

Practice Regarding Biomedical Waste Management among Supporting Staff in a Hospital

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ABSTRACT

Background: Biomedical waste has high potential for infections and injuries. Effective biomedical waste management is vital in the health care delivery system, and it could possibly be achieved through standard practices with safety measures. As supporting staff plays a significant role in proper waste management, this study aims to assess the level of practice regarding biomedical waste management among supporting staff in a hospital.

Methods: A descriptive cross-sectional study was conducted among 109 supporting staff working in the general wards of Tribhuvan University Teaching Hospital (TUTH). The consecutive sampling technique was used to collect data. After ethical approval Data were collected by using a structured interview schedule within 2 weeks and was analyzed by using SPSS version 20. Descriptive statistics were used to describe the personal characteristics. Inferential statistics were used to measure the association between the level of practice and selected variables.

Results: The study findings revealed that the majority of the respondents (84.4%) had adequate practice regarding biomedical waste management, 15.6% had moderately adequate practice, and none of them had inadequate practice. A statistically significant association was found between the level of practice and age ($p=0.003$), working area ($p=0.001$), duration of work experience ($p=0.034$), and history of needle stick injury ($p=0.045$) of the respondents.

Conclusion: This study concludes that more than four-fifths of the supporting staff had adequate practice regarding biomedical waste management. Therefore, it is recommended to conduct refresher training program for supporting staff in frequent time interval to enhance and sustain safe practices.

Keywords: Biomedical waste, health care waste, waste management guidelines, waste management practice

INTRODUCTION

Biomedical waste management is very essential practice for preventing the spread of infection and reducing the environmental hazards. Biomedical waste contains significant pathogens and toxic substances that can pose major health risks to healthcare workers and waste handlers.¹ Health Care Waste (HCW) are classified into several categories, including infectious, pathological, chemical, pharmaceutical, cytotoxic, radioactive,

and non-hazardous or general waste.² Global expanding of hospitals in both the public and private sectors has led to the generation of significant volume of hospital waste.³ High-income countries produce approximately 0.5 kg of hazardous waste daily per bed, whereas low-income countries produce about 0.2 kg per day.² Similarly, in Nepal, the average daily waste generation per patient is 3.0 kg; of which one-third is hazardous waste.⁴ Additionally, mixing infectious waste with other non-infectious waste,

turns all the waste to infectious.⁵ Globally, improper medical waste management is linked to 5.2 million deaths annually.⁶ The occurrence of new infections including hepatitis B and C is still associated with unsafe healthcare practices.²

HCW management includes systematic handling, segregation, treatment, and disposal of waste produced in healthcare settings.^{2,7} Supporting staff who clean contaminated medical equipment, handle and manage potentially hazardous medical wastes, are at a higher risk of exposure⁷ than the medical staff who generate it.⁸ Despite this, global adherence to safety protocols is alarmingly low. Only 10.5% of healthcare workers in Uganda adhered to proper HCW management practices, while 85% of them adhered partially.⁹ Similarly, 63.6% demonstrated poor waste handling practices in Tanzania.¹⁰ Additionally, another study found that the practices were inadequate among waste handlers.⁷ Though hospitals have proper HCW management, staff often handle waste without following any safety protocols as recommended by WHO¹¹, including failing to use personal protective equipment, ignoring color-coding for segregation and failing to report workplace incidents and injuries.¹² Research indicates that over half (53.3%) of HCW handlers and nearly two-thirds of non-professional healthcare workers inadequately handled health care waste.^{7,13,14}

HCW management is becoming more significant due to the escalating risks associated with HCW and the rapidly rising incidence of blood-borne pathogens.¹⁵ In Nepal, despite the existence of waste management legislation, HCW management has become a major problem because the actual implementation remains unsatisfactory¹⁶ and compliance of medical waste management practice was not in accordance with the guidelines and standards in most of the health care institutions.^{4,17} As biomedical waste presents a serious risk to patients, health care personnel, and anybody who comes in contact with it, health care workers should adopt safer practices in handling HCW.^{13, 18} Thus, the study aims to find out the practice regarding biomedical waste management among supporting staff in a tertiary hospital.

METHODS

A descriptive cross-sectional research design was used to assess the practice regarding biomedical waste management among 109 supporting staff working in general wards of Tribhuvan University Teaching Hospital (TUTH) and having at least 6 months of work experience. The samples were selected using consecutive sampling techniques.

Data were collected through face-to-face interviews from March 23 to April 5, 2025, using a Nepali-translated interview schedule containing questions related to personal and work-related information, and practice related to biomedical waste management. Practice was measured using structured questions prepared based on research objectives, literature review, Health Care Waste Management Rapid Assessment tool of WHO,¹⁹ National Health Care Waste Management Standards and Operating Procedure-2020,²⁰ & consultation and validation with the subject experts. This included 27 statements related to waste collection, segregation, transportation, storage, and safety measures, which was measured by four-point Likert scale i.e. 0=Never, 1=Rarely, 2=Often, 3=Always. The total score ranged from minimum zero (0) to maximum 81. The instrument was translated into Nepali language and back translated to English language by two bilingual experts. For the practice level, the obtained scores were summed up, converted to a percentage and categorized as score $\geq 80\%$: adequate practice, 60-79%: moderately adequate practice, and $<60\%$: inadequate practice.²¹

Pretesting of the Nepali-translated tool was done among 10% of the total sample size i.e. 11 respondents from Manmohan Cardiothoracic Vascular and Transplant Center, Kathmandu. Necessary modification was done based on the feedback of the respondents.

Ethical approval was obtained from the Institutional Review Committee, Institute of Medicine, Tribhuvan University (Ref.461 [6-11] E2), and administrative permission was taken from the hospital authority. Written informed consent was obtained from each respondent before data collection. Voluntary participation

and withdrawal from the study at any time were considered. Anonymity was maintained by coding the interview schedule, and confidentiality was maintained by keeping the data safe and using data for research purposes only. Each respondent was interviewed separately by maintaining their privacy. Data were analyzed using both descriptive statistics (frequency, percentage, mean, median, and standard deviation) and inferential statistics (Chi-square test, Fisher’s Exact Test) to measure the association between the level of practice and selected variables

RESULTS

Table 1 showed that the age of the respondents ranged from 19 to 70 years with the mean age 35.65±10.35 years. Most of the respondents 85.3% were female and married (76.1%). Fewer (8.3%) respondents could not read and write while 17.4% can read and write without formal

education and maximum (45.9%) had secondary level (class 9-12) education. Similarly, more than one-third of the respondents (38.5%) were working in the medical ward, followed by the surgical ward (27.5%). Likewise, 52.3% had more than 5 years, and the least (7.3%) had less than 1 year of work experience. All (100%) of the respondents had received orientation about biomedical waste management; among them, only 46.8% had received additional training in waste management. Almost all (94.5%) of the respondents stated that the hospital has provided necessary equipment, and they were supervised during biomedical waste management (97.2%). In addition, 32.1% respondents had needle stick injury during biomedical waste management, but only 12.8% respondents reported needle stick injury, and 53.6% had taken vaccination against Hepatitis B.

Table 1: Respondents’ Personal and Work-related Variables (n=109)

Characteristics	Number	Percentage
Age (in completed years)		
≤25	22	20.2
26-35	37	33.9
36-45	30	27.5
>45	20	18.3
Mean age: 35.52±10.004, Range: 19-58 years		
Sex		
Female	93	85.3
Male	16	14.7
Marital Status		
Married	83	76.1
Unmarried	26	23.9
Level of Education		
Cannot read and write	9	8.3
Can read and write	19	17.4
Basic level (1-8)	22	20.2
Secondary Level (9-12)	50	45.9
Bachelor and above (13 and above)	9	8.3
Working area		
Surgical ward	30	27.5
Medical ward	42	38.5
Ortho	14	12.8
Eye	7	6.4

ENT	7	6.4
Psychiatric	5	4.6
Burn ward	4	3.7
Duration of Work Experience		
<1 year	8	7.3
1-5 year	44	40.4
> 5 year	57	52.3
Mean Work Experience: 2.45 ± 0.63 years		
Received orientation about waste management	109	100.0
Provision of necessary equipment's	103	94.5
Received additional training in waste management	51	46.8
Supervision during waste management	106	97.2
History of needle stick injury	35	32.1
Reported needle stick injury (n=35)	14	12.8
Vaccination against Hepatitis B	58	53.8

Regarding waste collection, all the respondents answered they always discarded waste in close containers, used puncture proof plastic containers to collect sharp waste, discarded syringes in red bins after cutting the used needle (98.2%), however, 93.6% of respondents never recapped and bent the used needle. Eighty four percent always maintained hygiene and cleanliness around bin areas immediately after spillage, disposed of liquid medical waste in drain (75.2%), tied up waste bags (81.7%) and changed the bag (90.8%) when it is three quarters full. Similarly, almost all respondents always emptied bins at the end of the shift (96.3%), cleaned containers regularly with detergent or soap and water (98.2%), 46.8% always covered waste bins with a lid. Further, all the respondents always segregated the waste in respective color-coded containers. Almost all respondents never stored infectious waste for longer than 48 hours in winter (99.1%) and longer than 24 hours in summer (96.3%) seasons.

Regarding waste transportation, most of the respondents (81.7%) never transported risk and general waste on different trolleys. All the respondents transported waste in trolley,

however, less respondents (24.8%) always covered waste during transportation and often discarded waste in bins that are kept in specified areas with adequate lighting and cross-ventilation (37.6%). Moreover, in terms of safety measures, 58.7% often wore gloves while picking up litter that fall on ground, 96.3% always wear facemask, and 45.9% rarely wear apron while handling medical waste. All the respondents always washed hands routinely and followed hospital rules and protocol for handling biomedical waste.

Table 2 shows that the highest mean scores were obtained in waste collection domain (28.95±2.34) followed by safety measures domain (12.84±1.16) and the lowest mean score in waste transportation domain (4.29±1.84).

Table 2: Respondents' Mean Score on Practice Domains (n=109)

Domains	Mean $\pm$ SD
Waste collection	28.95 $\pm$ 2.34
Safety measures	12.84 $\pm$ 1.16
Waste segregation	9.00 $\pm$ 0.00
Waste storage	7.60 $\pm$ 1.05
Waste transportation	4.29 $\pm$ 1.84

Table 3 reveals that majority of the respondents (84.4%) had adequate practice regarding biomedical waste management, followed by moderately adequate practice (15.6%) and none of them had inadequate practice.

Table 3: Respondents' Level of Practice on Biomedical Waste Management

Level of Practice	Number	Percentage
Adequate practice ($\geq 80\%$)	92	84.4
Moderately adequate practice (60% - 79%)	17	15.6
Inadequate practice ($< 60\%$)	-	-
Total	109	100

Possible scores: 0-81

Obtained scores: 59-80

Table 4 reveals the statistically significant association between level of practice regarding biomedical waste management and age ($p=0.003$), working area ($p=0.001$), duration of work experience ($p=0.034$) and history of needle stick injury ($p=0.045$).

Table 4: Association between Respondents' Level of Practice with Selected Variables (n= 109)

Variables	Level of Practice		χ^2 value	p value
	Adequate No. (%)	Moderately adequate No. (%)		
Age				
<35	48 (96.0)	2 (4.0)	9.436	0.003 ^a *
≥ 35	44 (74.6)	15 (25.4)		
Sex				
Male	13 (81.3)	3 (18.8)	0.142	0.713 ^a
Female	79 (84.9)	14 (15.1)		
Working area				
Medical & Surgical wards	67 (93.1)	5 (6.9)	12.061	0.001*
Other wards**	25 (67.6)	12 (32.4)		
Duration of Work Experience (in years)				
<6	49 (92.5)	4 (7.5)	5.077	0.034 ^a *
≥ 6	43 (76.8)	13 (23.2)		
Received training				
Yes	44 (86.3)	7 (13.7)	0.255	0.614
No	48 (82.8)	10 (17.2)		
History of needle stick injury				
Yes	26 (74.3)	9 (25.7)	4.000	0.045*
No	66 (89.2)	8 (10.8)		

* p-value significant at < 0.05 ^a: value of Fisher's Exact Test **Other wards: Ortho, Psychiatric, Burn, Eye, ENT wards

DISCUSSION

In the present study, the majority of the respondents (84.4%) had adequate practice regarding biomedical waste management, 15.6% had moderately adequate practice and none of them had inadequate practice. These findings are similar to the study which showed 90% of the ward attendants had a good level of practice and 10% had average practice.²² Another study also revealed similar findings, which showed 80% of the medical waste handlers have an adequate practice score.⁷ However, in a study inconsistent practice was found among 49.5% health care workers.²¹

The present study showed almost all the respondents (98.2%) always discarded the syringe in red bins after cutting the used needle with a needle cutter. Similar to this, a study reported that all the participants cut needles before disposal.²³ In this study, almost all respondents (93.6%) never recapped and bent used needles. In contrast, 66.6% of employees did not recap the used needle.²⁴ The present study showed most of the respondents (75.2%) always disposed liquid medical waste in drain (bathroom used by patient) and 81.7% always tied up waste bags when it is three quarters full. An inconsistent finding was seen in the study in which 95% of the cleaner always flushed liquid medical waste in toilet bowl and 25% of cleaners always closed medical waste bag when it is 2/3 full.²⁵ In the present study, nearly half of the respondents (46.8%) always covered waste bins with a lid. Similar to this, a study reported 40% of waste bins were properly covered.²⁶ In this study, all respondents always segregated the waste in color-coded containers, only 24.8% of the respondents always covered waste on trolley during transportation and 99.1% never stored infectious waste for longer than 48 hours in winter and 96.3% in summer seasons. In contrast to these findings, a study reported 68.3% of the waste handlers always used color-coded dust bins to segregate waste, 38.3% closed the lid container during health care waste transportation and only 43.3% always removed health care waste from storage area within 48 hours in the winter season, and 45% removed

health care waste from the storage area within 24 hours in the summer season.¹³

In this study, 81.7% never transported risk and general waste on different trolley, and the transportation is done by supporting staff, only if necessary. A similar finding was presented by the study in which almost all the study participants (90.9%) separately transported different waste types.⁷ This study showed 40.4% respondents always wore gloves while picking up litter that fall on the ground. Similar to this, 53.8% of the sanitary workers wore gloves.²⁷ In this study, nearly half of the respondents (45.9%) rarely wore an apron while handling medical waste. This finding is consistent with the study in which 40.6% of the respondents had never used an apron while handling waste.¹³ This study showed that all the respondents washed their hands with soap and water routinely after handling biomedical waste. In contrast to this, one study mentioned 83.3% of the respondents washed their hands after work.²⁷ The present study findings revealed the association between level of practice in biomedical waste management is statistically significant with respondents' age ($p=0.003$), working area ($p=0.001$), duration of work experience ($p=0.034$) and history of needle stick injury ($p=0.045$). Another two studies had similar findings which showed significant association between occupation and level of practice in biomedical waste management.^{1, 22}

CONCLUSION

This study concludes that majority of the respondents had adequate practice regarding biomedical waste management and only few respondents had moderately adequate practice. The level of practice tends to be associated with the age, working area and duration of work experience and history of needle stick injury. The study findings recommend for the regular refresher training to improve and update the practice of supporting staff with greater emphasis on safety measures, disposal of liquid medical waste, and waste transportation and encourage the mandatory use of personal protective equipment during waste management and immediately report needle stick injury.

ACKNOWLEDGEMENT

The authors would like to acknowledge the Tribhuvan University Teaching Hospital for granting permission to conduct this study and all the participants for their valuable time and support for this study.

CONFLICT OF INTEREST: None

REFERENCES

1. Thapa S, Laskar NB. Biomedical waste management among healthcare workers in a Primary Health Centre in Sikkim, India—A KAP study. *Journal of Education and Health Promotion*. 2024 Oct 1;13(1):378. https://doi.org/10.4103/jehp.jehp_1884_23.
2. World Health Organization, Healthcare waste [Internet]. [cited 2024 Dec 21]. Available from: <https://www.who.int/news-room/fact-sheets/detail/health-care-waste>
3. Gautam S, Mandal PK, Yangden N, Rai M. Knowledge on Biomedical Waste Management among Nurses Working in a Hospital of Biratnagar. *Tribhuvan Univ J*. 2021 Dec 31;36(02):26–38. <https://doi.org/10.3126/tuj.v36i02.46596>.
4. Joshi HD, Acharya T, Dhakal P, Ayer R, Karki KB, Dhimal M. Health care waste management practice in health care institutions of Nepal. *J. Nepal Health Res. Counc*. 2017 Aug 13;15(1):7-11.
5. Karki S, Niraula SR, Karki S. Perceived risk and associated factors of healthcare waste in selected hospitals of Kathmandu, Nepal. *PLoS One*. 2020 Jul 13;15(7):e0235982. <https://doi.org/10.1371/journal.pone.0235982>
6. Rahman MM, Bodrud-Doza M, Griffiths MD, Mamun MA. Biomedical waste amid COVID-19: perspectives from Bangladesh. *The Lancet Global Health*. 2020 Oct 1;8(10):e1262.
7. Deress T, Jemal M, Girma M, Adane K. Knowledge, attitude, and practice of waste handlers about medical waste management in Debre Markos town healthcare facilities, northwest Ethiopia. *BMC research notes*. 2019 Mar 15;12(1):146. <https://doi.org/10.1186/s13104-019-4174-7>.
8. Hosny G, Samir S, El-Sharkawy R. An intervention significantly improve medical waste handling and management: A consequence of raising knowledge and practical skills of health care workers. *International journal of health sciences*. 2018 Jul;12(4):56. PMID: 30022905.
9. Babirye J, Vuzi P, Mutekanga DR. Factors influencing adherence to proper health care waste management practices among health workers in Wakiso District. Uganda. *Journal of Environmental Science and Public Health*. 2020;4(2):96-111. <https://doi.org/10.26502/jesph.96120088>
10. Millanzi WC, Herman PZ, Mtangi SA. Knowledge, attitude, and perceived practice of sanitary workers on healthcare waste management: A descriptive cross-sectional study in Dodoma region, Tanzania. *SAGE Open Medicine*. 2023 May;11:1-16. <https://doi.org/10.1177/20503121231174735>
11. Chand U, Mahara MB, Bhatta A, Joshi A. The study on hospital waste management practices among the different hospitals of bheemdatta municipality of Kanchanpur district, far-western region, Nepal. *IJFMR*. 2023;5(4). dOI: 10.36948/ijfmr.2023.v05i04.5320
12. Basavaraj TJ, Shashibhushan BL, Sreedevi A. To assess the knowledge, attitude and practices in biomedical waste management among health care workers in dedicated COVID hospital in Bangalore. *The Egyptian Journal of Internal Medicine*. 2021 Dec;33(1):37. <https://doi.org/10.1186/s43162-021-00066-9>.
13. Patel JN, Upadhyay SK, Rajbhandari A, Bhandari R, Poudyal A. Knowledge about handling hazardous materials as factors associated with adherence to healthcare waste management practices among waste handlers at government district hospitals of Madhesh province, Nepal: A quantitative-qualitative methods study. *PLOS Global Public Health*. 2024 Dec 5;4(12):e0002028. <https://doi.org/10.1371/journal.pgph.0002028>.
14. Olaifa A, Govender RD, Ross AJ. Knowledge, attitudes and practices of healthcare workers about healthcare waste management at a district hospital in KwaZulu-Natal. *South African Family Practice*. 2018 Sep 1;60(5):137-145. DOI: 10.1080/20786190.2018.1432137
15. Chaudhary N, Mahato SK, Chaudhary S, Bhatiya BD. Biomedical waste management in Nepal: A review. *Journal of Universal college of medical*

- sciences. 2015;2(4):45-52. <http://dx.doi.org/10.3126/jucms.v2i4.12070>
16. Joshi HD. . Health care waste management practice in Nepal. J Nepal Health Res Counc 2013 Jan;11(23):102-8 doi: <https://doi.org/10.33314/jnhrc.v0i0.354>
 17. Ministry of Health and Population. (2014). National-Health-Care-Waste-Management-Guidelines. Available from: http://climate.mohp.gov.np/downloads/Health_Care_Waste_Management_Guideline_2071.pdf
 18. Rutayisire E, Nsabimana JA, Habtu M. Knowledge and practice for Bio-Medical waste management among healthcare personnel at Kabgayi district hospital, Rwanda. Journal of public health international. 2019 Sep 13;1(4):36-44. <https://doi.org/10.14302/issn.2641-4538.jphi-19-3005>
 19. World Health Organization;Health-care waste management rapid assessment tool; Available from <https://www.who.int/publications/m/item/health-care-waste-management-rapid-assessment-tool>
 20. National Health Care Waste Management Standards and Operating Procedure-2020. Available from:<http://climate.mohp.gov.np/downloads/National%20Health%20Care%20Waste%20Standard%20Operating%20Procedure-2020.pdf>
 21. Thirunavukkarasu A, Al-Hazmi AH, Dar UF, Alruwaili AM, Alsharari SD, Alazmi FA, Alruwaili SF, Alarjan AM. Knowledge, attitude and practice towards bio-medical waste management among healthcare workers: a northern Saudi study. PeerJ. 2022 Jul 20;10:e13773. <https://doi.org/10.7717/peerj.13773>
 22. Kaur S, Kaur M. Knowledge and practices of ward attendants regarding biomedical waste management. International Journal of Current Research. 2020;12(8):13138-13141.
 23. Mattoo AM, Hameed S, Butt AM. Healthcare waste management: Current knowledge, attitude and practices “a study at secondary and tertiary care hospitals”. Pakistan Journal of Medical Research. 2019;58(4):187-92.
 24. Anand P, Jain R, Dhyani A. Knowledge, attitude and practice of biomedical waste management among health care personnel in a teaching institution in Haryana, India. International Journal of Research in Medical Sciences. 2016 Oct;4(10):4246-4250. <https://doi.org/10.18203/2320-6012.ijrms20163115>.
 25. Akkajit P, Romin H, Assawadithalerd M. Assessment of knowledge, attitude, and practice in respect of medical waste management among healthcare workers in clinics. Journal of environmental and public health. 2020;2020(1):8745472. doi: [10.1155/2020/8745472](https://doi.org/10.1155/2020/8745472)
 26. Rakh VA, Bagade VG, Kale SB, Baravakar JP, Shruti S. Study on the Waste Disposal Practices in a Tertiary Care Hospital in Western Maharashtra. institutions. 2025;11(2): 7200-7205. <https://doi.org/10.21276/SSR-IIJLS.2025.11.2.30>.
 27. Elamin MO, Sanhoury M, Mohamed HR. Study of knowledge, attitudes, and practices among sanitary workers regarding medical waste management in Khartoum Locality Teaching Hospitals. Int J Med Res Health Sci. 2020;9:53-62.