that HAIs affect a considerable proportion of hospitalized patients, with the burden generally being higher in low- and middle-income countries than in high-income countries (Allegranzi et al., 2011; Magill et al., 2014). The WHO estimates that approximately 7% of patients in acute-care hospitals in high-income countries and up to 15% of patients in low- and middle-income countries acquire at least one HAI during their hospital stay (Storr et al., 2017; World Health Organization, 2016). These infections therefore represent a major patient-safety and public-health concern.

The development and transmission of HAIs are influenced by complex interactions among susceptible hosts, infectious agents, and the healthcare environment (Allegranzi et al., 2011; Otter et al., 2011). Hospitalized patients are often particularly vulnerable because of underlying illnesses, impaired immune responses, invasive medical procedures, and prolonged exposure to healthcare environments (Allegranzi et al., 2011; Magill et al., 2014). At the same time, hospital environments may harbor a wide range of pathogenic microorganisms, including antimicrobial-resistant organisms, which can persist on surfaces, medical equipment, and other environmental reservoirs (Otter et al., 2011). Contaminated environmental surfaces have been recognized as potential reservoirs for healthcare-associated pathogens and may contribute to their transmission, particularly when appropriate environmental cleaning and disinfection practices are not adequately implemented (Leas et al., 2018; Otter et al., 2011). Consequently, the healthcare environment can play an important role in the transmission of infectious agents, particularly when environmental cleaning and disinfection, ventilation, water and sanitation, waste management, and other infection prevention measures are inadequate (Johnson & Baum, 2001; Leas et al., 2018; Otter et al., 2011).

Environmental health in hospitals encompasses a broad range of measures aimed at maintaining a safe and hygienic healthcare environment and reducing opportunities for pathogen transmission. These measures include appropriate environmental cleaning and disinfection, access to safe water and sanitation, effective healthcare-waste management, adequate ventilation, proper management and

decontamination of healthcare equipment and environmental surfaces, and compliance with established IPC practices (Johnson & Baum, 2001; Leas et al., 2018; Storr et al., 2017). Environmental cleaning is particularly important because contaminated surfaces can serve as reservoirs for healthcare-associated pathogens, while appropriate cleaning and disinfection practices can reduce environmental contamination and contribute to infection prevention (Leas et al., 2018; Otter et al., 2011). Therefore, systematic assessment and continuous improvement of environmental health conditions within hospitals should be considered integral components of comprehensive infection prevention strategies and may contribute substantially to reducing the occurrence and transmission of HAIs (Johnson & Baum, 2001; Leas et al., 2018; Storr et al., 2017).

Achieving and maintaining an appropriate level of environmental health in hospitals requires compliance with established standards, regulations, and technical requirements. Hospital environmental health standards provide a framework for maintaining safe and hygienic conditions and establishing minimum acceptable requirements for healthcare facilities. Compliance with these standards is particularly important because environmental hygiene encompasses multiple domains, including cleaning and disinfection, water and sanitation, healthcare-waste management, ventilation, and the appropriate management of environmental surfaces and equipment (Carling, 2016; Storr et al., 2017).

Despite the recognized importance of environmental hygiene in preventing healthcare-associated infections (HAIs), evidence indicates that deficiencies in environmental health practices remain a concern in healthcare facilities (Carling, 2016; Peters et al., 2022). Environmental surfaces can serve as reservoirs for pathogenic microorganisms, and inadequate cleaning and disinfection may increase opportunities for pathogen transmission within healthcare settings (Carling, 2016; Otter et al., 2011). A systematic review of environmental hygiene interventions found that most included studies reported reductions in healthcare-associated infections or patient colonization following environmental hygiene interventions, further emphasizing the importance of maintaining appropriate environmental conditions in healthcare facilities (Peters et al., 2022).

Evidence from Iran has similarly identified deficiencies in several components of hospital environmental health. Studies conducted in Iranian hospitals have reported shortcomings in healthcare-waste segregation, collection, storage, treatment, and disposal, as well as inadequate implementation of relevant management requirements (Farzadkia et al., 2009; Malekahmadi et al., 2014). For example, a study conducted in teaching hospitals affiliated with Iran University of Medical Sciences identified deficiencies in waste segregation, collection, transportation, treatment, and disposal and emphasized the need for appropriate standards, regulations, and personnel training to improve existing conditions (Farzadkia et al., 2009). More recent evidence from Kermanshah has also highlighted persistent challenges in hospital waste management and the need for more sustainable and systematic approaches (Alighardashi et al., 2024). Similarly, recent evidence from Isfahan has highlighted excessive infectious waste generation, gaps in waste treatment, and the need for more sustainable approaches to hospital waste management (Mohammadi, 2025).

These findings suggest that hospital environmental health should not be considered a static condition but rather as an ongoing quality and safety priority requiring regular monitoring, periodic assessment, and continuous improvement (Peters et al., 2022; Storr et al., 2017). Systematic evaluation of compliance with environmental health standards can help identify deficiencies, guide corrective interventions, and support the maintenance of a safe healthcare environment for patients, healthcare workers, and visitors (Carling, 2016; Storr et al., 2017).

Given the potential role of hospital environmental health monitoring in reducing healthcare-associated infections and associated healthcare costs, maintaining and regularly assessing environmental health conditions is an important component of hospital quality and patient safety. However, despite the importance of this issue, there is limited evidence regarding the status of environmental health indicators in teaching hospitals in southern Kerman Province. Therefore, considering the importance of maintaining appropriate environmental health conditions and the lack of comprehensive evidence in this setting, the present study aimed to assess the status of environmental health indicators in teaching hospitals affiliated with Jiroft University of Medical Sciences in 2021.

2. Materials and Methods

This study is a descriptive-analytical and applied approach that uses cross-sectional data from 1400. The study population is comprised of teaching hospitals affiliated with Jiroft University of Medical Sciences, including six teaching hospitals. In accordance with the number of hospitals, the census method was used in this study, and all teaching and medical hospitals in the south of Kerman province were investigated. These data were collected using the checklist of the National Evaluation Program of Public Hospitals (Health and Hygiene Department). The Ministry of Health and Medical Education has prepared this checklist, whose content validity has been approved.

This study tool includes 99 questions and 1180 points that aim to assess the health status of the construction and the environment in terms of health Index (30 questions), Health mission of manpower (9 questions), sanitation (27 questions), waste management (9 questions), water quality and sewage (2 questions), infection control (10 questions), and occupational health (12 questions).

According to the standard checklist, each of the questions had three answers (yes, somewhat, and no). According to the type of questions, the option "yes" received 20, 15, and 10 points, and the option "no" earned zero points, and "somewhat" was given a score of 1 to 19, 1 to 14, and 1 to 10. In order to control measurement errors, checklists were completed, in all six hospitals, by a trained environmental health expert through observation and interview. Inter-rater reliability was not

separately assessed in the present study because the checklist was completed by a single trained environmental health evaluator. To minimize measurement error, the evaluator followed the standardized scoring criteria and procedures specified in the national checklist.

The maximum standard limit for each of the six indices of the health status of hospitals was equal to the sum of the highest scores for each question. The minimum standard limit was equal to 20% of the maximum standard limit.

Finally, scores between 80-60, and over 80%, or the difference between the highest and lowest standards in each dimension, were divided into three groups: weak, medium, and good. Due to the principle of trustworthiness and confidentiality of information, hospitals were not named.

3.1 Results and Discussion

In this study, health indices of six hospitals in the south of Kerman province were analyzed. In order to determine the health status of these hospitals separately, the following data analysis has been conducted. The total number of hospital scores (A) obtained was 1087, which, according to Table 2, represents an average level of health. The water and wastewater hygiene index has the greatest percentage difference compared to another Index. As for environmental health and cleanliness in the hospital, a difference in points is also found with the highest standard level being 37.6%. In order for a sanitation index to be calculated, there must be the lowest percentage difference between the highest score and the highest standard. This hospital has favorable construction conditions and is in a healthy state of sanitation.

In the present study, water and wastewater health and occupational health were among the less favorable domains. These findings highlight that hospital environmental health extends beyond healthcare waste management and requires simultaneous attention to wastewater treatment, water quality, occupational safety, infection prevention, and environmental hygiene. The observed variation among hospitals also suggests that hospital-level organizational and managerial factors may influence compliance with environmental health standards. Therefore, interventions should be tailored to the specific deficiencies identified in each hospital rather than applying a uniform corrective strategy.

Table 1 The values of the lowest and highest scores in different health indices

Study index	Number of questions	The minimum standard	Maximum standard	Difference between Max and Min standard	Unfavorable	Moderate	Favorable
The health mission	9	100	125	25	less than 115	115.1-120	more than 120
Sanitation condition	27	244	305	61	less than 288	288.1-293	more than 293
Hospital waste	9	72	90	18	less than 83	83.1-86	more than 86
Water and wastewater	2	16	20	4	less than 18	18.1-19	more than 19
Occupational Health	12	124	155	31	less than 143	143.1-149	more than 149
Patient health and infection control	10	96	120	24	less than 97	97.1-101	more than 101
Environmental health status	30	292	365	73	less than 340	340.1-346	more than 346
Total	99	944	1180	236	less than 1084	1084.6 - 1114	more than 1114

The hospital obtained a total of 1109 points (B), which is the average score of the hospital's indices (Table 2). Consequently, this hospital has the highest standard of sanitation and control of nosocomial infections, and its water and sewage health index differs the most from the desired standard. There is a difference of 28% in environmental cleanliness and 9% in occupational health from the standard limit. It is evident from the results of this study that hospital (C) possesses a comprehensive desirableness; its acquired score was 1144, and it is considered to be one of the most reputable hospitals in terms of health quality. A total of 1014 points were obtained by Hospital (D), which is one of the weaker hospitals according to Table (2) based on a total of 7 indexes. There was an unfavorable level of cleanliness and hygiene in this hospital compared to the highest standards. In terms of occupational health, water and sewage health, and sanitation status, this hospital differs the most from the standard. A total of 1085 points have been earned by Hospital (E). This score indicates the overall health of the hospital based on indexes such as cleanliness and environmental health.

When comparing water and wastewater hygiene, the hospital had the highest percentage difference from the highest

standard. In terms of sanitation, it is only 8% different from what is desirable. Hospital (F) has the lowest score among the six hospitals studied. A score of 974 indicates that this hospital is weak in terms of health indexes. Hospital (F) in terms of water and wastewater health index was 125% lower than the highest standard. There was a large difference between the two indexes of environmental health and the health mission within this hospital, at 86.4% and 72%, respectively. Inefficient management is responsible for the poor performance of this hospital.

Table 2 Amount of acquired points and percentage of points acquired with the highest limit by different Indices

Hospital	Score and percentage	The health mission	Sanitation condition	Hospital waste	Water and wastewater	Occupational Health	Patient health and infection control	Environmental health status	Total points
A	Score	118	300	85	16	148	102	318	1087
	Differential percentage	28	8	28.7	100	22.6	14.3	37.6	90
B	Score	114	300	90	18	152	105	330	1109
	Differential percentage	44	8	0	50	9.7	0	28	15.5
C	Score	120	302	90	18	152	105	357	1144
	Differential percentage	13.6	4.8	0	50	9.7	0	6.4	0
D	Score	115	270	87	18	140	98	286	1014
	Differential percentage	39.6	56	16.7	50	50.2	33.3	63.2	125
E	Score	116	300	85	16	138	102	336	1085
	Differential percentage	35.2	8	27.8	100	55.6	14.3	23.2	96
F	Score	107	281	82	15	137	92	260	974
	Differential percentage	72	38.4	44.4	125	58.1	60	86.4	150

Table 3 The average score of different Index of the studied hospitals

Index of the study	Average score	Weak	Average	Good
The health mission	2.5±115	2 (33.3)	4 (6.66)	0 (0)
Sanitation condition	13.4±292.16	2 (33.3)	0 (0)	4 (66.6)
Hospital waste	2.5±87.5	1 (16.16)	2 (33.3)	3 (50)
Water and wastewater	17.6 ±1.8	3 (50)	3 (50)	0 (0)
Occupational Health	144±0.6	3(50)	1 (16.16)	2 (33.3)
Patient health and infection control	100.6±1.7	1 (16.16)	1 (16.16)	4 (66.6)
Environmental health status	314.5±14.8	5 (83.8)	0 (0)	1 (16.16)
Total	1068.8 ±2.4	3 (50)	2 (33.3)	1 (16.16)

Although the data were collected in 2021, the findings provide a baseline assessment of environmental health conditions in teaching hospitals in southern Kerman Province. The study was based on a standardized national hospital health checklist and included all six teaching hospitals affiliated with Jiroft University of Medical Sciences, thereby documenting the

environmental health status of these hospitals at the time of assessment. The findings can serve as a reference point for subsequent evaluations and for identifying areas that require continued monitoring and improvement. However, because environmental health practices and hospital management systems may change over time, the findings should not be interpreted as representing the current environmental health status of these hospitals. The time elapsed since data collection is therefore acknowledged as a limitation of the present study.

3.1 Limitations

This study has several limitations. First, the data were collected in 2021; therefore, changes in hospital infrastructure, environmental health practices, and management systems after the study period may limit the generalizability of the findings to the current situation. Second, the checklist was completed by a single trained environmental health evaluator. Although standardized scoring procedures were followed, the absence of multiple independent evaluators prevented assessment of inter-rater reliability and may have introduced observer bias. Future studies should consider repeated assessments and the use of multiple independent evaluators to improve the reliability and temporal relevance of the findings.

4. Conclusion

As the most important health centers, hospitals should be excellent in terms of health indicators. However, this study has revealed that the level of environmental health and indicators evaluated by 6 hospitals under the auspices of Jiroft University of Medical Sciences is reasonable. This is consistent with previous studies conducted in Isfahan, Qom, Fars, Kermanshah, and Karaj hospitals. It appears that the country's hospitals, despite their health mission, have received little attention and that basic measures must be taken to improve performance. According to the various indexes, indicators related to environmental health status, water quality and sewage health, and occupational health are poorly evaluated. In contrast, the indicators related to patient health and infection control are in reasonable shape. The reason for this is the numerous measures taken in recent years to prevent nosocomial infections in the country. It is commendable that the medical staff has taken such measures. A weakness of some hospitals is their failure to explain the health mission of human resources. In the analysis of the data, we found that a hospital that has been weak in this area does not fare well in other areas. The serious mission hospitals have in improving society has been ignored due to reasons such as clients not adhering to health standards and inadequate supervision. The most unfavorable indicator is related to the environmental health status of hospitals, and a major cause of this is the lack of regular cleaning. The evidence shows that the principles of hospital waste collection are appropriate, and that only temporary landfills are unsanitary. As it relates to wastewater, the most critical issue is the management of treatment plants, which must also be overseen by environmental health. There are 33% of hospitals that are considered to be weak due to the age of the construction and defects in the floors, laundry and kitchen, which are costly to maintain. According to the points earned, Jiroft University of Medical Sciences hospitals are in a moderate state, and comprehensive management is required in order to achieve the desired conditions. Therefore, Jiroft University of Medical Sciences is expected to take appropriate measures in order to turn the current situation into a favorable one.

Statements and Declarations

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Ethical considerations
Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the author.

Data availability
Data will be made available on request.

Conflicts of interest
The author declares that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author contribution
MM. Soori: Writing Main Draft; S. Akhoundi Taraadeh, F. Eslami, and R. Noroozpoor: Conceptualization; Writing – Review & Editing; and A. Hosein Panahi: Conceptualization, Methodology, Review, and Final Proof.

AI Use Declaration
During the preparation of this manuscript, the authors used AI tools for designing the Graphical Abstract. All content has been carefully reviewed and revised by the authors, who take full responsibility for the final version of the manuscript.

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