



Health Care Waste Collection Practices and Associated Risks in Health Care Facilities in North-West Senatorial District of Benue State, North-Central Nigeria

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Abstract

This study investigated healthcare waste (HCW) collection practices and associated risks in healthcare facilities in North-West Senatorial District of Benue State. The study adopted a cross-sectional descriptive design. The population of the study was 2,510 healthcare workers in primary, secondary and tertiary health facilities in North-West Senatorial District of Benue State. A sample size of 232 healthcare workers was derived from the population using proportionate sampling. A valid 14-item questionnaire named Health Care Waste Collection Practices and Associated Risks Questionnaire (HCWCP&ARQ) with a Cronbach's Alpha reliability Coefficient index of 0.85 was used for data collection. Frequency counts and percentages were used to describe the sociodemographic characteristics of the participants and to answer the research questions. Pearson chi-square was used to test hypotheses at 0.05 alpha level. The results revealed poor HCW collection practices in health facilities as most of the study participants indicated non-separation of containers for collection of hazardous and non-hazardous wastes (60.8%), non-segregation of sharps with colour-coding containers (59.5%), improper placement of waste bins around facility premises (59.9%) and non-use of Personal Protective Equipment (PPE) by waste handlers during HCW collection (52.2%) in their health facilities. Results further revealed that the associated risks with waste collection practices were: exposing waste handlers to infectious diseases (60.3%), littering the environment (59.9%), cross-contamination (59.9%), sharp-inflicted injuries (58.6%), and air pollution (58.2%). Results of chi-square analysis indicate significant association in HCW collection practices $\chi^2 (2, N = 232) = 111.0, p < .001$ with tertiary health facilities having better management practices than secondary and primary health facilities. Chi-square analysis further indicated significant association in risks with HCW practices, $\chi^2 (2, N = 232) = 121.1, p < .001$ with primary health facilities having higher risks than others. It was recommended that Healthcare Waste Management Committee (HCWMC) should be constituted in each health facility with the mandate to enforce compliance with best health care waste collection practices to reduce associated risks in health care facilities in North-West Senatorial District of Benue State, North-Central, Nigeria.

Keywords: Healthcare waste, Waste collection, Waste segregation, Infectious waste

Introduction

Healthcare waste collection practices are associated with the transmission of infectious diseases the world over. This is because the wastes most often contain infectious agents and when not properly handled, it becomes an avenue of transfer of infection to both the attendee and the attendant. It is one of the commonest ways through which patients and



health care workers acquire hospital infections. It is estimated that each year there are about 8-16 million new cases of Hepatitis B virus (HBV), 2.3-4.7 million cases of Hepatitis C virus (HCV), and 80,000 to 160,000 cases of HIV mostly due to unsafe injections and very poor healthcare waste collection and management practices (Yeoh, Othman & Ahmad, 2013). Healthcare Waste (HCW) refers to unwanted materials that are generated from healthcare facilities linked with medical procedures (Oyebanji, Adeleke & Adeleke, 2020). HCW waste is generated in healthcare facilities such as hospitals, clinics, and laboratories. This waste includes sharps such as needles, syringes, and scalpels; infectious waste such as blood, bodily fluids, and contaminated dressings, and pharmaceutical waste such as expired or unused medications.

The HCW must be collected in secure containers to prevent unauthorized access and exposure to infectious diseases (WHO, 2017). The containers used for HCW collection must be leak-proof, puncture-resistant, and labelled with appropriate markings to indicate the type of waste contained (Ali et al., 2015). Ineffective HCW collection in the health facilities can lead to exposure to infectious diseases, environmental pollution, and negative impacts on public health and safety (Karki et.al.,2020).

In Nigeria, the collection of HCW in the health sector is regulated by the National Environmental Standards and Regulations Enforcement Agency (NESREA) and the Federal Ministry of Environment. These agencies provide guidelines and regulations for the proper waste collection, segregation, transportation, and disposal. The NESREA guidelines are implemented and enforced in the State by the Benue State Environmental Sanitation Authority (BENSESA).

Despite the efforts of regulatory agencies, there are still challenges in the collection of HCW in Nigeria. According to Oyebanji et al. (2020), HCW management in Nigeria is poor, and there is a lack of awareness and knowledge among healthcare workers regarding proper waste segregation. Segregation means separating different waste into different color-coded bins with liners or sharps containers at locations where they are generated. In healthcare facilities, Proper segregation of waste is achieved through the use of color-coded waste bins or containers, with different colors designated for different types of waste. For example, red bins can be used for sharps, yellow bins for infectious waste, and blue bins for non-infectious waste. This prevents waste handlers from sorting through waste after it has been placed in a bin (Gitonga, 2017).

The absence of proper HCW segregation increases the risk of occupational injury and blood born viral infections particularly among waste handlers. Tadesse and Dolamo (2022) studied healthcare waste handlers and managers in public, primary and secondary health facilities in Addis Ababa City. Results indicated that in the health facilities: waste collection containers were not clearly marked or labelled: primary = 61 (15.2%), secondary=29(21.0%); used protective clothing when handling waste: primary=29(21.0%), secondary=61(15.2%) and were provided with protective clothing: primary health = 31 (91.2%), secondary = 64 (91.4%) respectively when handling healthcare wastes in their health facilities. Abah and Ohimain (2011) assessed healthcare waste management at a tertiary health facility in Nigeria. Results show that there was no form of colour coding to indicate the type of waste to be deposited in a particular waste bin. Ali et al., (2015) investigated the current hospital waste management activities and checked their alignment with the national and international standards in hospitals in Pakistan. Results indicated that both public and private sector hospitals had: good hygienic conditions inside their premises (100%), were using leak-proof and puncture resistant containers for collection of sharp waste (100%). Results further show that there were proper waste segregation practices (20%), standard labelling of waste bins



(40%). Biswas et al (2011) reported that 27% tertiary hospitals segregated infectious waste in the wards, 18% hospitals segregated at the time of generation while 9% hospitals did it at the time of collection. Currently, in many developing countries like Nigeria, poor segregation and the question of identifying the different types of HCW are of critical concern (Gitonga, 2017). The study conducted by WHO in 22 developing countries including Nigeria showed that the proportion of facilities that did not manage waste properly and used inappropriate waste collection methods ranged between 18% and 64% (Ghasemi & Yusuff, 2016).

This study was therefore carried out in public health facilities located in the North-West Senatorial District of Benue State, North -Central Nigeria among workers in tertiary, secondary and primary levels of healthcare facilities in the cadre of Nurses, Doctors, Pharmacists, Lab Scientists and Health Assistants. These categories of healthcare workers are chosen because of their active and direct involvement in the generation and handling of HCW. There are 2 tertiary health facilities, 7 secondary and 194 primary healthcare facilities in the study area. The facilities attract very large number of patients; hence generate a substantial amount of HCW according to the services provided. It is established that waste collection practices differ in the levels of healthcare facilities across the world (Tadesse & Dolamo, 2022). These levels of facilities will be surveyed. Very few studies have tried to assess HCW management practices and its associated risks among healthcare workers in Nigeria. Many previous studies reviewed also recommended further research on the waste collection practices of healthcare workers and associated risks in developing countries to influence policy makers. Hence, the dearth of studies on HCW collection practices in Benue State, Nigeria formed the basis for this study.

The study therefore sought to find out the HCW collection practices and associated risks with HCW collection among healthcare workers in North-West Senatorial District of Benue State. Two hypotheses verified the association between HCW collection practices; and the risks associated with the HCW collection practices among the levels of healthcare facilities in North-West Senatorial District of Benue State. The study will be significant to the government, policy makers, community and health workers by providing baseline data for tackling the problem of waste collection and its attendant risks.

Methods

The cross-sectional survey research design was used to assess the healthcare waste collection practices and associated risks in healthcare facilities in North-West Senatorial District of Benue State. The population of the study consisted of all staff working in the healthcare facilities in the North-West Senatorial District of Benue State numbering 2,510 health workers cutting across public tertiary health facilities (840 health workers), secondary health facilities (986 health workers) and primary health facilities (684 health workers) comprising medical doctors, nurses, midwives, laboratory scientists and community health extension workers (CHEW) (Benue State Ministry of Health and Human Services & Benue State Primary Healthcare Board, 2022).

A sample of 251 health workers was drawn from the population using two-stage sampling procedure. In the first stage, the study adopted proportionate stratified sampling to make the sample equitable by proportionally sharing among the three tiers of healthcare facilities. With this computation, tertiary health facilities were represented by 84 health workers, secondary health facilities were represented by 99 health workers while primary health facilities were represented by 68 health workers.

In the second stage, purposive sampling was applied for sampling the respondents.



The instrument for data collection was researchers designed titled “Healthcare Waste Collection Practices and Associated Risks Questionnaire (HCWCP & ARQ) and was validated by 3 experts in the Department of Human Kinetics and Health Education, Benue State University, Makurdi. The reliability of the instrument was ascertained through Cronbach Alpha Statistic which yielded a reliability co-efficient index above .70 with a mean of 0.85 which was substantial for use in the study (Kothari,2004).

Data were collected from the respondents in their respective health facilities. Respondents filled and returned the completed questionnaire on the spot to avoid loss. Data were analysed using frequencies and percentages to answer research questions, while hypotheses were tested using Pearson chi-square statistic at .05 level of significance. All the analysis were computed using Statistical Package for Social Sciences (SPSS) version 26.

Results and Discussion

Table 1: Sociodemographic Characteristics of the Respondents (n = 232)

	Sociodemographic Variable	Frequency	Percentage (%)
1	Job Type		
	Cleaner	20	8.6
	Community health extension workers (CHEW)	45	19.4
	Midwife	37	15.9
	Nurse	53	22.8
	Laboratory Scientist	24	10.3
	Pharmacist	17	7.5
	Doctor	36	15.5
2	Level of Healthcare Facility		
	Primary	61	26.3
	Secondary	100	43.1
	Tertiary	71	30.6

Table 1 presents the sociodemographic characteristics of the respondents. With respect to job type of the respondents, the Table shows that most (22.8%) were nurses, followed by community health extension workers (19.4%), midwives (15.9%), doctors (15.5%), laboratory scientists (10.3%), cleaners (8.3%) and pharmacists (7.5%).

On type of healthcare facilities where the respondents were working, most 100 (43.1%) of the respondents indicated that they were working in secondary healthcare facilities, 71 (30.6%) were working in tertiary health facilities while 61 (26.3%) indicated that they were working in primary healthcare facilities.

Table 2: Frequency and Percentage Analysis of Responses on HCW Collection Practices (n = 232)

S/N	HCW Collection Practices	Yes n (%)	No n (%)
3	In my health facility: there are separate containers for collecting hazardous and non-hazardous waste.	91 (39.2)	141 (60.8)
4	all types of containers for waste collection are clearly marked or labelled	107 (46.1)	125 (53.9)
5	sharp wastes are segregated with the use of coloured containers	94 (40.5)	138 (59.5)



S/N	HCW Collection Practices	Yes n (%)	No n (%)
6	containers for waste collection are made of leak-proof (plastic) material	147 (63.4)	85 (36.6)
7	containers used for collecting sharps are puncture-resistant (plastic or metal)	141 (60.8)	91 (39.2)
8	public bins are appropriately placed around the facility premises to collect wastes	93 (40.1)	139 (59.9)
9	waste handlers always use personal protective equipment (PPE) when collecting wastes	111 (47.8)	121 (52.2)
	Overall %		140 (60.3)

Data on Table 2 show that majority 147 (63.4%) of healthcare workers indicated that containers for healthcare waste collection in their health facilities were made of leak-proof (plastic) materials, containers for collecting sharps were puncture-resistant (60.8%).

The Table further shows that majority 141 (60.8%) of the healthcare workers indicated that their health facilities did not have separate containers for collecting hazardous and non-hazardous waste; not all types of containers for waste collection at their facilities were clearly marked or labelled 125 (53.9%). The Table further shows that most 138 (59.5%) of the healthcare workers indicated that sharp wastes were not segregated with the use of coloured containers at the facilities where they worked. Majority 139 (59.9%) of the healthcare workers indicated that public bins were not appropriately placed around their health facilities' premises to collect waste; and more than half 121 (52.2%) of the healthcare workers indicated that waste handlers at their health facilities did not always use personal protective equipment (PPE) when collecting wastes. Overall, the Table indicates that majority 140 (60.3%) of the healthcare workers indicated poor healthcare waste collection practices at their health facilities.

Table 3: Frequency and Percentage Analysis of Responses on Risks associated with HCW Collection Practices (n = 232)

S/N	Risks associated with HCW collection practices	Yes n (%)	No n (%)
	Healthcare waste collection practices at my health facility:		
10	litter the environment	139 (59.9)	93 (40.1)
11	cause air pollution	135 (58.2)	97 (41.8)
12	expose waste handlers to sharp-inflicted injuries	136 (58.6)	96 (41.4)
13	expose waste handlers to infectious diseases	140 (60.3)	92 (39.7)
14	can induce cross-contamination	139 (59.9)	93 (40.1)
	Overall %	138 (59.5)	94 (40.5)

Table 3 show the responses of the healthcare workers which indicated that HCW collection practices at their health facilities: litter the environment 139 (59.9%); cause air pollution 135 (58.2%); expose waste handlers to sharp-inflicted injuries 136 (58.6%); expose waste handlers to infectious diseases 140 (60.3%); and can induce cross-contamination 139 (59.9%). Overall, Table 3 indicates that most 138 (59.5%) of the respondents reported risky healthcare waste collection practices at their health facilities.



Table 4: Frequency and Percentage Analysis on Differences in HCW Collection Practices among Levels of Healthcare Facilities in North-West Senatorial District of Benue State

S/N	HCW Collection Practices	Primary (n = 61)		Secondary (n = 100)		Tertiary (n =71)	
		Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
3	In my health facility: there are separate containers for collecting hazardous and non-hazardous waste.	5 (8.2)	56 (91.8)	67 (67.0)	33 (33.0)	69 (97.2)	2 (2.8)
4	all types of containers for waste collection are clearly marked or labelled	3 (4.9)	58 (95.1)	37 (37.0)	63 (63.0)	67 (94.4)	4 (5.6)
5	sharp wastes are segregated with the use of coloured containers	2 (3.3)	59 (96.7)	25 (25.0)	75 (75.0)	67 (94.4)	4 (5.6)
6	containers for waste collection are made of leak-proof (plastic) material	7 (11.5)	54 (88.5)	71 (71.0)	29 (29.0)	69 (97.2)	2 (2.8)
7	containers used for collecting sharps are puncture-resistant (plastic or metal)	5 (8.2)	56 (91.8)	67 (67.0)	33 (33.0)	69 (97.2)	2 (2.8)
8	public bins are appropriately placed around the facility premises to collect wastes	2 (3.3)	59 (96.7)	32 (32.0)	68 (68.0)	59 (83.1)	12 (16.9)
9	waste handlers always use personal protective equipment (PPE) when collecting wastes	2 (3.3)	59 (96.7)	42 (42.0)	58 (58.0)	67 (94.4)	4 (5.6)
	Overall %	4 (6.6)	57 (93.4)	49 (49.0)	51 (51.0)	67 (94.4)	4 (5.6)

Table 4 shows a higher percentage 67 (94.4%) of health workers from tertiary health facilities than those from secondary (49%) and primary (6.6%) healthcare facilities indicated that these were the HCW collection practices at their facilities. This means that the HCW collection practices among levels of healthcare facilities were not the same in North-West Senatorial District of Benue State.

Table 5: Frequency and Percentage Analysis on the Risks associated with HCW Collection Practices among Levels of Healthcare Facilities in North-West Senatorial District of Benue State

S/N	Risks associated with HCW Collection Practices	Primary (n = 61)		Secondary (n = 100)		Tertiary (n =71)	
		Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
10	Healthcare waste collection practices at my health facility: litter the environment	61 (100)	0 (0.0)	72 (72.0)	28 (28.0)	6 (8.5)	65 (91.5)
11	cause air pollution	61 (100)	0 (0.0)	69 (69.0)	31 (31.0)	6 (8.5)	65 (91.5)
12	expose waste handlers to sharp-inflicted injuries	61 (100)	0 (0.0)	69 (69.0)	31 (31.0)	6 (8.5)	65 (91.5)
13	expose waste handlers to infectious diseases	61 (100)	0 (0.0)	71 (71.0)	29 (29.0)	8 (11.3)	63 (88.7)
14	can induce cross-contamination	61 (100)	0 (0.0)	72 (72.0)	28 (28.0)	6 (8.5)	65 (91.5)
	Overall %	61 (100)	0 (0.0)	71 (71.0)	29 (29.0)	6 (8.5)	65 (91.5)



Table 5 shows that a higher percentage (100%) of health workers from primary health facilities than those from secondary (71%) and tertiary (8.5%) healthcare facilities indicated that these were the risks associated with HCW collection practices at their facilities. This result indicates association in the risks of HCW collection practices among levels of healthcare facilities in North-West Senatorial District of Benue State.

Table 6: Chi-square Analysis of Association between HCW Collection Practices and Levels of Healthcare Facilities in North-West Senatorial District of Benue State

S/N	HCW Collection Practices	Primary (n = 61)		Secondary (n = 100)		Tertiary (n =71)		χ^2
		Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	
	In my health facility:							
3	there are separate containers for collecting hazardous and non-hazardous waste.	5 (8.2)	56 (91.8)	67 (67.0)	33 (33.0)	69 (97.2)	2 (2.8)	111.8***
4	all types of containers for waste collection are clearly marked or labelled	3 (4.9)	58 (95.1)	37 (37.0)	63 (63.0)	67 (94.4)	4 (5.6)	111.5***
5	sharp wastes are segregated with the use of coloured containers	2 (3.3)	59 (96.7)	25 (25.0)	75 (75.0)	67 (94.4)	4 (5.6)	130.5***
6	containers for waste collection are made of leak-proof (plastic) material	7 (11.5)	54 (88.5)	71 (71.0)	29 (29.0)	69 (97.2)	2 (2.8)	108.2***
7	containers used for collecting sharps are puncture-resistant (plastic or metal)	5 (8.2)	56 (91.8)	67 (67.0)	33 (33.0)	69 (97.2)	2 (2.8)	111.8***
8	public bins are appropriately placed around the facility premises to collect wastes	2 (3.3)	59 (96.7)	32 (32.0)	68 (68.0)	59 (83.1)	12 (16.9)	91.8***
9	waste handlers always use personal protective equipment (PPE) when collecting wastes	2 (3.3)	59 (96.7)	42 (42.0)	58 (58.0)	67 (94.4)	4 (5.6)	111.5***
	Overall % & Chi-square	4 (6.6)	57 (93.4)	49 (49.0)	51 (51.0)	67 (94.4)	4 (5.6)	111.0***

*** $p < .001$, Df = 2

Table 6 reveals the result of chi-square analysis indicating a significant association in the healthcare waste collection practices among levels of healthcare facilities (χ^2 (2, N = 232) = 111.0, $p < .001$). The null hypothesis which states that there is no significant association in the HCW collection practices among levels of healthcare facilities in North-West Senatorial District of Benue State was therefore, rejected. This means that HCW collection practices are influenced by the levels of healthcare facilities with the tertiary healthcare facilities having better HCW collection practices than the secondary and primary.



Table 7: Chi-square Analysis of Association between Risks in HCW Collection Practices and Levels of Healthcare Facilities in North-West Senatorial District of Benue State

S/N	Risks associated with HCW Collection Practices	Primary (n = 61)		Secondary (n = 100)		Tertiary (n =71)		χ^2
		Yes	No	Yes	No	Yes	No	
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Healthcare waste collection practices at my health facility:								
10	litter the environment	61 (100)	0 (0.0)	72 (72.0)	28 (28.0)	6 (8.5)	65 (91.5)	125.2***
11	cause air pollution	61 (100)	0 (0.0)	69 (69.0)	31 (31.0)	6 (8.5)	65 (91.5)	117.5***
12	expose waste handlers to sharp-inflicted injuries	61 (100)	0 (0.0)	69 (69.0)	31 (31.0)	6 (8.5)	65 (91.5)	121.2***
13	expose waste handlers to infectious diseases	61 (100)	0 (0.0)	71 (71.0)	29 (29.0)	8 (11.3)	63 (88.7)	116.3***
14	can induce cross-contamination	61 (100)	0 (0.0)	72 (72.0)	28 (28.0)	6 (8.5)	65 (91.5)	125.2***
Overall % & Chi-square		61 (100)	0 (0.0)	71 (71.0)	29 (29.0)	6 (8.5)	65 (91.5)	121.1***

*** $p < .001$, Df = 2

Table 7 shows the result of the chi-square analysis indicating significant risks associated with HCW collection practices among levels of healthcare facilities ($\chi^2 (2, N = 232) = 121.1, p < .001$). The null hypothesis which state that there are no significant risks associated with healthcare waste collection practices among levels of healthcare facilities in North-West Senatorial District of Benue State was therefore, rejected. This means that risks in HCW collection practices are influenced by levels of healthcare facilities where the primary healthcare facilities facing more risks than the tertiary and secondary.

Discussion of Findings

On healthcare waste collection practices, this study found that most (60.8%) of the healthcare workers indicated that their health facilities did not have separate containers for collecting hazardous and non-hazardous wastes. This finding disagrees with Tadesse and Dolamo (2022) who reported a high percentage (90.9%) of healthcare workers in Addis Ababa reporting that their health facilities had separate containers for collecting hazardous and non-hazardous wastes. In this study, more than half (53.9%) of the respondents indicated that the containers used for collecting wastes in their health facilities were not clearly marked or labelled, and that sharp wastes were not segregated with the use of coloured containers (59.5%). This result is in conformity of Abah and Ohimain (2011) who assessed healthcare waste management at a tertiary health facility in Nigeria. Results show that there was no form of colour coding to indicate the type of waste to be deposited in a particular waste bin. This result however, is not in conformity with WHO's guideline, which states that healthcare waste should be segregated into general waste, pathological waste, infectious waste, sharps, pharmaceutical waste, and radioactive waste (WHO, 2017). Public bins were not appropriately placed for waste collection in most health facilities (59.9%), and more than half (52.2%) of the respondents indicated that waste handlers in their health facilities did not always use Personal Protective Equipment (PPE) when collecting wastes. On a whole, healthcare waste collection practices in healthcare facilities in Benue North-West Senatorial District were poor. This is a clear indication of training deficit in waste collection practices in healthcare facilities in the study area. These findings agree with that of Abah and Ohimain



(2011); Anozie et al., (2017) in Nigeria, where waste segregation, labelling of waste containers, colour coding of waste containers, public bins for waste collection and use of PPE by waste handlers during waste collection were reported to be either non-existent or poorly observed. The findings, however, contrast the results of a study conducted in Addis Ababa, Ethiopia which reported high levels of waste segregation, colour coding of waste containers, appropriate placement of public bins around health facilities, and use of PPE during waste collection by waste handlers (Tadesse & Dolamo, 2022). The variation in the findings could be that in Addis Ababa, healthcare facilities may have more organized and established healthcare waste management practice involving the public waste management authority than healthcare facilities in Benue State. This study also found that most (63.4%) respondents indicated that their health facilities were using leak-proof containers for waste collection. This result implies that a substantial number of health facilities in the study area were using containers for waste collection that were substandard. This finding contrasts the result of a study by Ali et al. (2015) which reported 100% use of leak-proof and puncture-resistant containers for healthcare waste collection in hospitals in Pakistan.

The result of the study further shows significant association in the healthcare waste collection practices among levels of healthcare facilities in North-West Senatorial District of Benue State ($\chi^2 (2, N = 232) = 111.0, p < .001$). This finding supports the result of a study in Addis Ababa, Ethiopia which reported significant association in healthcare waste collection practices between primary and secondary public healthcare facilities.

On the risks associated with healthcare waste collection practices, this study found that exposure of waste handlers to infectious diseases was indicated by most participants (60.3%), littering of the environment and cross-contamination (59.9% each), exposure of waste handlers to sharp-inflicted injuries (68.6%), and air pollution (58.2%). Overall, this study found that healthcare waste collection practices at health facilities in Benue North-West Senatorial District were risky (59.5%). This is consistent with the findings of Ferreira and Teixeira (2010) who in their assessment of risks perceptions associated with healthcare waste collection practices in hospitals in Algarve, Portugal reported highest perception of risks such as infections and injuries for the waste handlers (4.24%) and environmental pollution (4.08%). These risks indicated by the study participants could be attributed to the poor healthcare waste collection practices indicated by participants in the study area.

The result of the study further indicates significant risks associated with healthcare waste collection practices among levels of healthcare facilities in North-West Senatorial District of Benue State ($\chi^2 (2, N = 232) = 121.1, p < .001$) with the primary health facilities having higher percentage score than others on risks associated with healthcare waste collection practices (primary = 100% > secondary = 71% > tertiary > 8.5%). The minimal risks indicated at tertiary health facilities by the study participants could be attributed to their better healthcare waste collection practices such as waste segregation, colour coding of waste containers and use of PPE by waste handlers during waste collection which may not be obtainable in many secondary and primary health facilities. This finding agrees with Joshua et al. (2014) who found that about 41% of health workers from selected primary healthcare centres in Zaria had suffered from sharp injuries due to poor healthcare waste collection practices which is higher than the reported percentage (1.6%) of sharp injuries among healthcare workers in secondary healthcare facilities.



Conclusion

Conclusively, HCW collection practices in health facilities in North-West Senatorial District of Benue State were poor. Risks associated with HCW collection practices include exposure of waste handlers to infections and sharp-inflicted injuries, littering the environment, air pollution and cross-contamination.

Findings also revealed that HCW collection practices were influenced by levels of healthcare facilities with tertiary health facilities having better practices than other levels. Further statistics revealed strong relationship between waste collection practices and level of healthcare facilities.

The risks associated with HCW collection practices among levels of healthcare facilities in Benue North-West Senatorial District varied, with primary health facilities having higher risks than other levels. The risks associated with HCW collection practices were influenced by the levels of healthcare facilities in the North-West Senatorial District of Benue State.

Recommendations

Based on the conclusions, it was recommended that:

1. Healthcare waste management committees should be formed in each health facility with the mandate to find ways of improving on the HCW collection practices and enforce compliance with best practices for all levels of healthcare in the North-West Senatorial District of Benue State.
2. Policymakers at the local level should provide periodic training of HCW handlers and provide the necessary apparatus to improve on HCW collection practices targeting the primary and secondary levels of health facilities. This will improve on the HCW collection practices and reduce risks associated with it.

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