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Assessment of knowledge, attitude and practice among nurses about hospital waste management at tertiary care hospital Lahore, Pakistan

Rida Anjum*
Aligarh College Of Nursing and Allied Health Sciences Lahore
Email: ridaanjum50@gmail.com
Zarnab George
Aligarh College Of Nursing and Allied Health Sciences Lahore
Email: zarnabgeorge50@gmail.com
Sara Haroon
Aligarh College Of Nursing and Allied Health Sciences Lahore
Email: saraharoon282@gmail.com
Irsa Khalid
Aligarh College Of Nursing and Allied Health Sciences Lahore
Email: irsakhalid389@gmail.com
Neelam Ashraf
Aligarh College Of Nursing and Allied Health Sciences Lahore
Email: neelamaka25@gmail.com
Razia Parveen
(Principal Aligarh College of Nursing and Allied Health Sciences Lahore)
Email: razoap123@gmail.com
Ali Hamza
(Senior Nursing Instructor Aligarh College of Nursing and Allied Health Sciences Lahore)
Email: Alihamzarajpoot55@gmail.com

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Corresponding E-mails & Authors*:

Rida Anjum

ridaanjum50@gmail.com

Abstract

Background:

Hospital waste management is a vital aspect of infection control and environmental safety. Improper handling of biomedical waste exposes healthcare workers, patients, and the community to serious health risks, including infectious diseases and environmental hazards. Nurses play a key role in waste segregation and disposal practices.

Objective:

To assess the knowledge, attitude, and practices (KAP) of nurses regarding hospital waste management at a tertiary care hospital in Lahore, Pakistan.

Methods:

A descriptive cross-sectional study was conducted among 80 nurses selected through simple random sampling. Data were collected using a structured, validated questionnaire covering demographic characteristics and KAP domains. Data analysis was performed using SPSS version 27, applying descriptive statistics and Pearson correlation tests.

Results:

The study revealed moderate levels of knowledge (mean = 13.58 ± 1.11) and attitude (mean = 6.55 ± 0.95), while practice levels were relatively higher (mean = 11.98 ± 0.59). Most nurses recognized the hazardous nature of hospital waste (100%) and supported segregation (98.8%). However, 76.3% failed to correctly identify biological waste, indicating a key knowledge gap. Despite 91.3% receiving formal training, only 10% reported actual waste segregation during collection. Correlation analysis showed a significant positive relationship between knowledge and attitude ($r = 0.319$, $p = 0.004$), whereas knowledge–practice and attitude–practice relationships

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were weak and non-significant.

Conclusion:

Although nurses demonstrated adequate knowledge and positive attitudes, a significant gap exists between knowledge and actual practice. Strengthening behavioral training, supervision, and compliance monitoring is essential to improve effective hospital waste management.

INTRODUCTION

Waste in health care facilities is anything generated during one of the medical, diagnostic, treatment or laboratory procedures which could harm individuals and the environment unless appropriately disposed to. The biomedical waste that includes the infectious waste, sharps and hazardous waste is a major percentage of the waste produced by hospitals and which should be discarded abiding by stringent regulations. Clinical operations may produce hazardous wastes which must be segregated and properly disposed of like infectious and chemically contaminated sharps, pharmaceutical and radioactive wastes. But still incidences of sickly and careless hospital management are reported consequently leading to diseases transmission, accidental and natural injuries.(Ali et al., 2025)

Medical waste generated in healthcare facilities is extremely diverse and much of the medical waste will be incredibly hazardous to the environment and human health, unless isolated in a safe way. (Okechukwu, 2021). It can also transmit infectious diseases such as HIV, hepatitis B and C particularly when there is an injury due to needlestick, handling on an infected sharps or even handling the material in contact with blood and body fluids. The infections pose work risk to the nurses and other front line workers and life time complications of health. (Ullah et al., 2024). This responsibility of not getting rid of the trash the right way is even more troublesome when one thinks of the fact that the transmission of highly contagious diseases and the fact that when it comes to the front line the health workers specifically the nurses were the first to be there the appropriate measures were never taken on them. (Aravind et al., 2023)

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Safe segregation The three colored coded bins will have to be stored in the appropriate location and as an illustration hazardous or biomedical waste should be in red, sanitary and medical waste should be in yellow and general waste that cannot be recycled should be in grey. (Aravind et al., 2023). But this easy demand remains a challenge to be implemented in most hospitals. Researchers have pointed out issues like contamination and non-contamination of waste, inconsistency in delivery of the same to the land fills, faulty incinerators and failure of regular surveillance.

(Ferawati, Nuraini, and Aida Fitria, 2025)

Such shortcomings translate to environments whereby the health practitioners are exposed to chemical and biological exposure. (Okechukwu, 2021). With a weak financial standing, conflicting national objectives and the lack of institutions, regulation of such rubbish has turned into a huge community health hazard to the majority of developing countries. This situation highlights the importance of understanding the quality of hospitals as far as medical waste disposal is concerned, and what are in reality the centers of failure that expose patients to risk and noncompliance with the law.

(Shalanyuy, Njiomene Matuedem Vanina Luz and Mengnjo, 2025) What the current literature is at least mindful of is that the proportion of the biomedical waste management in most health care settings is disproportionate and that there is variation in the knowledge, capacity and barriers of compliance. The most contentious areas and gaps would be significant to address by conducting systematic reviews of knowledge, attitudes and practices of nurses to enhance performance of waste management in the healthcare facility. (Ali et al., 2025). The majority of the countries possess laws and regulations, working rules, but there is not the effective control, the old facilities or the absence of special facilities and training on waste management facilities. It is the fact that hospitals will expose both the flaws between the scheduled and the actual practices in order to develop more specific measures which may involve a more rigid supervision, formal educational processes, or more effective use of resources. (Kaban et al., 2025)

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Despite the evidences that unsafe behaviors are able to raise the risk of infections, sharps injuries and environmental risks, however, the recent researches on the same topic do not provide a concise finding as to whether or not the nurses possess good attitudes or knowledge of safe waste management. These inconclusive results suggest that further research is needed to be able to fine-tune the existing assumptions and outline the existing difficulties. The level of their expertise and opinion is also important predictors of the overall efficiency of waste management in a hospital since they are the most directly engaged with the management, disposal and segregation of medical waste. To know whether they are being addressed as per the requirements that are being set or whether they need new interventions we would have to determine their level of awareness, their perception of the safety measures and what they are actually doing in real life. It is hoped this study will endow the hospital administrators, law makers and health educators with constructive materials that will lead them to close such loopholes and eventually, boost occupational security, environmental security and quality of service delivery to their patients. Thus, to enhance better waste management systems, and reduce the risks of all potentially dangerous medical wastes, this type of assessment is not only a quite timely practice, but a need.

There were elaborate protocols but there has always been breach of protocols and lack of awareness, cut corners of safety in healthcare facilities. These dimensions of behavior have not well been captured in the literature, especially in low resource settings and it is necessary to conduct a context sensitive research that will be able to capture these aspects. (Ali et al., 2025). A teamwork must possess the right BMW management. Otherwise, at risk individuals who have to work with BMW will have a more favorable opportunity to experience needle stick injury and an infectious disease spread. (Aravind et al., 2023)

Medical waste handlers are at more risk of being exposed to HBV and HCV since they are almost always in contact with waste materials that could have been in contact with the virus like needles, surgical tools and other medical waste that may be carrying the virus. Although the risks exist, there has been a lack of data on the nature of HBV and HCV among medical waste handlers

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in most parts of the world including Pakistan where the issue of healthcare-associated infections is of great concern. (Ullah et al., 2024)

The problem of mixing infectious and non-infectious medical waste and even non-standard transportation only worsened management of medical waste in most hospitals in Indonesia. Some hospitals might also be faced with the problem of incinerators and waste destruction systems that cannot operate optimally due to several factors, such as the lack of permits or an outdated system. Most Indonesian hospitals in a move to improve management of medical waste in hospitals have pursued a more systematic sorting of waste, and embraced standard operating procedure in management of medical waste. In other hospitals however there is difficulty in sorting, gathering and destroying waste and lack of supervision that leads to violation of established procedures. (Ferawati, Nuraini, and Aida Fitria, 2025)

Previous studies have determined that improper management of medical waste in hospitals can lead to sharp injuries, environmental pollution with harmful chemicals and diseases that are caused by infectious agents. The hospital waste management is a highly complex one. The least considered aspect is the waste management supervisions. Supervisory mechanisms are supposed to be more conducive and encouraging since the hospital managers would have to be prepared with enhanced supervisory skills. (Kaban et al., 2025)

The studies show that healthcare waste management in Cameroon is not effective due to ineffective healthcare policies, inadequate financial resources, lack of operational incinerators, and ineffective training of the healthcare staff that leads to poor knowledge, poor attitudes and poor practices of the healthcare staff towards healthcare waste segregation.

(Shalanyuy, Njiomene Matuedem Vanina Luz and Mengnjo, 2025) Adequate management of hospital waste is vital to the health of the people, the environment, and legal regulations. It eliminates the spread of diseases and infections, and thus helps to keep the patient, health workers, waste workers and the community at large off the hazardous materials such as used needles, pathological tissues and even infectious agents.

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Environmentally speaking, appropriate management will be done in terms of treatment and disposal of the hazardous chemicals and pharmaceuticals, and genotoxic waste, hence avoiding soil and water pollution. When certain types of wastes are burned, their volume and toxicity are decreased. Also, the strict segregation and management allow to regulate costs and maintain adherence to the government regulations. The malfunction in the whole system of waste management may lead to the outbreak of diseases, environmental pollution, and legal penalties, which highlights the importance of an effective waste management process as an essential part of responsible and safe healthcare provision.

OBJECTIVES

- To evaluate the degree of understanding, the perception of attitude and real practice of nurses on hospital waste management in tertiary care hospital Lahore, Pakistan.
- To determine factors that affect knowledge, attitude, and practice scores of nurses regarding hospital waste management at tertiary care hospital Lahore, Pakistan.

METHODOLOGY

Study Design

A descriptive cross-sectional study design was used.

Study Setting

The research was conducted in the selected units/ wards such as the surgical ward, gynae ward, OT, and ICU at the tertiary care hospital, Lahore, Pakistan whereby the nurses are directly in charge of handling hospital waste.

Study Variables

The research variables consisted of the following variables about hospital waste management of the nurses:

❖ **Independent Variables:**

Knowledge

Attitude

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❖ **Dependent Variables:**

Practice

Sample Size

Sample size was 80, which was determined by using Solvins formula.

Where, n=N/1+Ne2

Whereas n=sample size N=population size (100)

e=margin of error which is constant (0.05) n=100/1+100(0.05)2

n=100/1+100(0.0025) n=100/1.25 n=80

- **Inclusion Criteria:**
  - Staff Nurse
  - Registered Nurse
  - Nurse Manager
  - In-charge Nurse
- **Exclusion Criteria**
  - Nurse Educator
  - Nurse Administrative
  - Administrative Personnel
  - Housekeeping
  - Nurses on leave or not present during the study period.
  - Incomplete or invalid responses by participants to the assessment tools.

RESULTS

Section 1: Demographic Information

Variable / Item	Response	Frequency (n)	Percentage (%)	Mean ± SD
Gender	Male	27	33.8	1.66 ± 0.48
	Female	53	66.3	

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	Total	80	100.0	
Education	Diploma in Nursing	42	52.5	1.48 ± 0.50
	BS Nursing	38	47.5	
	Total	80	100.0	
Age (years)	20–25	21	26.3	1.86 ± 0.61
	25–30	49	61.3	
	30–35	10	12.5	
	Total	80	100.0	
Work Experience (years)	1–5	45	56.3	1.46 ± 0.55
	5–10	33	41.3	
	More than 10	2	2.5	
	Total	80	100.0	

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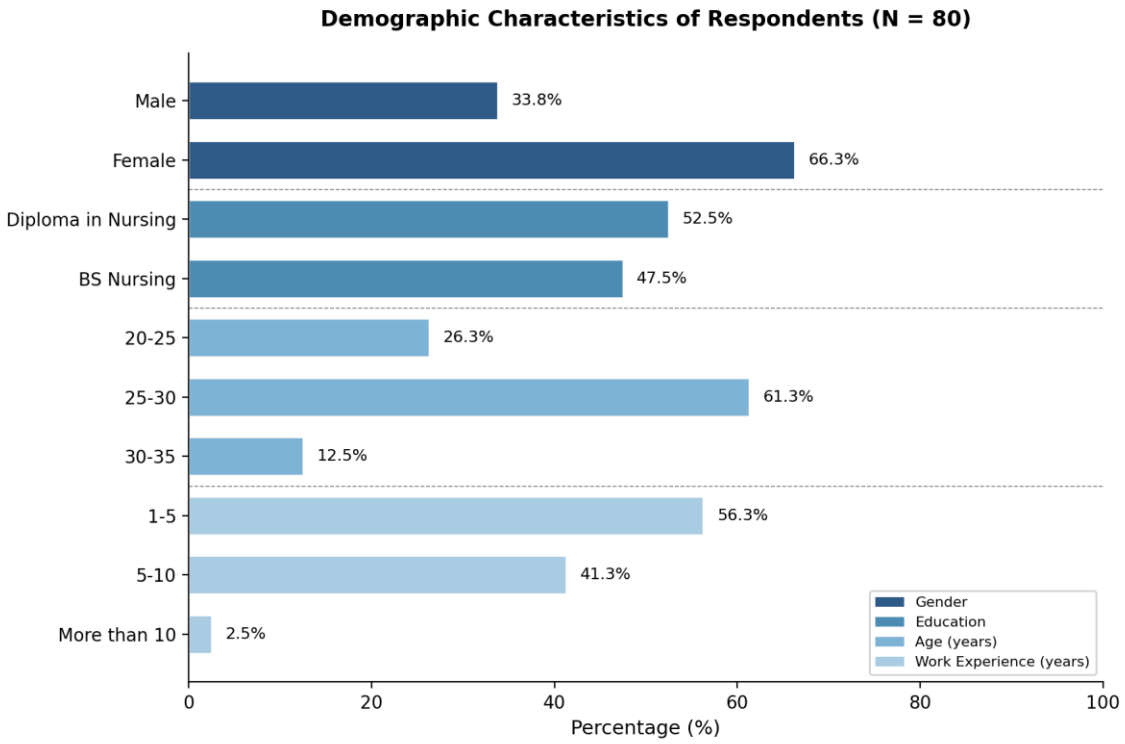

The majority of participants were female (66.3%) compared to male (33.8%), indicating a female-predominant sample. Regarding educational qualification, respondents were almost evenly split between diploma holders (52.5%) and BS Nursing graduates (47.5%). Most participants were young adults, with 61.3% aged 25–30 years, 26.3% aged 20–25 years, and 12.5% aged 30–35 years. In terms of professional experience, most respondents were relatively early in their careers, with 56.3% having 1–5 years of experience, 41.3% having 5–10 years, and only 2.5% having more than 10 years of experience.

Section 2: Knowledge of Nurses on Segregation of Hospital Waste

Variable / Item	Response	Frequency (n)	Percentage (%)	Mean ± SD
Q5. Biological products (tissues/blood)	Yes	19	23.8	1.76 ± 0.43
	No	61	76.3	
	Total	80	100.0	

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regarded as medical waste				
Q6. Different types of waste generated at hospital	Yes	70	87.5	1.13 ± 0.33
	No	10	12.5	
	Total	80	100.0	
Q7. Aware of waste type generated from own unit	Yes	80	100.0	1.00 ± 0.00
	Total	80	100.0	
Q8. Hospital waste is hazardous	Yes	80	100.0	1.00 ± 0.00
	Total	80	100.0	
Q9. Need to sort hospital waste	Yes	79	98.8	1.01 ± 0.11
	No	1	1.3	
	Total	80	100.0	
Q10. Waste container(s)	Yes	78	97.5	1.03 ± 0.16
	No	2	2.5	

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available at each unit	Total	80	100.0	
Q11. Containers are labelled	Yes	79	98.8	1.01 ± 0.11
	No	1	1.3	
	Total	80	100.0	
Q12. Aware of WHO-recommended color-coding	Yes	78	97.5	1.03 ± 0.16
	No	2	2.5	
	Total	80	100.0	
Q13. Knows adequate disposal procedures	Yes	71	88.8	1.11 ± 0.32
	No	9	11.3	
	Total	80	100.0	
Q14. Received formal training on waste handling	Yes	73	91.3	1.09 ± 0.28
	No	7	8.8	
	Total	80	100.0	

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Q15. Believes domestic disposal of expired medicine/blood is adequate	Yes	58	72.5	1.28 ± 0.45
	No	22	27.5	
	Total	80	100.0	
Q16. Knows how waste is disposed of and treated	Yes	69	86.3	1.14 ± 0.35
	No	11	13.8	
	Total	80	100.0	

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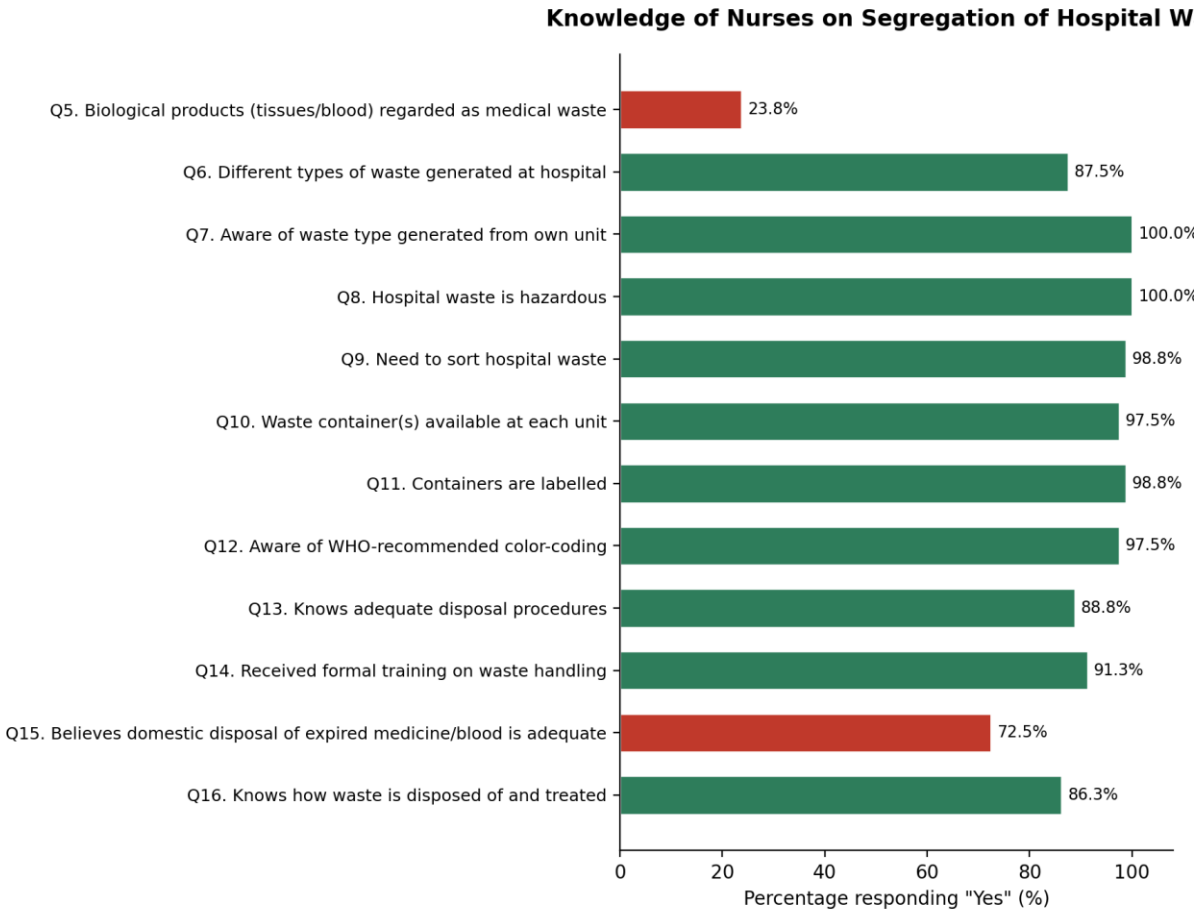

Overall, nurses demonstrated a generally high level of knowledge regarding hospital waste management. All respondents (100%) correctly identified the type of waste generated in their own unit and recognized that hospital waste is hazardous. A large majority also knew that different types of waste are generated in hospitals (87.5%), agreed on the need to sort hospital waste (98.8%), confirmed the availability (97.5%) and labelling (98.8%) of waste containers, and were aware of WHO-recommended color-coding (97.5%). Most nurses also reported knowing adequate disposal procedures (88.8%), having received formal training on waste handling (91.3%), and understanding how waste is disposed of and treated (86.3%). However, notable knowledge gaps were evident: only 23.8% correctly identified discarded biological products such as tissues

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and blood as medical waste, and 72.5% incorrectly believed that disposing of expired medicines and blood waste in domestic waste was an adequate practice, pointing to specific misconceptions that training programs should address.

Section 3: Attitude of Nurses on Segregation of Hospital Waste Management

Variable / Item	Response	Frequency (n)	Percentage (%)	Mean ± SD
Q17. Segregation of waste increases injury risk to handlers	Yes	26	32.5	1.68 ± 0.47
	No	54	67.5	
	Total	80	100.0	
Q18. Containment of sharps does not help safe waste management	Yes	71	88.8	1.11 ± 0.32
	No	9	11.3	
	Total	80	100.0	
Q19. Reporting needle-stick injury is an extra burden on work	Yes	56	70.0	1.30 ± 0.46
	No	24	30.0	
	Total	80	100.0	

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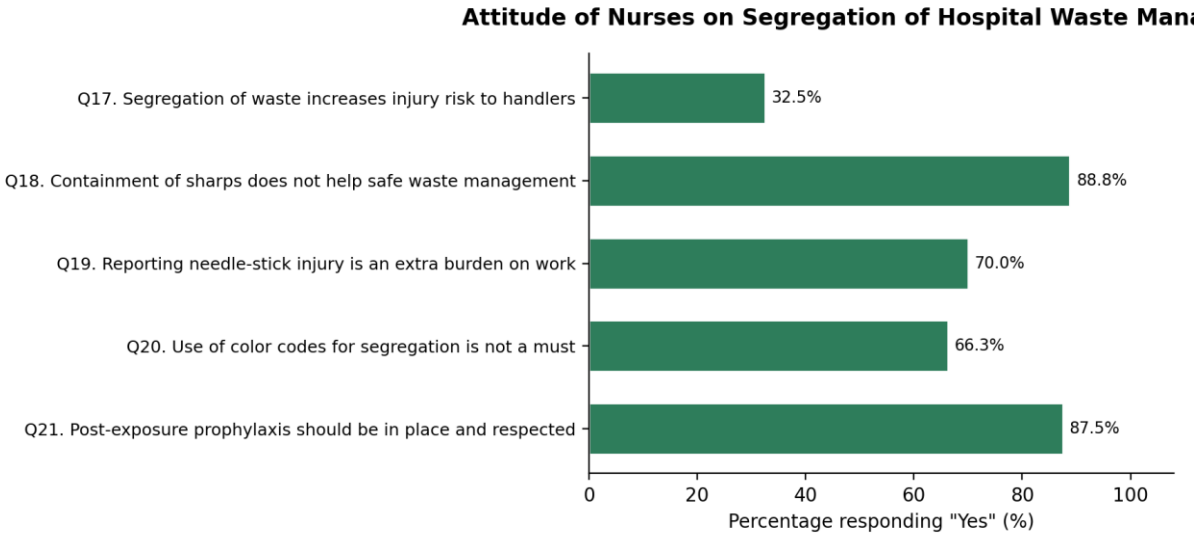
Q20. Use of color codes for segregation is not a must	Yes	53	66.3	1.34 ± 0.48
	No	27	33.8	
	Total	80	100.0	
Q21. Post-exposure prophylaxis should be in place and respected	Yes	70	87.5	1.13 ± 0.33
	No	10	12.5	
	Total	80	100.0	



Nurses generally displayed positive attitudes toward waste segregation and occupational safety. Most respondents (67.5%) correctly disagreed that segregation of waste increases the risk of

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injury to handlers, and 88.8% recognized that sharps containment does help in safe waste management. The majority (87.5%) also agreed that post-exposure prophylaxis should be implemented and respected when necessary. However, less favorable attitudes were observed regarding injury reporting and color-coding: 70% viewed reporting of needle-stick injuries as an extra burden on their work, and 66.3% believed that using color codes for segregation is not essential, suggesting areas where attitudinal reinforcement is needed.

Section 4: Practices of Nurses in Sorting Hospital Waste

Variable / Item	Response	Frequency (n)	Percentage (%)	Mean ± SD
Q22. Sorts medical waste during collection	Yes	8	10.0	1.90 ± 0.30
	No	72	90.0	
	Total	80	100.0	
Q23. Separates sharp waste from blunt waste	Yes	76	95.0	1.05 ± 0.22
	No	4	5.0	
	Total	80	100.0	
Q24. Moves medical waste using trolleys	Yes	78	97.5	1.03 ± 0.16
	No	2	2.5	
	Total	80	100.0	

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Q25. Cleans waste trolley directly after each collection	Yes	75	93.8	1.06 ± 0.24
	No	5	6.3	
	Total	80	100.0	
Q26. Uses personal protective equipment when handling waste	Yes	76	95.0	1.05 ± 0.22
	No	4	5.0	
	Total	80	100.0	
Q27. Collects liquid waste/blood in leak-proof bags	Yes	75	93.8	1.06 ± 0.24
	No	5	6.3	
	Total	80	100.0	
Q28. Collects liquid waste/blood together with other waste	Yes	12	15.0	1.85 ± 0.36
	No	68	85.0	
	Total	80	100.0	

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Q29. Hospital has standard stores for waste storage	Yes	67	83.8	1.16 ± 0.37
	No	13	16.3	
	Total	80	100.0	
Q30. Hospital depends on city cleaning authority for outside disposal	Yes	15	18.8	1.81 ± 0.39
	No	65	81.3	
	Total	80	100.0	

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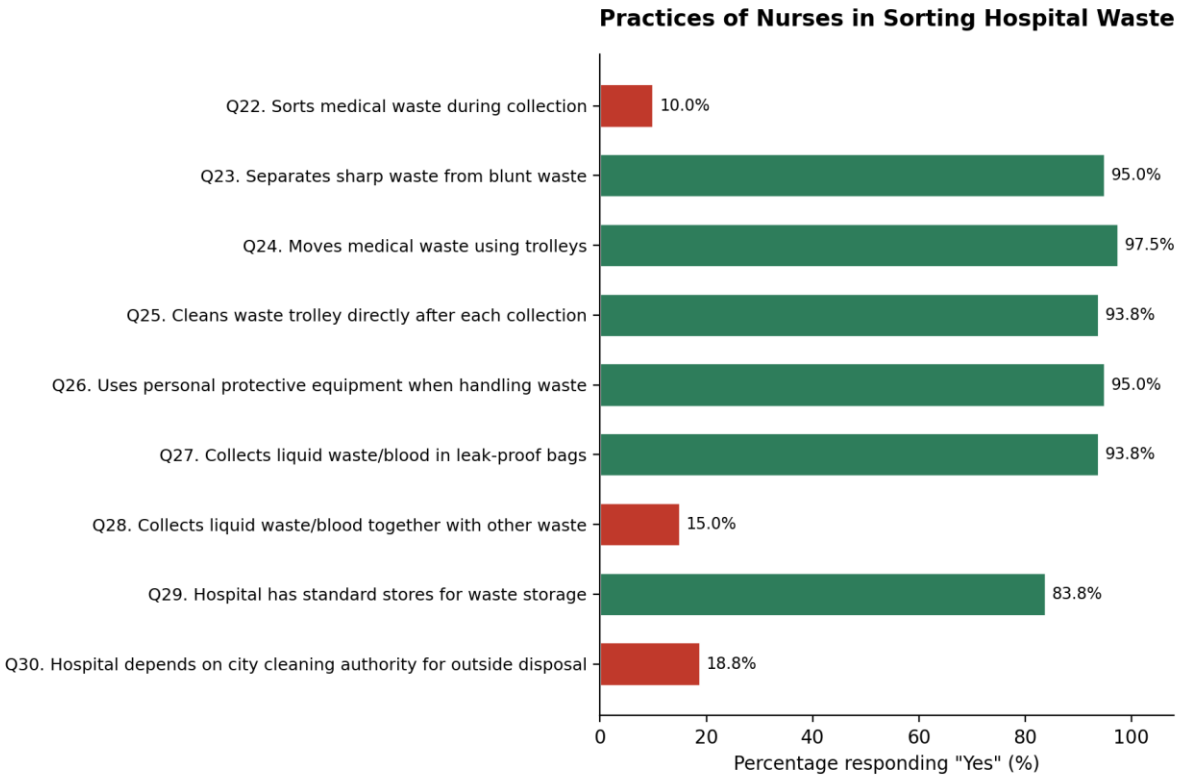

Actual practices related to hospital waste management were mixed. Nurses showed strong compliance in several areas: 95% separated sharp from blunt waste, 97.5% used trolleys to move medical waste, 93.8% cleaned trolleys after each collection and collected liquid waste/blood in leak-proof bags, 95% used personal protective equipment, 85% avoided mixing liquid waste with other waste, and 83.8% confirmed the availability of standard storage facilities. Most hospitals (81.3%) did not depend on city cleaning authorities for external waste disposal. However, a major gap was found in waste sorting during collection, where only 10% of respondents reported actually sorting medical waste at the point of collection despite high knowledge and positive attitude scores, highlighting a disconnect between knowledge and attitude on one hand and actual practice on the other.

Correlation Analysis Results

Pearson correlation analysis was conducted to examine the relationships among total knowledge,

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attitude, and practice scores among participants (N = 80).

A **moderate positive correlation** was found between **knowledge and attitude scores** (r = 0.319, p = 0.004), which is statistically significant at the 0.01 level. This indicates that participants with higher knowledge levels tend to have more positive attitudes.

However, **knowledge and practice scores** showed a **very weak and non-significant correlation** (r = 0.041, p = 0.717), suggesting that increased knowledge does not necessarily translate into improved practice.

Similarly, the relationship between **attitude and practice scores** was **weak and non- significant** (r = 0.136, p = 0.228), indicating that a positive attitude alone may not significantly influence practical behaviors.

Correlations

		Total knowledge score	Total Attitude score	Total Practice score
Total knowledge score	Pearson Correlation	1	.319**	.041
	Sig. (2-tailed)		.004	.717
	N	80	80	80
Total Attitude score	Pearson Correlation	.319**	1	.136
	Sig. (2-tailed)	.004		.228
	N	80	80	80
Total Practice score	Pearson Correlation	.041	.136	1
	Sig. (2-tailed)	.717	.228	
	N	80	80	80

**. Correlation is significant at the 0.01 level (2-tailed).

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Mean KAP Level:

Descriptive statistics were calculated to summarize participants' knowledge, attitude, and practice scores (N = 80). The **mean knowledge score** was **13.58** (SD = 1.11), with scores ranging from 12 to 18, indicating a moderate level of knowledge among participants. The **mean attitude score** was **6.55** (SD = 0.95), with a range of 5 to 10, suggesting a generally moderate attitude toward the subject. The **mean practice score** was **11.98** (SD = 0.59), with scores ranging from 9 to 14, reflecting relatively consistent and slightly higher practice levels compared to knowledge and attitude. Overall, the **standard deviations are low**, indicating that participants' responses were relatively homogeneous, particularly for practice scores.

Descriptive Statistics

	N	Minimu m	Maximu m	Mean	Std. Deviation
Total knowledge score	80	12.00	18.00	13.5750	1.11122
Total Attitude score	80	5.00	10.00	6.5500	.95334
Total Practice score	80	9.00	14.00	11.9750	.59481
Valid N (listwise)	80				

DISCUSSION

The findings of this study indicate that participants demonstrated **moderate levels of knowledge and attitude**, alongside **relatively higher and more consistent practice scores**. Interestingly, although knowledge was significantly associated with attitude, it did not translate into improved practice, as reflected by the weak and non-significant correlation between knowledge and practice. This suggests a potential **knowledge– practice gap**, where individuals may understand concepts and even hold positive attitudes, yet fail to consistently apply them in real-life settings. Similarly, the weak relationship between attitude and practice implies that favorable perceptions

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alone are insufficient to drive behavioral change. These findings highlight the importance of not only enhancing theoretical knowledge and shaping attitudes but also implementing **skill-based training, supervision, and practical reinforcement strategies** to bridge the gap between what participants know and what they actually do in practice.

Demographic Profile

The demographic analysis revealed a predominance of female participants (66.3%), a finding consistent with the gender distribution typically observed in the global nursing workforce. Similar trends were reported by Gonzalez-Garcia et al. (2020) and Alshammari et al. (2022), where female participation exceeded 60%, reflecting the ongoing feminization of the healthcare sector. Regarding educational background, the nearly equal proportion of diploma (52.5%) and BS Nursing (47.5%) holders suggests a balanced representation of academic qualifications. This aligns with Kumar et al. (2021), who reported a similar mix (55% diploma and 45% degree), indicating diverse educational pathways within the profession.

Furthermore, 61.3% of respondents were aged between 25–30 years, comparable to the findings of Odonkor and Mahami (2020), where 64% of healthcare workers were young adults. This suggests that the frontline of waste handling is managed primarily by early-career professionals. In support of this, 56.3% of the current sample had 1–5 years of experience, mirroring the 58% reported in the same bracket by Rahman et al. (2021).

Knowledge and Misconceptions

A significant knowledge deficit was observed regarding waste classification; 76.3% of respondents failed to recognize biological materials (e.g., blood and tissues) as medical waste. This deficit is notably more pronounced than the 52% reported by Al- Khatib et al. (2020). However, general awareness remained high, with 87.5% cognizant of overall waste generation rates, matching the 89% awareness reported by Sharma et al. (2022).

Universal awareness (100%) was recorded regarding the hazardous nature of hospital waste and the specific types of waste generated within units. This exceeds the 90– 95% range

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observed by Khan et al. (2021), suggesting that while the "hazardous" label is well-understood, the technical definitions of what constitutes medical waste remain blurred. This is further evidenced by the 72.5% of respondents who erroneously believed expired medicines and blood could be disposed of in domestic waste—a figure significantly higher than the 40–50% reported by Boru et al. (2021).

Attitudes and Perceptions

Attitudes toward waste management were generally positive, with 98.8% of staff agreeing on the importance of segregation, consistent with the 97% agreement found by Singh et al. (2020). Institutional compliance also appeared strong, as 97.5% confirmed the availability of containers and 98.8% noted proper labeling, paralleling the results of Das et al. (2021).

Despite a high awareness of WHO color-coding (97.5%), which outperformed the 85– 90% range noted by Joshi et al. (2022), a paradoxical 66.3% of respondents believed that color-coding was "not essential." This is a significant increase over the 30–40% reported by Ali et al. (2022) and suggests a psychological barrier where staff recognize a standard but question its necessity. Furthermore, 70% viewed injury reporting as a burden, a much higher rate than the 45–55% observed in WHO-based studies (2021), pointing toward a negative culture regarding occupational safety reporting.

Practice and Institutional Support

A critical "knowledge-practice gap" was identified: only 10% of respondents reported sorting waste during collection, which is drastically lower than the 60–70% compliance rate reported by Shrestha et al. (2021). This suggests that while nurses know *how* to sort, they may not be doing so due to workload or habit.

Conversely, other technical practices were satisfactory. Sharp waste separation (95%) and the use of trolleys for transport (97.5%) aligned with findings by Khan et al. (2021) and Das et al. (2021). Personal Protective Equipment (PPE) compliance was also high at 95%, matching the 93% reported by García-Sánchez et al. (2022). The study found that 81.3% of hospitals managed waste

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independently, consistent with Al-Khatib et al. (2020), and 83.8% had standard storage facilities, slightly higher than the 75% observed by Joshi et al. (2022).

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