

Green Hospital and Effective Waste Management as Perceived by Nursing Staff

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Abstract

Background: Healthcare setting represents a broad array of services and places where healthcare occurs, improper management of wastes at healthcare facilities is lethal and can have health impacts on the nursing staff working. Green hospitals with effective hospital waste management can be a key solution to many problems. **Aim:** assess green hospital and effective waste management as perceived by nursing staff. **Research design:** A descriptive correlational research design was utilized to conduct this study. **Setting:** study was conducted at Tanta Main University Hospitals, which is affiliated to the Ministry of Higher Education and Scientific Research **Subjects:** The study subjects were consisted of all (n=28) head nurses and a stratified sample of nurses (n=265). **Tools:** Two tools were used to collect the data, Green Hospital and Effective Hospital Waste Management Questionnaires. **Results:** Showed that more than three quarter (79.5%) and more than half of (51.9%) nursing staff had a low level perception of green and effective waste management, respectively. Solid waste management was ranked as the highest dimension of green hospital (51.91 %) with Mean \pm SD 15.38 \pm 4.06. Waste collection was ranked as the highest dimension of effective waste management (66.26 %) with Mean \pm SD 18.25 \pm 3.51. **Conclusion:** there was a positive statistically significant correlation between overall effective hospital waste management and overall green hospital. **Recommendations:** Encourage nurses to conduct research regarding green hospital and effective waste management to transform research results into practices and to take responsibility in this regard.

Key words: Green hospital, Effective waste management, Nursing staff.

Introduction

Healthcare setting is a wide range of services and locations where healthcare is provided. Poor waste management in healthcare facilities can be fatal and have negative health effects on the nursing staff who work in it. (Chan, Canver, McNeil, & Sue, 2022). Potential issues with hospital waste disposal and management may be

addressed in large part by green hospitals that use efficient hospital waste management. Green hospitals are a building concept that lessens environmental, water, and energy disruptions. Since sustainability and health are given first priority in green hospitals, these facilities must practice energy, water, and material conservation. (Tarkar, 2022).

If hazardous healthcare waste is not appropriately managed, it can seriously endanger both the environment, the management of waste in healthcare facilities continues to get public attention (**Leonard et al., 2022**). To comprehend the crucial connection between environmental and human health, nursing personnel must be involved in its management (**Saxena, Pradhan, & Kumar, 2022**).

A green hospital prioritizes the optimal use of natural resources while improving patient care. A green hospital looks for greener ways to dispose of trash, conserves water, uses less electricity, and takes chemical safety into account (**Tarkar, 2022**). Green hospitals are among the structures with the fewest amounts of waste, either medical or non-medical. It is a phrase used to describe hospitals that are thought to be less damaging to the environment and to use fewer environmental resources (**Kumari, 2020**).

Green hospital include five dimensions namely; material and resources, indoor environmental quality, chemical management, solid waste management and environmental services (**Dhillon & Kaur , 2018**). First, materials and resources, materials found in the natural world that have practical use and value for humans. The selection of materials and resources must be friendly to environment and renewable material resources(**sharma et al., 2022**). Second, the indoor environmental quality (IEQ) interior characteristics of a facility can be referred as the IEQ of green hospitals. Air quality, views and daylight, comfortable acoustics, and occupant

control over lighting and temperature comfort are all included. (**Kamath et al., 2019**).

Third, chemical management is a systematic approach for procuring, storing, using and disposing of chemicals within a facility. (**James& Owo,2022**). Fourth, Solid waste management refers to a method where organizations put comprehensive plans into place to effectively manage wastes from the place of origin to the point of disposal. (**Salvi, 2023**).

Finally, environmental services refer to the concept that infection control depends on keeping the surroundings inside and outside of healthcare institutions clean. Environmental services handle cleaning and sanitation operations within an organization. Each of these aspects of green hospitals helps to efficient management of waste (**Sahamir &, Zakaria, 2018**).

Hospital waste is produced by medical procedures and includes radioactive materials, chemicals, utilized needles and syringes, dirty dressings, diagnostic samples, blood, and other materials (**Negarandeh, & Tajdin, 2022**). An integral component of health care is waste management. In order to prevent harmful health consequences linked to subpar practices, such as exposure to infectious agents and poisonous substances, health care waste management demands more focus and effort (**Sürme & Maraş,2022**).

Sorting, categorizing, collecting, storing, circulating, disinfection, processing, and final disposal of healthcare waste are all necessary for efficient hospital waste management

(Azmal et al., 2014). To begin with, waste sorting is the act of classifying all of the waste that the organization generates into distinct waste categories. After being gathered, this undesired material is recycled or disposed of in another way. (Lu & Chen, 2022). Second, waste classification refers to the act of separating and organizing waste materials into hazardous and non-hazardous groupings in order to reduce processing costs and enhance hospital waste management efficiency. (Labib, Hussein, Zakaria, Mohamed, 2015).

Third, waste collection, is to efficiently and economically gather as much correctly-sourced waste as possible in order to facilitate the waste sorting and/or treatment stage (Zhou et al., 2022). Fourth, waste storage is the process of separating waste materials into different kinds for shipping and recycling (Jiang et al., 2023). Fifth, waste processing is the process of handling solid waste both during and after collection and disposal. (He et al., 2023).

Sixth, waste transfer means to pack waste containers with label and move it to outside hospital. Seventh, disinfection of waste means eliminate many or all pathogenic microorganisms on inanimate objects, with the exception of bacterial spores. Finally, disposal of medical waste means removing, discarding, recycling or destroying unwanted materials called waste to prevent spread to infection and diseases (Farooqi et al., 2023).

Significant of the study

The mission of hospitals is to save and enhance lives, meaning hospitals

prioritize health the most. People come to hospitals to receive medical treatment; therefore, hospitals should be clean and comfortable. According to previous research, a well-designed hospital building may improve the healing process. Designers must focus on green strategies to benefit hospital patients and staff (Wyssusek, Foong, Steel, Gillespie, 2016).

Green buildings reduce environmental impacts by reducing on-site operations, conserving energy and water, and improving health. They also improve the indoor environment and reduce power use and emissions that cause dangerous diseases. The current trend of using disposables, and the expansion of healthcare institutions, has resulted in an exceptional load of health-care-related trash (Agarwal, Yadav, Yadav, Mahore & Singh, 2022). Tanta Main University Hospital generates estimated Thousands of hazardous or infectious waste from all departments. Therefore, this study attempted to assess green hospital and effective waste management as perceived by nursing staff.

The study aims to:

Assess green hospital and effective waste management as perceived by nursing staff.

Research questions:

- What are levels of nursing staff perception of green hospital and effective waste management?
- What is the relation between nursing staff perception of green hospital and effective waste management?

Subjects & methods

Study design

A descriptive correlational research design was used to conduct this study.

Setting

The present study was conducted at Tanta Main University Hospitals, which is affiliated to the Ministry of Higher Education and Scientific Research.

Subjects

The study subjects were contained all head nurses (n=28) and a stratified proportional randomized sampling of staff nurses (n=265) who are working in previously mentioned setting. Tools of data collection

Tool I: Nursing Staff Perception Regarding Green Hospital Questionnaire.

This tool was consisted of two parts as follow:

Part 1: Nursing staff personal data including age, gender, marital status, educational level, years of experience, job title and working unit.

Part 2: Green Hospital Questionnaire: this tool was developed by the investigator guided by Clark (2019) and related literatures. (Lattanzio *et al.*, 2023) & López-Medina *et al.*, 2023). It was used to assess nursing staff perception toward their hospital as green one, it included five dimensions namely:

- Material and resources, included 6 items, indoor environmental quality, included 13 items, chemical management, included 4 items, Solid waste management, included 5 items and environmental services, included 6 items.

Scoring system

The nursing staff perception was assessed using three points Likert Scale ranging from 1 to 5; while strongly disagree =1, disagree =2, uncertain =3, agree =4, strongly agree

=5. The strongly disagree response was added to disagree and strongly agree was added to agree response. The total scores were summing up and classified into levels according to statistical cut-off points as follow:

- High level of nursing staff perception regarding green hospital > 80 %
- Moderate level of nursing staff perception regarding green hospital 60-80%
- Low level of nursing staff perception regarding green hospital < 60 %

Tool II: Nursing Staff Perception of Effective Hospital Waste Management Questionnaire.

This tool was developed by the investigator guided by Al-Habash& Al-Zu'bi (2012) and related literatures (Keleb *et al.*2023)& El Ella., Shazly, Abd Elazeem, (2018). It was used to assess nursing staff perception towards effective hospital waste management. It included eight dimensions namely:

- Waste sorting, included 10 items, Classification of waste, included 4, Waste collection, included 5 items, Waste storage, included 11 items, Waste transfer, included 6 items, Disinfection, included 4 items, Waste processing, included 3 items and disposal of waste, included 6 items.

Scoring system:

The nursing staff responses were measured on five points Likert Scale ranging from 1 to 5; while strongly disagree =1, disagree =2, uncertain =3, agree =4, strongly agree =5. The strongly disagree response was added to disagree and strongly agree was added to agree response .The total scores were summing up and classified into levels according to cut off points where:

- High level of waste management perception $\geq 80\%$
- Moderate level of waste management of perception 60-80%
- Low level of waste management perception < 60

Method

1. An official permission was obtained from the Dean of Faculty of Nursing, Tanta Main University Hospital to responsible authorities of hospital to conduct the study.

2. Ethical considerations

a. An approval of Scientific Research Ethics Committee at Faculty of Nursing was obtained code No (27) on 8/27/2023 before conducting the study.

b. Nature of the study was not cause harm to the entire sample.

c. Informed consent was obtained from the study's participants after explanation of the study's aim.

d. Confidentiality and anonymity was maintained regarding data collection and the participants have right to withdrawal.

e. Assuring the nurses that their collecting data will remain confidential and private, and confirming it will utilized for the objective of study.

3. Tools I and II were translated into Arabic and presented to a jury of five experts in the area of specialty to check their content validity. The experts were three professors and two assistant professors of Nursing Administration, Faculty of Nursing, Tanta University.

4. The experts responses were represented in four points rating scale ranging from (4-1); 4=strongly relevant, 3=relevant, 2=little relevant, and 1=not relevant. Necessary modification were made including;

clarification, omission, of certain items and adding others and simplifying work related words.

- The face validity value of Green hospital questionnaire was 96.3%, Effective waste management questionnaire was 94.9%.

5. A pilot study was carried out on a sample 10% of the subjects (n=30). A pilot study was carried out after the experts opinion and before starting the actual data collection. The pilot study was done to test the clarity, sequence of items and applicability.

6. The estimated time needed to complete the questionnaire items from nursing staff was 10-15 minutes, (5minutes for first scale and 10 minutes for second scale).

7. Reliability of tools was tested using Cronbach's Alpha test, reliability of nursing staff perception regarding green hospital was=0.837 and reliability of nursing staff perception of effective hospital waste management was=0.878.

8. Data collection phase

The data were collected from nursing staff by the investigator, the investigator met nursing staff in the waiting area of their departments to explain the aim of the study and distribute the questionnaire individually. Data was collected three days per week. Subjects recorded the answer in the presence of the investigator to ascertain that all questions were answered. The data was collected over a period of four months from October to January 2024.

9. Statistical analysis of the data

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0 (Armonk, NY:

IBM Corp). Qualitative data were used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation and median.

Results

Table (1): showed that about half (46.8%) of nursing staff age was ranged from 25-35 years old with mean age 32.46 ± 10.0 . The majority (84.6%) of them are female and 71.7% were married. Regarding the education level, less than half (47.1%) of nursing staff had bachelor of science in nursing. Additionally, more than one third (36.5%) of nursing staff had less than 5 years of experience with mean 10.86 ± 10.16 . The majority (90.4%) of them were staff nurse and more than half (52.6%) worked in morning shift. Around three fifths (59%) of nursing staff had trained in waste management, while two fifth (41%) of them hadn't trained.

Figure (1): shows that highest percent (72.3%) of nursing staff were working at Intensive Care Units, while less than one third (27.6) were working in wards.

Table (2): Demonstrate solid waste management was ranked as the highest green hospital dimension (51.91 %) with Mean \pm SD 3.08 ± 0.81 , follow by environmental services (49.47%) with Mean \pm SD 2.98 ± 0.73 , while chemical management with was ranked as lowest green hospital dimension (42.34%) with Mean \pm SD 2.69 ± 0.74 .

Figure (2): shows that more than three quarters (79.5%) of nursing staff had a low level perception about overall

green hospital, while a low percent (.7%) of nursing staff had a high level perception about overall green hospital dimension.

Table (3): Demonstrates that waste collection was ranked as the highest effective hospital waste management dimension (66.26 %) with Mean \pm SD 3.65 ± 0.70 , followed by waste sorting (63.43 %) with Mean \pm SD 3.54 ± 0.58 , while waste processing was ranked as lowest dimension (47.61 %) with Mean \pm SD 2.90 ± 0.88 . **Figure (3):** shows that more than half (51.9%) of nursing staff had a low level perception of overall effective waste management dimension, while a low percent (2%) of nursing staff had a high level perception of overall effective waste management dimension. **Figure (4):** showed that there was a positive statistically significant correlation between overall green hospital and overall hospital effective hospital waste where $r = 0.511^*$, $p \text{ value} = < 0.001^*$.

Table (1): Distribution of nursing staff according to personal data (n = 293)

Nursing staff personal data	No.	%
Age		
< 25	71	24.2
25 ≤ 35	137	46.8
35 < 45	32	10.9
≥ 45	53	18.1
Min. – Max.	20.0 – 59.0	
Mean ± SD.	32.46 ± 10.0	
Median	29.0	
Gender		
Male	45	15.4
Female	248	84.6
Material status		
Married	210	71.7
Not married	83	28.3
Education level		
Secondary Nursing Diploma	44	15.0
Technical Nursing Institute	87	29.7
Bachelor of Science in nursing	138	47.1
Post graduate studies	24	8.2
Years of experience		
< 5	107	36.5
5 ≤ 15	105	35.8
15 ≤ 25	26	8.9
25 ≤ 35	48	16.4
≤ 35	7	2.4
Min. – Max.	1.0 – 40.0	
Mean ± SD.	10.86 ± 10.16	
Median	7.0	
Job title		
Head nurse	28	9.6
Staff nurse	265	90.4
Working shift		
Morning shift	154	52.6
Evening shift	91	31.1
Night shift	48	16.4
Have you been previously trained in waste management?		
No	120	41.0
Yes	173	59.0

SD: Standard deviation

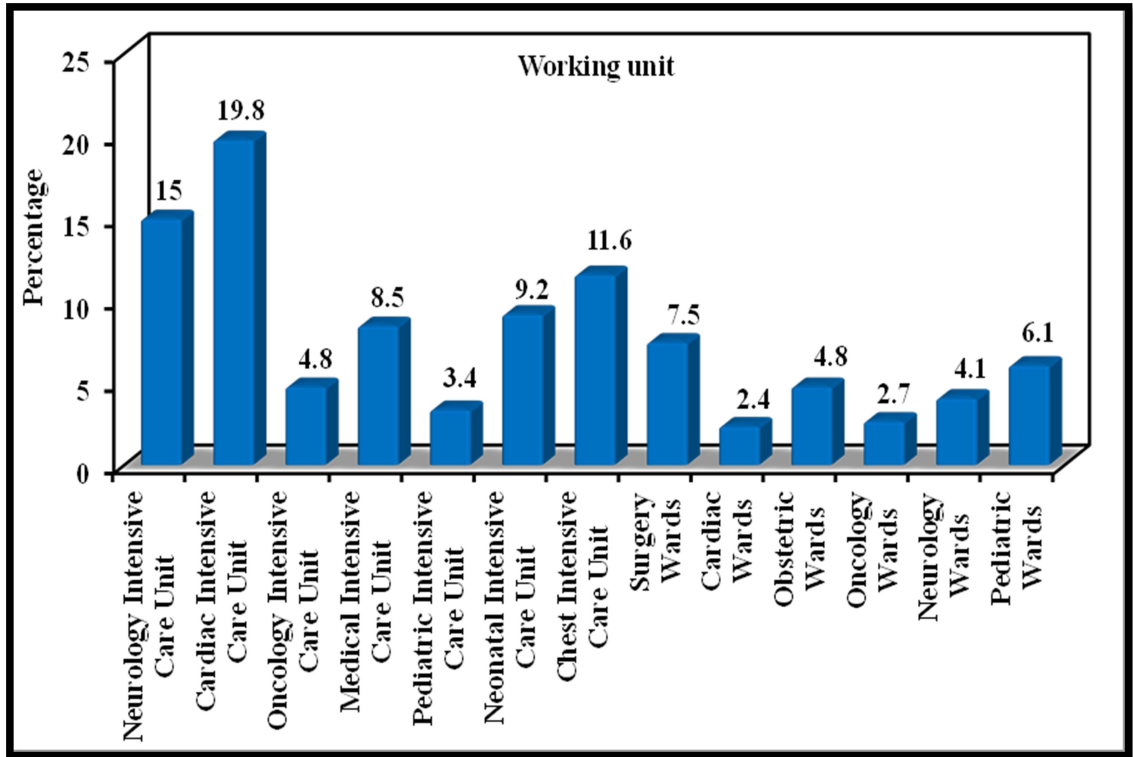


Figure (1): Distribution of the studied nurses according to working unit (n = 293)

Table (2): Mean score, Mean percent, standard deviation and rank of nursing staff according to green hospital dimensions (n = 293)

Green Hospital	Score Range	Total score			Average Score (1 – 5)	% Score	Rank
		Min. – Max.	Mean ± SD.	Median	Mean ± SD.		
Material and resources	(6 – 30)	6.0 – 30.0	16.94 ± 3.91	17.0	2.82 ± 0.65	45.58	4
Indoor environmental quality	(13 – 65)	18.0 – 59.0	38.12 ± 8.31	39.0	2.93 ± 0.64	48.31	3
Chemical management	(4 – 20)	4.0 – 20.0	10.77 ± 2.98	11.0	2.69 ± 0.74	42.34	5
Solid waste management	(5 – 25)	5.0 – 25.0	15.38 ± 4.06	15.0	3.08 ± 0.81	51.91	1
Environmental services	(6 – 30)	6.0 – 30.0	17.87 ± 4.38	18.0	2.98 ± 0.73	49.47	2
Overall	(34 – 170)	41.0 – 146.	99.09 ± 18.3	99.0	2.91 ± 0.55	47.86	

SD: Standard deviation

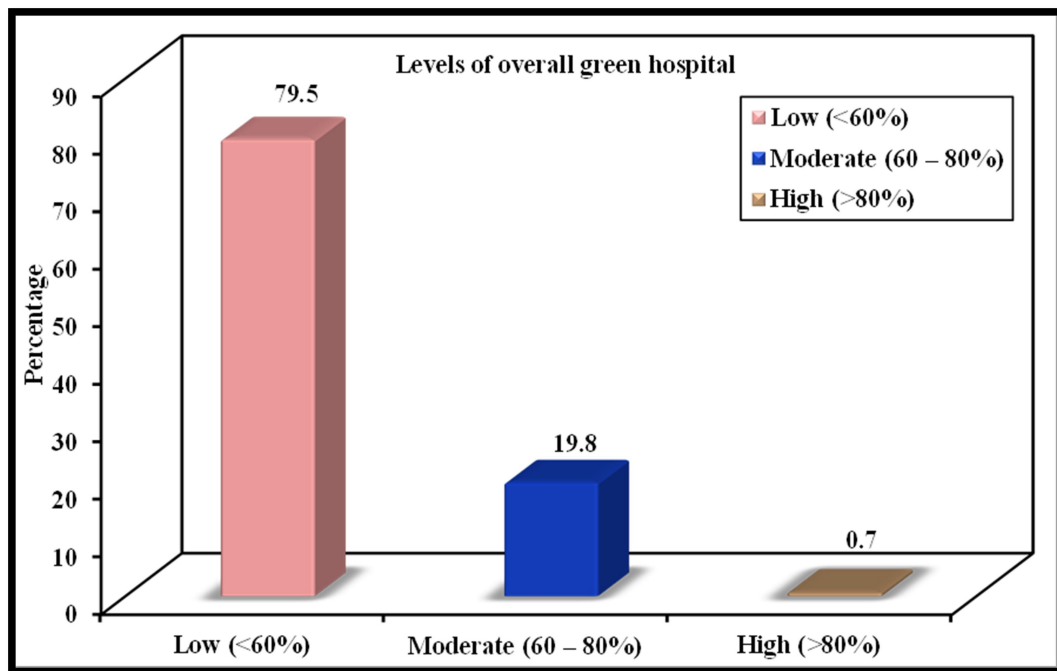
**Figure (2): levels of nursing staff perception about overall green hospital**

Table (3): Mean score, Mean percent, standard deviation and rank of nursing staff according to effective hospital waste management dimensions (n = 293)

Effective hospital waste management	Score Range	Total score			Average Score (1 – 5)	% Score	Rank
		Min. – Max.	Mean ± SD.	Median	Mean ± SD.		
Waste sorting	(10 – 50)	10.0 – 50.0	35.37 ± 5.83	36.0	3.54 ± 0.58	63.43	2
Classification of waste	(4 – 20)	4.0 – 20.0	13.66 ± 3.18	14.0	3.42 ± 0.80	60.39	3
Waste collection	(5 – 25)	5.0 – 25.0	18.25 ± 3.51	19.0	3.65 ± 0.70	66.26	1
Waste storage	(9 – 45)	9.0 – 45.0	29.46 ± 5.72	29.0	3.27 ± 0.64	56.83	6
Waste transfer	(5 – 25)	5.0 – 25.0	16.70 ± 3.95	17.0	3.34 ± 0.79	58.48	5
Disinfection	(4 – 20)	4.0 – 20.0	12.47 ± 3.21	13.0	3.12 ± 0.80	52.97	7
Waste processing	(3 – 15)	3.0 – 15.0	8.71 ± 2.63	8.0	2.90 ± 0.88	47.61	8
Disposal of waste	(6 – 30)	6.0 – 29.0	20.38 ± 3.78	21.0	3.40 ± 0.63	59.90	4
Overall	(46 – 230)	85.0 – 20.0	155.0 ± 23.6	153.0	3.37 ± 0.50	59.24	

SD: Standard deviation

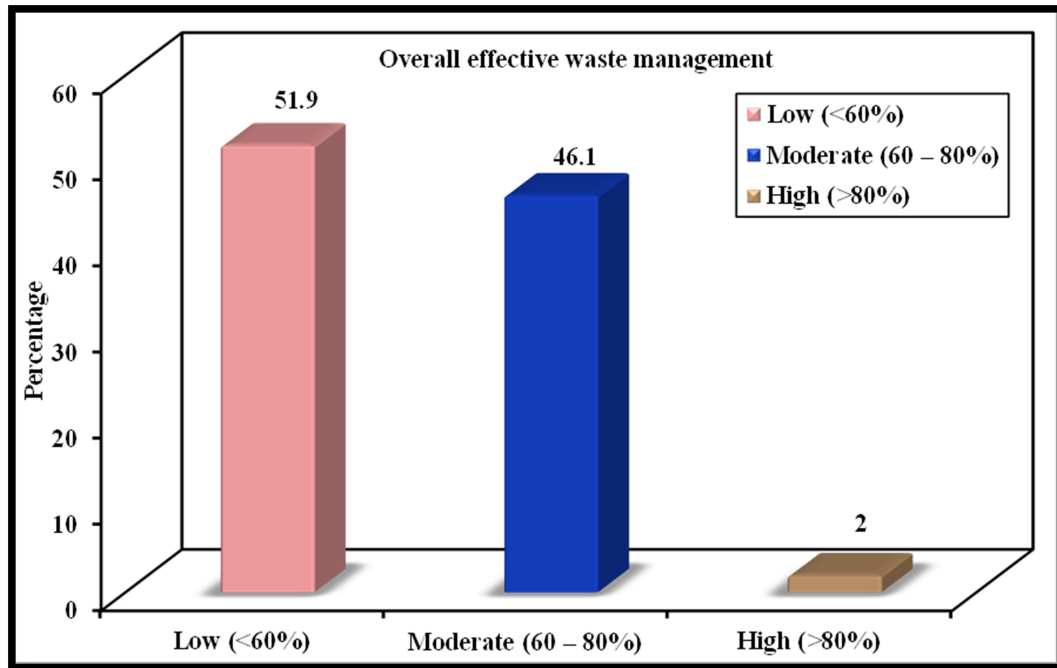


Figure (3): Levels of Nursing staff perception about overall effective waste management (n = 293)

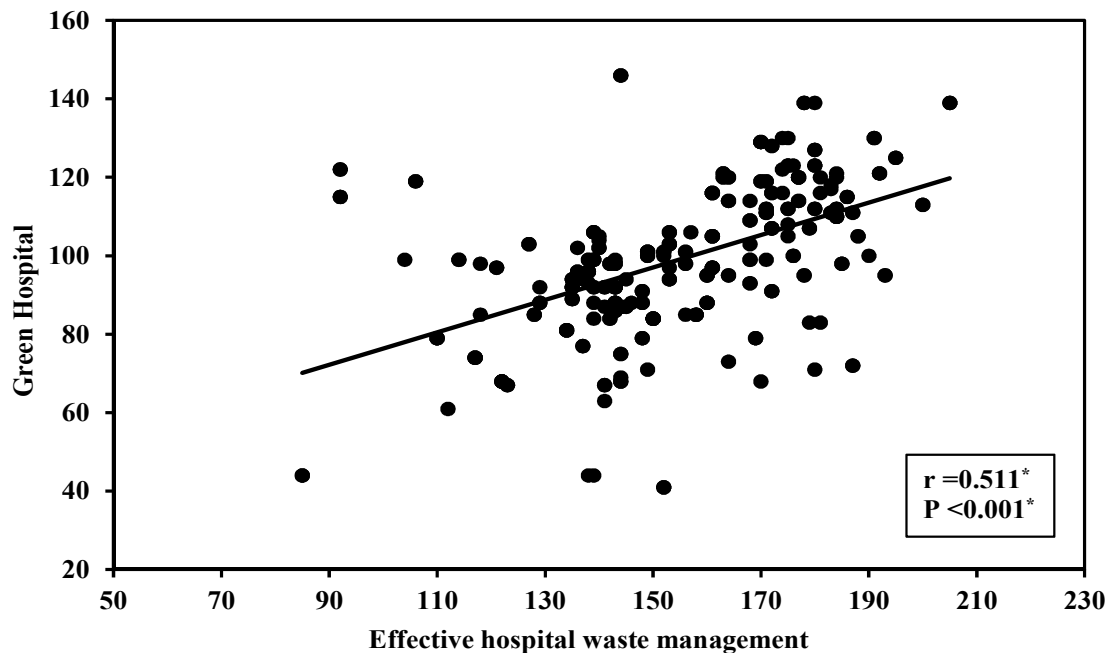


Figure (4): Correlation between overall green hospital and overall effective hospital waste management (n = 293)

Discussion

Green hospital perception among nursing staff

Results of the study showed that solid waste management was ranked as the highest percent followed by environmental services, while chemical management was ranked as lowest percent. According to the current study, more than three-quarters of nursing staff had a low perception level of overall green hospital. From the investigator point of view, this result may be due to nursing staff had not enough information about green hospital concept, they don't attending workshops, or the hospital management did not provide the necessary material for work. Along with the present study finding is, **Bharara Gur, Duggal, Jena, Khatri, & Sharma, (2018)** and **Chías& Abadad (2017)**, they demonstrated that nursing staff had a low perception level about overall green hospital dimension, on the other line, this result contradictory with **Dion & Evans, (2023)** and **Benzidia, Bentahar, Husson, & Makaoui, (2023)**, they not supported the present study and showed that nursing staff had a high level of perception about overall green hospital dimension.

Effective hospital waste management perception among nursing staff

Results of the study showed that solid waste collection was ranked as the highest percent followed by waste sorting, while waste processing was ranked as lowest percent. According to the current study results about half of nursing staff had a low perception level of overall effective waste management. This clarified by more than two-thirds of nursing staff had a moderate level perception about waste collection more than half of nursing staff had a moderate level perception on waste sorting. While, about three-quarters of them had a low level

perception about waste processing dimension of effective waste management.

From the investigator point of view, this study result may be due to lack of guidelines regarding waste management, lack of reporting about problem of waste management and the facility hadn't clear legislations about effective medical waste. Along with the present study findings is **Nassour, Nabhani-Gebara, Barton, & Barker, (2023)** who demonstrated that nursing staff had a low perception level of overall effective waste management dimension. On contrary, this result contradictory with **Altin, Budak, & Özcan, (2023)** and **Pamučar, Puška, Simić, Stojanović, & Deveci, (2023)** they not supported the present study and showed that nursing staff had a high level perception of overall effective waste management dimension.

III- Correlation and relation between study variable and nursing staff personal data

The present study findings illustrated that there was a positive statistically significant correlation between overall green hospital and overall effective hospital waste management. Also, this result may be due to a key factor in going to green hospital, the hospital must had a high score of effective waste management. Along with the present study findings is **Lattanzio e t al.,(2022)** **Suwasono et al., (2020)** and **Azmal et al., (2014)** who reported that there was a positive statistically significant correlation was found between overall effective hospital waste management and overall green hospital.

Conclusion

There was a positive statistically significant correlation between overall effective hospital waste management and overall green hospital .More than three quarter of

nursing staff had a low level perception of green hospital dimension, while a low percentage of nursing staff had a high level perception of green hospital dimension. About half of nursing staff had a low level perception of effective waste management dimension, while a low percentage of nursing staff had a high level perception of effective waste management dimension.

Recommendations

Hospital administrators need to -Pay concentration to green attraction and effective waste management , in light of incorporating sustainable procedure into the job description and performance evaluation process .

-Conduct periodical workshop and continuous training program to improve nurses, green consciousness and to develop green leadership methods for improving outcomes.

Nurse manager need to:

-Conduct regular in-service educational programs once monthly with nurses to foster their perception regarding green hospital and effective waste management.

Nursing education need to

-Offer opportunities for nursing students to participate in activities related to waste management.

-Establishment of an educational program to raise the awareness of nursing students and educators about green hospital.

Nursing research need to

-Conduct further nursing research can be handled to identify the nature of relationship between green hospital and patient outcomes.

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