

## **Scientific Paper Entitled: Nurses' Practices On Health Care Waste Management In The Government Health Sector In The Kingdom Of Saudi Arabia**

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### **Abstract**

*Background: The proper management of healthcare waste is crucial due to its potential risks to the environment and public health. Ensuring the safe handling and disposal of healthcare waste is an ethical responsibility of hospitals and healthcare providers, particularly the nursing staff.*

*Aim: This study aims to assess the knowledge and practices of staff nurses in El-Zohor Hospital, a government health facility in Saudi Arabia, regarding healthcare waste management. A descriptive study design was employed.*

*Subject and method: sample of 110 nurses was included. Data were collected using a questionnaire to assess knowledge and an observation checklist to evaluate the nurses' practices.*

*Results: Results indicated that the majority of nurses demonstrated satisfactory knowledge of healthcare waste management and displayed adequate practices in most aspects of waste management.*

*Conclusion: The findings also revealed a statistically significant correlation between nurses' knowledge and their actual practices in healthcare waste management.*

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*Recommendation: Based on these results, it is recommended that continuous monitoring be implemented to ensure strict adherence to safety regulations in waste handling within the healthcare facility.*

**Keywords:** *Health care, Knowledge, Practice, Staff nurses, Waste management.*

## Introduction

Hospitals are vital institutions in the Saudi Arabian government health sector, providing a wide range of healthcare services to the community. These services encompass curative, rehabilitative, preventive, patient care, and health education promotion activities (Patil & Pokhrel, 2012). It is the responsibility of hospitals and healthcare establishments to prioritize public health by ensuring a clean and healthy environment for both their employees and the community they serve.

Healthcare waste (HCW) refers to all waste generated by healthcare facilities, including health research facilities and associated laboratories (Onursal, 2011). HCW comprises solid or liquid waste that poses a potential infection threat to humans. It is generated from various healthcare establishments such as hospitals, clinics, dental practices, laboratories, blood banks, medical research facilities, veterinary hospitals, and other healthcare services (Sreegiri & Babu, 2009).

Hospital waste is a distinct category of waste that is highly hazardous due to its infectious and/or toxic characteristics. Moreover, the handling of such waste in healthcare units exposes waste management workers and the general public to increased risks. Although medical waste management practices may vary across hospitals, the problematic areas regarding waste management are generally similar across all healthcare units and stages, including segregation, collection, packaging, storage, transport, treatment, and disposal (Fluke, 2000).

Members of the healthcare team, including nurses, doctors, and housekeepers, are the first line of defense against the risks associated with healthcare waste. Without the cooperation of these healthcare team members, the hospital administration cannot effectively mitigate the hazards of healthcare waste. Waste segregation, which is crucial for proper healthcare waste management, begins at the point of waste generation. Therefore, healthcare team members must possess comprehensive awareness of the types of medical waste, their associated risks, and appropriate handling methods (Goddu, Duvvuri & Bakki, 2007; Pasupathi, Sindhu, Ponnusha & Ambika, 2011).

It is essential to dispel the misconception that medical waste management is solely reliant on the presence of incinerators and other treatment methods. Healthcare waste management is based on fundamental principles and the establishment of a comprehensive medical waste treatment system. The risks associated with medical waste extend beyond inadequate accumulation and treatment; they also encompass the potential for infection and risks that may arise before the waste reaches incinerators or other treatment facilities (Mohammed, 2009).

To ensure the proper long-term management of healthcare waste, regular supervision of staff practices is crucial. This responsibility should be assigned to a healthcare waste management officer and/or members of a healthcare waste management committee within each healthcare facility, depending on its size. Typically, the committee members include those responsible for addressing nosocomial infections. Ongoing training and awareness sessions should be organized to maintain the highest possible standards of practice (Aukour, 2008; Fasola et al., 2008).

### Significance of the study

Healthcare settings pose a significant environmental concern as they can harbor potentially dangerous microorganisms and elevate the risk of infection transmission among healthcare workers, patients, and the public. Biomedical waste presents a particular challenge in many healthcare facilities. Inadequate handling practices and improper disposal of biomedical waste are becoming a growing health hazard, posing risks to municipal workers, the general public, and the environment (Woromogo et al., 2020).

### Aim of the study

Evaluate the knowledge and practice of healthcare waste management among staff nurses.

### Research question

To accomplish the study's objectives, the following research inquiries are delineated:

1. What is the extent of staff nurses' comprehension and execution of healthcare waste management?
2. Do the nurses' levels of knowledge correlate with their implementation of waste management practices?

### Study Limitations

- Spatial Limitations: The study will be conducted in Riyadh, Saudi Arabia.
- Temporal Limitations: The study will be conducted in the year 2021.
- Human Limitations: The study will be conducted on a sample of healthcare staff in the government health sector in Riyadh.
- Subjective Limitations: The study is limited to investigating Nurses' practices on health care waste management in the government health sector in the Kingdom of Saudi Arabia.

## **Methods**

### Study design

A descriptive correlation research design was used for this study.

### study setting

This study was conducted in the government health sector in Saudi Arabia.

### Population

The study population consists of all nursing staff in the governmental healthcare sector in Riyadh city.

### Study sample

The study sample, selected from the study population, comprises a subset of individuals or elements representing the population accurately. The sample is chosen based on scientific criteria, utilizing random or non-random selection methods. The researchers selected a random sample of 110 nursing staff from the governmental healthcare sector in Riyadh city.

### Inclusion criterion

1. Agree to participate in the study.
2. They have at least one year of experience in their current job.

### Tools for data collection

Data for this study was collected by using two tools

### First tool knowledge questionnaire sheet

This tool was used for the purpose of assessing nurses' knowledge about health care waste management. It is divided into two parts:

- The First Part: (Personal and Job Characteristics Data Sheet):

This section, designed by the researcher, aimed to gather data on demographic and job-related characteristics of the respondents. These included age, gender, educational qualifications, years of experience, working units, marital status, and attendance of relevant training courses.

- The Second Part: (Knowledge Questionnaire Sheet)

This section of the study, based on scientific literature (WHO, 2005; Rao, 2008; Hegde et al., 2009; Athy, 2009; Sreegiri & Babu, 2009; Soliman & Ahmed, 2010; WH, 2010; Singh et al., 2011; Khan et al., 2012), was developed by the researcher to assess the knowledge of staff nurses regarding healthcare waste management. It consisted of 39 items, including 12 multiple-choice questions and 27 true or false statements. The questionnaire covered nine dimensions, namely: healthcare waste background (7 items), healthcare waste classification (5 items), healthcare waste hazards (2 items), healthcare waste segregation (6 items), healthcare waste collection (5 items), healthcare waste storage (3 items), healthcare waste transportation (3 items), occupational health and safety measures of healthcare waste management (3 items), and universal precautions of healthcare waste management (5 items).

### Scoring System

The scoring system for the questionnaire involved assigning a score of one for correct answers and zero for incorrect answers in true or false questions. For multiple-choice questions, a score of one was given for the correct answer and zero for an incorrect answer. The knowledge score was deemed satisfactory if it reached 60% or higher and unsatisfactory if it fell below 60% (Hassan, 2012).

### Second tool: Observation Checklist (Appendix II)

This tool, adapted from Hassan (2012), was utilized to assess the practice of staff nurses in relation to healthcare waste management. It comprised 26 items designed to gather data on nurses' practices regarding waste management. These items were categorized into eight dimensions, namely: segregation of hazardous waste (3 items), nursing trolley (6 items), sharps box (5 items), chemical waste bucket (3 items), small red bags (2 items), large red bags (2 items), small black bags (3 items), and large black bags (2 items).

### Scoring System

The scoring system for evaluating the practice of staff nurses involved assigning a score of one for each step performed correctly and a score of zero for steps not completed. The practice was deemed proper if the percentage score reached 60% or higher and inadequate if it was below 60% (Samin et al., 2011).

## OPERATIONAL DESIGN

The operational design consists of the preparatory phase, pilot study, validity and reliability, and fieldwork.

### 1- The Preparatory Phase

This involves examining existing literature, a variety of studies, and theoretical frameworks concerning various facets of the issues, utilizing resources such as books, articles, the internet, and academic journals.

## 2- Pilot study

A pilot study was conducted over a span of two weeks, involving 10% (11 nurses) of the total sample size. This pilot aimed to assess the suitability, feasibility, and clarity of the tools, as well as to evaluate the sequence of questions to ensure consistency. Additionally, it helped estimate the time required to complete the tool. Based on the findings from the pilot study, minor adjustments were made, and the pilot data were subsequently integrated into the main study.

## 3- Content Validity

A panel of five experts in Nursing administration, Community health nursing, Pediatric nursing, and Medical and surgical nursing reviewed the tools. Necessary modifications were made based on their feedback to ensure the validity of the tools.

## 4- Reliability

The reliability of the tools was assessed by examining their internal consistency through a Cronbach's Alpha reliability test. The knowledge questionnaire demonstrated a reliability of 0.79, whereas the observational checklist exhibited a reliability of 0.81.

## 5- Field of work

Once the necessary permissions were obtained from the hospital, the researcher met with the medical director and matron to explain the aim and process of the study. Their support and cooperation were sought. Subsequently, individual nurses were approached, and their participation in the study was invited. The nature of the study and the data collection procedure were explained, and their consent was obtained, ensuring the confidentiality and anonymity of their responses.

The researcher distributed the data collection forms along with instructions on how to fill them out. To avoid any missing data, the filled forms were collected in a timely manner and checked for completeness. It took approximately 20-30 minutes for each participant to complete the form.

Data collection took place on two specific days per week during the morning shifts, specifically on Mondays and Wednesdays, between 9:30 am and 1:30 pm. The researcher was present throughout this period to clarify any ambiguities and address any questions that arose. The researcher utilized an observational checklist to assess the nurses' practice, and each nurse's practice was observed for each skill over a period of 20 minutes, conducted three times.

## Ethical Consideration

This study received ethical approval from the Medical Ethics Committee of government health sector in Riyadh city. Prior to data collection, informed consent was obtained from all participants, ensuring their understanding and agreement to participate. The confidentiality of participants' clinical data and basic information was strictly maintained.

## Statistical analysis

The raw data underwent coding and were organized into a coding sheet. Subsequently, the accuracy of the results was verified. The data were then entered into SPSS system files (version 18) using a personal computer. Output drafts were cross-checked with the revised coded data to identify any typing or spelling errors. Finally, data analysis and interpretation were performed.

## Result

Table 1 presents the socio-demographic characteristics of the nurses included in the study, conducted in the government health sector in Saudi Arabia. A total of 110 nurses

participated, with 63.6% of them belonging to the age group of over 30 years, and a mean age of  $34.3 \pm 7.8$  years. The majority of the nurses (93.6%) were female, and 73.6% held a Secondary nursing diploma. More than half of the participants (56.4%) had over five years of experience, and all nurses had attended training programs in waste management.

Table 2 provides an overview of the nurses' knowledge regarding health care waste management. It indicates that all staff nurses possessed knowledge about universal precautions and waste transportation. However, only 36.4% of the nurses had knowledge about the background of health care waste management. Overall, the majority of the nurses (80.0%) exhibited satisfactory knowledge related to waste management.

Table 3 presents the observed practice of the nurses in relation to health care waste management. It shows that all staff nurses adhered to the proper handling of the nursing trolley. Additionally, 52.7% of the observed nurses demonstrated proper handling of the chemical waste bucket. The table further indicates that the majority of the nurses exhibited adequate practice in managing health care waste.

Table 4 depicts the relationship between nurses' knowledge of health care waste management and their personal and job characteristics. According to the table, staff nurses who had satisfactory knowledge tended to be over the age of 30, female, hold a technical institute diploma, and have more than 10 years of experience in the nursing field. The table also indicates statistically significant associations between nurses' knowledge and their age, nursing qualification, total experience, and department.

Table 5 reveals the relationship between the practice level of staff nurses and their personal and job characteristics. It shows that the highest percentage of nurses with adequate practice were over the age of 30, female, held a technical institute diploma, had current experience of more than 5 years, and had a total experience of more than 10 years. However, none of these relationships were statistically significant.

Table 6 illustrates the relationship between nurses' total knowledge of health care waste management and their total practice. According to the table, the highest percentage of nurses with satisfactory knowledge also exhibited adequate practice (86.4%). Furthermore, there was a statistically significant relationship between total knowledge and total practice ( $p=0.03$ ).

Table 1

Percentage distribution of studied nurses related to Socio-demographic characteristics (n=110)

	No	%
Age:		
<30	40	36.4
30+	70	63.6
Range	23.0-59.0	
Mean $\pm$ SD	34.3 $\pm$ 7.8	
Median 32.0	32.0	
Gender:		
Male	7	6.4
Female	103	93.6
Nursing qualification:		
Secondary nursing diploma	81	73.6

Technical institute diploma	29	26.4
Experience years (total):		
<10	31	28.2
10+	79	71.8
Range	2.0-39.0	
Mean±SD	15.2±8.1	
Median	13.5	
Experience years (current):		
<5	48	43.6
5+	62	56.4
Range	1.0-6.0	
Mean±SD	4.6±1.6	
Median	5.0	
Department:		
Emergency	25	22.7
CCU	11	10.0
Critical care	16	14.5
Outpatient	9	8.2
Central sterilization	6	5.5
Operation room	14	12.7
Medical	16	14.5
Attending training program in waste management:		
Yes	110	100
No	0.0	0.0

Table 2

Percentage distribution of studied nurses' knowledge related to health care waste management (n=110)

Satisfactory knowledge (60%+) of:	No	%
Waste management elements knowledge:		
Background of waste management	40	36.4
Waste classification	74	67.3
Waste hazards	80	72.7
Waste segregation	89	80.9
Waste collection	109	99.1
Waste storage	88	80.0
Waste transportation	110	100.0

Occupational safety measures	70	63.6
Universal precautions	110	100.0
Total knowledge:		
Satisfactory	88	80.0
Unsatisfactory	22	20.0

Table 3

Percentage distribution of studied nurses practice related to health care waste management (n=110)

Waste management practice area:	Practice percent	
	No	%
Adequate practice (80%+) of:		
Segregation of hazardous waste	92	83.6
Nursing trolley	110	100.0
Sharps box	85	77.3
Chemical waste bucket	58	52.7
Small red bags	68	61.8
Large red bags	109	99.1
Small black bags	67	60.9
Large black bags	108	98.2
Total practice:		
Adequate	90	81.8
Inadequate	20	18.2

Table 4

Relation between nurses' knowledge of health care waste management and their socio-demographic characteristics (n=110)

Socio demographic characteristics	Knowledge score				X <sup>2</sup> test	P-test
	Unsatisfactory		Satisfactory			
	No.	%	No.	%		
Age:						
<30	12	30.0	28	70.0		
30+	10	14.3	60	85.7	3.93	0.047*
Gender:						
Male	2	28.6	5	71.4		
Female	20	19.4	83	80.6	Fisher	0.63
Nursing qualification:						
Secondary nursing diploma	21	25.9	60	74.1		
Technical institute diploma	1	3.4	28	96.6	6.74	0.01*
Experience years (total):						

<10	10	32.3	21	67.7		
10+	12	15.2	67	84.8	4.05	0.04*
Experience years(current):						
<5	12	25.0	36	75.0		
5+	10	16.1	52	83.9	1.33	0.25
Department:						
Emergency	9	36.0	16	64.0		
CCU	1	9.1	10	90.9		
Critical care	1	6.3	15	93.8		
Outpatient	1	11.1	8	88.9		
Central sterilization	0	0.0	6	100.0		
Operation room	0	0.0	14	100.0	21.48	0.003*
Medical	3	18.8	13	81.3		
Surgical	7	53.8	6	46.2		

(\*) Statistically significant at  $p < 0.05$

Table 5

Relation between nurses' practice of health care waste management and their socio-demographic characteristics (n=110)

Socio demographic characteristics	Practice score				X <sup>2</sup> test	P-test
	Adequate		Inadequate			
	No.	%	No.	%		
Age:						
<30	31	77.5	9	22.5		
30+	59	84.3	11	15.7	0.79	0.37
Gender:						
Male	5	71.4	2	28.6		
Female	85	82.5	18	17.5	Fisher	0.61
Nursing qualification:						
Secondary nursing diploma	65	80.2	16	19.8		
Technical institute diploma	25	86.2	4	13.8	0.51	0.48
Experience years (total):						
<10	22	71.0	9	29.0		
10+	68	86.1	11	13.9	3.42	0.06
Experience years(current):						
<5	39	81.3	9	18.8		
5+	51	82.3	11	17.7	0.02	0.89

Department:						
Emergency	10	40.0	15	60.0		
CCU	9	81.8	2	18.2		
Critical care	16	100.0	0	0.0		
Outpatient	9	100.0	0	0.0		
Central sterilization	5	83.3	1	16.7		
Operation room	14	100.0	0	0.0		
Medical	16	100.0	0	0.0	--	--
Surgical	11	84.6	2	15.4		

(-- ) Test result not valid

Table 6

Relation between nurses' total knowledge of health care waste management and their total practice (n=110)

Total knowledge	Total practice				X <sup>2</sup> test	P- test
	Adequate		Inadequate			
	No.	%	No.	%		
Total knowledge:						
Unsatisfactory	14	63.6	8	36.4		
Satisfactory	76	86.4	12	13.6	Fisher	0.03*

(\* ) Statistically significant at  $p < 0.0$

## Discussion

In the 21st century, effective medical waste management has become a critical concern for healthcare organizations worldwide. Improper management of medical waste can pose significant environmental hazards and public health risks, particularly in developing countries (Awodele, Adewoye & Opar, 2016).

In the current study conducted within the government health sector in Saudi Arabia, the results revealed that the majority of nurses were female and over 30 years old, with an age range of 23-59 years and a mean age of  $34.1 \pm 7.8$ . Most nurses held a secondary nursing diploma and had more than ten years of experience in the nursing field. All nurses were actively attending training programs in waste management.

Regarding the knowledge level of staff nurses, the study found that the majority had satisfactory knowledge regarding health care waste management. This could be attributed to various factors, such as the supervision of an infection control nurse, participation in refresher conferences during employment, the availability of waste management handouts as nursing guides, and orientation programs and training facilities related to waste management. These findings align with a study by Wasee, Hassan, Baba, Kadrizo & Nazi (2010) which reported that nurses' improved knowledge could be attributed to their active involvement in hospital waste management, including the appointment of an infection control nurse responsible for BMW (biomedical waste) policy formation, implementation, and revision, as well as regular in-service education programs.

Similar findings were reported by Saini, Nagarajan & Sarma (2011), who evaluated biomedical waste management among staff nurses in a tertiary level hospital in India and found that 85% of nurses had good knowledge in this area. Awodele et al. (2016) conducted a study to assess the knowledge, attitude, and practice of the healthcare team regarding biomedical waste management methods and found that 95.8% of nurses had knowledge about the health hazards associated with biomedical waste management.

In a study conducted in private hospitals in India by Ramokate et al. (2013), it was found that the majority of nursing staff had the perception that biomedical waste (BMW) is different from general waste and requires special attention for proper management. This finding is consistent with a study conducted in Johannesburg by Sawalem & Selic (2012), which showed that 90% of respondents treated biomedical waste differently from general waste.

However, contrasting findings were reported by Mustafa, Shazly & Sherief (2012) who found that almost all nurses (98.7%) had unsatisfactory knowledge regarding health care waste management before the implementation of an educational training program at Mansoura University Hospital. The present study's results are also inconsistent with EL-Awady (2009), who implemented an educational program about medical waste management in Zagazig University hospitals and found that only a minority (25%) of participants had good knowledge. Similarly, Deno (2011) found that nurses working in a general hospital in Malaysia had a mean knowledge score of  $45.5 \pm 10.52$ , indicating unsatisfactory knowledge.

Regarding nurses' practice level, the present study found that the majority (81.8%) of nurses had adequate practices in most areas of waste management. This can be attributed to their satisfactory knowledge, the availability of training courses and programs, adequate supplies, good supervision by the infection control team, and nurses' recognition of biomedical waste management as an important aspect of providing quality patient care. These findings are supported by Mathur et al. (2011), who stated that good practice is the result of theoretical understanding that helps nurses acquire new skills. Additionally, Shafee et al. (2010) claimed that all nurses were practicing health care waste management according to the rules.

In terms of the relationship between nurses' knowledge level and personal characteristics, the study findings revealed a positive correlation between nurses' knowledge and their age and years of experience. This suggests that as nurses' age and experience increase, their knowledge regarding biomedical waste management significantly improves. This may be attributed to older nurses being familiar with the hospital system, routine work, and their participation in numerous educational programs. Furthermore, nurses with more years of nursing experience tend to become more knowledgeable and expert in their field.

The views expressed by Patil & Shekdar (2004) align with the present study, indicating that nurses with more years of nursing experience tend to become more expert, knowledgeable, and confident in pursuing a standard of excellence. This finding is consistent with the study conducted by Ismail et al. (2013) in India, which concluded that increased age and experience are associated with significant increases in knowledge regarding biomedical waste management among nursing staff.

However, the findings of Al-Khatib (2007) contradict the present study, as they showed that years of experience had no influence on the knowledge of staff nurses regarding health care waste. Al-Khatib suggested that this could be due to a lack of regular in-service orientation courses providing recent scientific information. Furthermore, Saraf & Shinda (2009) demonstrated a negative relationship between personal characteristics and nurses' knowledge.

Regarding the relationship between staff nurses' practice level and personal characteristics, the present study found a statistically significant positive correlation between nurses'

practice and their age and years of experience. This suggests that with an increase in age and experience, there is a significant improvement in practice regarding biomedical waste management. This may be attributed to older and more experienced nurses attending numerous training programs. This view is supported by Radha (2012), who emphasized the critical role of training for both technical and non-technical staff in ensuring proper and appropriate biomedical waste management. Additionally, Mohamed (2009) and Mnowan (2012) reported a positive statistically significant relationship between nurses' age and their performance.

However, the findings of Hassan (2012) and Katoch (2007) contradict the present study, as they found no statistically significant relationship between nurses' practice and their years of experience.

Regarding the relationship between knowledge and practice among staff nurses, the study findings indicated a statistically significant correlation between nurses' knowledge and practice scores. This may be attributed to the hospital's commitment to quality and the provision of waste management training programs to nurses with adequate knowledge, leading to their increased commitment to practicing waste management policies and rules. The World Health Organization (WHO, 2005) emphasizes that training aims to develop a competent workforce and raise awareness of health, safety, and environmental issues related to healthcare waste management.

These findings are in line with Khan et al. (2012), Hassan (2012), and Sarma et al. (2011), who all found statistically significant correlations between nurses' knowledge and practice scores, as well as a positive correlation between nurses' knowledge and their performance.

## Conclusion

Based on the findings of this study conducted in the government health sector in Saudi Arabia, it can be concluded that 80% of staff nurses demonstrated satisfactory knowledge regarding health care waste management. Furthermore, a significant majority of 81.8% of staff nurses exhibited adequate practices in various aspects of waste management.

The study also revealed a statistically significant correlation between nurses' knowledge and their practice in relation to health care waste management. This indicates that nurses who possessed greater knowledge in this area were more likely to demonstrate better practices.

Moreover, the results indicated a positive and statistically significant relationship between nurses' knowledge, practice, and their social demographic characteristics, specifically in terms of age and years of experience. This suggests that older and more experienced nurses tended to have higher levels of knowledge and better practices in health care waste management.

## Recommendations

In hospital management

1. Clear policies and plans must be formulated by hospitals within the Saudi Arabian government health sector to effectively manage and dispose of hospital waste. It is imperative that comprehensive guidelines for safe hospital waste management are activated and accessible across all departments.
2. Adequate financial and human resources should be allocated by government health facilities in Saudi Arabia to implement the Healthcare Waste Management (HCWM) plan efficiently.

3. There should be rigorous monitoring and supervision mechanisms in place to ensure compliance with safety regulations in waste handling and to foster the effective implementation of HCWM practices in hospitals within the Saudi Arabian government health sector.

4. Incentive schemes should be introduced by government health facilities in Saudi Arabia to motivate staff nurses towards adopting safe waste management practices.

#### In education

1. Regular evaluation of nurses' knowledge and practices concerning hospital waste management is crucial within the government health sector in Saudi Arabia to pinpoint areas requiring further training among nurses.

2. Comprehensive training programs are indispensable for cultivating an understanding of health, safety, and environmental concerns among healthcare staff. It is imperative for employees to be aware of and comprehend the potential risks associated with healthcare waste.

3. A structured infection control program aimed at educating staff nurses about the dangers of needlestick injuries is essential within the government health sector in Saudi Arabia. This program should focus on raising awareness and educating nurses about infection control measures, disease transmission, post-exposure prophylaxis, and the benefits of vaccines and other preventive measures to effectively instill a change in attitude.

4. Government health facilities in Saudi Arabia should offer staff nurses an in-service training program focused on healthcare waste management, practices, and monitoring to ensure adherence to proper waste disposal protocols.

#### In research

Further studies need to be conducted to:

1. Evaluate nurses' understanding and implementation of biomedical waste management, as well as the factors and obstacles influencing it.

2. Reassess the correlation between nurses' comprehension and practical application.

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