

KNOWLEDGE OF HOSPITAL WASTE, AND SAFE MANAGEMENT PRACTICES AMONG HEALTHCARE WORKERS IN AMINU KANO TEACHING HOSPITAL, NORTHWEST NIGERIA

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ABSTRACT

Background: Management of healthcare waste (HCW) has continued to generate increasing public health interest due to the health problems associated with exposure of human beings to wastes, arising from healthcare services. **Objective:** This study assessed knowledge of hospital waste, and safe management practices among healthcare workers in Aminu Kano Teaching Hospital, Northwest Nigeria. **Method:** Descriptive cross-sectional study design was used to study 152 healthcare workers in Aminu Kano Teaching Hospital. Data was collected using semi-structured self-administered questionnaire and analyzed using IBM SPSS version 22. **Results:** The mean age of the respondents was 35.3±6.4 years with about one-half 77(50.7%) within the age range of 35 years. Majority 108(71.1%) of the healthcare workers were males and 145(95.4%) had tertiary education. Doctors constituted 44(28.9%) with up to 105(69.1%) respondents employed less than 10 years ago. Majority of the respondents 123(80.9%) versus 120(78.9%) had satisfactory knowledge and safe hospital waste management practices respectively. Statistically significant association was found between attending training on hospital waste management and having satisfactory knowledge of hospital waste management ($\chi^2=11.8$, p-value=0.001) with those who had previous training on hospital waste management to be 4 times more likely to have satisfactory knowledge of hospital waste management than those with no previous training on hospital waste management {AOR=3.7, 95%CI=(1.3-10.8)}. Satisfactory knowledge of hospital waste was found to be statistically associated with correct hospital waste management practices ($\chi^2=30.4$, p-value<0.001), healthcare workers with satisfactory knowledge had many folds likelihood of safe hospital waste management practice {AOR=9,95%CI= (2.9-28.4)}. **Conclusions:** Knowledge of hospital waste and safe waste management practices were encouraging and associated with formal training on hospital waste management. Therefore, Hospital management should ensure regular training and re-training of healthcare workers.

Key words: Knowledge, Practice, Hospital waste, Healthcare workers

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INTRODUCTION

The most common problems associated with health care wastes are limited waste management, lack of awareness about health risk associated with exposure to such hazards, insufficient financial and human resources for proper management and poor control of waste disposal.¹⁻³ Approximately 15-20% of total hospital wastes generated in

developing countries were found to be hazardous, and there is an associated limited waste segregation and/or nonexistent waste disposal methods.¹Unwanted materials generated during diagnosis, treatment, operation, immunization or in research activities including production of biologicals are termed as biomedical wastes.¹Infectious waste” refers to the portion of medical waste that is in contact with a patient who has infectious disease and is capable of producing an infectious disease while general hospital waste” refers to other forms of waste similar to the ones generated in normal settings at home.³Other forms of biomedical wastes are: sharps, chemical waste from laboratories, pharmaceutical wastes, cytotoxic wastes, radioactive wastes and pathological wastes from deceased persons /post-mortem.³

Wastes generated by health institutions are potential sources of infection transmission, including hepatitis B and C, HIV among others. Generation of waste is indispensable with respect to Health-care Facilities (HCFs) activities, but knowledge of its hazards and good disposable practices have been very poor.¹⁻⁷Medical waste has continued to generate increasing public health interest due to the health problems associated with exposure of human beings to potentially hazardous wastes arising from health-care facilities.³⁻⁷Tertiary health facilities in Nigeria are trying to improve on the management of large amount of waste generated from the wards, clinics, theatre and other units of the hospital to reduce the risk of hazard to exposure.⁴

Management of waste produced during health care is an integral part of hospital hygiene and infection control. Waste generated during provision of health services may be a reservoir of pathogenic microorganisms, and can lead to surge in infection rates. The transmission of microorganisms can be by various means such as direct contact, in the air, or by a variety of other routes. Medical waste hazards and risks exist not only for the waste generators and operators, but also for the general community including children who could play near disposal areas.^{5,6}

Finding from developing countries on healthcare wastes management revealed that segregation,

collection of waste using recommended color coding containers and storage of waste in isolated area were not satisfactory.⁷Moreover, healthcare wastes originating from HCFs are being dumped either into their backyard in a simple pit or put in open garbage bins on the roads, and personal protective equipment and accessories were not provided and not used by HCWs in situations where it was provided. It was reported that, healthcare waste management in Ethiopia indicated that there was no waste segregation in most studied HCFs, personal protective equipment and accessories were not provided and not used by HCWs.⁷

There is paucity of data in Kano that explored hospital waste management knowledge and practices and therefore this study can serve as a foundation for future research in addition to possibly sensitizing policy makers at all levels in regulations and enforcement that will ensure good hospital waste management practices both in private and public hospitals. This study therefore, assessed the level of knowledge and safe hospital waste management practices among healthcare workers in Aminu Kano Teaching Hospital, Northwestern Nigeria.

MATERIALS AND METHOD

Study area/Setting

Aminu Kano Teaching Hospital is a tertiary health institution under the Federal Ministry of Health, in Kano State. This 500 bedded tertiary hospital provides highly specialized services and general care for specific disease conditions for different categories of patients and serves as a referral facility from the neighboring states of Jigawa, Katsina, Kaduna, Bauchi, Gombe, and Zamfara state and neighboring African countries.

The hospital has 17 clinical departments; Surgery, Medicine, Obstetrics and Gynecology, Pediatric, Radiology, Anesthesia, among others. It also has a functional infection control unit. Most of the inpatients and those admitted in emergency units are referred from General Hospitals and other private Hospital/Clinics within Kano state and other hospitals from neighboring states. On the other hand, the General Out-Patient Department and the various specialty clinics take care of usually

stable new and follow up patients. All the departments operate daily including weekends with various categories of hospital waste generated in all the departments. However, some departments generate predominantly more waste based on the type of services offered to the patients than others. Similarly, more wastes are generated during morning hours and between Mondays to Fridays, likely due to larger number of patients seen during those periods. Most hospital wastes are generated during services delivery from consultation by healthcare workers where general hospital wastes can be generated, injections and intravenous access which can generate sharps, medications and laboratory investigations where chemical and infectious waste can be generated and then dispensing and/or serving medications that can generate pharmaceutical wastes.

The hospital has staff strength of about 1443 (Out of which 865 are senior staff and 643 junior staff). This number comprises of both administrative and clinical staff consisting of Doctors, Nurses, and Medical laboratory scientists among others. The staff from clinical departments is involved in various patients' care that is associated with the generation of various categories of hospital wastes that require proper segregation and disposal to prevent infections.

Study design

Descriptive cross-sectional study design was used.

Study population/Inclusion criteria

The study population comprised of all the healthcare providers in clinical departments of Aminu Kano Teaching who have been working for at least one year. However, healthcare workers temporarily away for sick, annual and casual leave or off duty during data collection were excluded from the study.

Sample size determination

A sample of 152 was determined using an appropriate formula for estimating minimum sample size for descriptive studies.⁸

$$n = \frac{Z^2 pq}{d^2}$$

Standard normal deviate (z) 1.96 at 95% confidence interval and margin of error (d) 0.05 and prevalence (p) from previous study,⁹ point prevalence rates of appropriate use of sharp boxes (90.1%) obtained from a past study and a non-response rate of 10% was used to compute the sample size.

Sampling technique

A two staged sampling technique was used to study eligible respondents.

In the first stage, the list of all the clinical units/departments was obtained from the hospital management from which 8 out of the 17 clinical units/departments were selected by simple balloting. The lists of all the healthcare workers in the selected departments were generated in consultation with the unit's head to form the sampling frame. Respondents were proportionately allocated based on the number of healthcare workers in the selected departments.

In the second stage, systematic sampling technique was used to select eligible respondents. For each of the selected departments, the sampling frame obtained was divided by the sample size to obtain the sampling interval. The first respondents of the selected departments were selected by simple balloting, thereafter; subsequent respondents were obtained by adding the sampling interval of each of the departments until the proportionately allocated number and total sample size of 152 was obtained.

Instrument of data collection

Self-administered semi-structured questionnaire with open and close ended questions adapted from previous study¹⁻¹⁰ was used to collect data from eligible respondents. Respondents were informed on the importance of completeness and the need not to check up answers to the questions and were given three days to complete the questionnaires. The questionnaire consisted of three sections that elicited information on the respondent's socio-demographic data, knowledge of hospital waste and safe hospital waste management practices and was pretested among 15 healthcare workers in Murtala Muhammad Specialist Hospital.

Data management and analysis

Data obtained were analyzed using IBM SPSS

version 20 (SPSS Inc, Chicago, USA, 2009) at univariate, bivariate and multivariate levels. Quantitative variables were summarized using appropriate measures of central tendency and dispersion while categorical variables were presented as frequencies and percentages. The dependent/outcome variables were knowledge of hospital waste and safe hospital waste management practices while the independent variables were the socio-demographic characteristics.

Knowledge domain: Fifteen questions were asked to assess the level of knowledge regarding hospital waste management; a correct response was scored one point while a wrong response was allocated a zero point. Respondents with knowledge score of <7.5 and 7.5 were considered to have unsatisfactory and satisfactory knowledge of hospital waste management respectively. Knowledge score of hospital waste management was converted to proportion by dividing the score by (15) and multiplied by hundred.¹⁰

Practice domain: Eleven questions were asked to assess safety hospital waste management practices among the respondents. Correct answer to each question was awarded one point while wrong response was allocated a zero point. Scores of <5.5 and 5.5 were considered unsatisfactory and satisfactory hospital waste safe management practices respectively. Chi square test was used to test for significant association between categorical variables and logistic regression analysis was used to adjust for confounders. A p-value of 0.05 was considered significant. The criteria for inclusion of variable into the logistic regression model were "apriori variable", variables significant on bivariate analysis, and a set p 0.2 for variables that were not significant in bivariate analysis.^{8,10} Adjusted Odds Ratio (OR) with 95% confidence interval (CI) was used to determine the strength of association.

Ethical considerations

Ethical approval was obtained from Health Research Ethics Committee of Aminu Kano Teaching Hospital with approval number of AKTH/MAC/SUB/12A/P-3/VI/2614, and advocacy visit was conducted to the heads of the selected units. Data was collected from April to June

2019. All the principles of research ethics were respected throughout the study and respondents indicated acceptance by filling and signing the consent form.

RESULTS

All the questionnaires distributed were retrieved giving a response rate of 100%.

Socio-demographic characteristics of the respondents.

The mean age of the respondents was 35.3±6.4 years with about one-half 77(50.7%) within the age range of 35 years. More than two-thirds 108(71.1%) of the healthcare workers studied were males with about two-thirds 103(67.8%) from Hausa/Fulani ethnic groups. Majority of the healthcare workers 145(95.4%) had tertiary education with about 82(53.9%) been married.

Doctors constituted about one-quarter 44(28.9%) of the respondents, with healthcare workers from laboratory departments of the hospital constituting about another one-quarter 36(23.7%). Most of the healthcare workers 105(69.1) were employed by the hospital within the last 10 years as shown in table 1 below.

Healthcare worker's knowledge of Hospital waste Management

The maximal point scored by the healthcare workers studied out of 15 knowledge items was 14 and the minimum was 1 point with a mean knowledge score of 9.4±2.4 points. More than three-quarter of the respondents 123(80.9%) had satisfactory knowledge of hospital waste management as shown in figure 1 below. Only about half 80(52.5%) of the respondents ever received formal training on hospital waste management. Slightly lower than half 73(48.0%) of the respondents were able to correctly respond to knowledge item eliciting the meaning of hospital waste segregation. Similarly, only less than one quarter 41(27.0%) of the healthcare workers were fully aware of the type of hospital waste/material that requires chemical disinfection. However, most of the respondents 107(70.4%) were able to explain the meaning of bio-hazard symbol as shown in table

Table 1 Socio-demographic characteristics of the respondents

Variables	Frequency n=152	Percentage (%)
Age(years)		
<35	75	49.3
=35	77	50.7
Mean±SD	35.3±6.4	
Sex		
Male	108	71.1
Female	44	28.9
Ethnic group		
Hausa/Fulani	103	67.8
Yoruba	29	19.1
Igbo	20	13.2
Religion		
Islam	123	80.9
Christianity	29	19.1
Educational status		
No tertiary	7	4.6
Tertiary	145	95.4
Marital status		
Married	82	53.9
Un married	70	46.1
Profession		
Doctors	44	28.9
Nurses	25	16.4
Laboratory scientists	29	19.1
Pharmacists/Technicians	10	6.6
Hospital attendants/ Physiotherapist	2	1.3
Radiographers	16	10.5
Lab technicians	13	8.6
CHEWS/JCHEWS/Cleaners	11	7.2
2	1.3	
Department		
Medicine	17	11.2
Surgery	25	16.4
Obstetrics and gynecology	12	7.9
Pediatrics	20	13.2
Pharmacy	9	6.0
Radiology	15	9.9
Laboratory	36	23.7
Physiotherapy	18	11.8
Number of years in service		
<10	105	69.1
=10	47	30.9
Median and range	6 and 30	
Presence of biohazard symbols in the ward		
Yes	121	79.6
No	31	20.4
Training on hospital waste		
Yes	80	52.6
No	72	47.4
Presence of color coded boxes in the ward		
Yes	100	65.8
No	52	34.2



Figure 1: Distribution of Knowledge of Hospital Waste and Safe Management Practices among Respondents

Table 2 Correct responses to parameters used to assess knowledge and safe hospital waste management practices among respondents

Knowledge items	Frequency n=152	Practice items	Frequency (%)
Ever attended training on Hospital waste	80(52.5)	Presence of departmental plan for waste disposal	119(78.3)
Presence of color coded containers in the ward.	100(65.8)	Existence of hospital system for waste disposal	123(80.9)
Sources of hospital waste.	55(36.2)	Wastes disposed in black containers/bags	59(38.8)
Meaning of general hospital waste	40(26.3)	Wastes disposed in yellow disposal bags	41(27.0)
Meaning of biomedical waste.	140(92.1)	Wastes disposed in red disposal bags	5(3.3)
Meaning of sharp waste	131(86.2)	Waste disposed in safety/sharp box	104(68.4)
Meaning of pharmaceutical waste.	129(84.9)	Identification of bio-hazard symbol	127(83.6)
Meaning of radioactive waste.	135(88.8)	Washing of hands after touching patients	148(97.4)
Meaning of liquid hospital waste.	121(79.6)	Safety measures during waste collection	83(54.6)
Meaning of hospital waste segregation.	73(48.0)	Presence of collected waste storage facility in the department	115(75.7)
Transport procedures for hospital waste.	97(63.8)	Presence of guidelines on waste management in the ward	128(84.2)
Safe disposal of hospital waste.	95(62.5)		
Category of hospital waste needing chemical disinfection.	41(27.0)		
Category of hospital waste needing incineration.	82(53.9)		
Meaning of biohazard symbol	107(70.4)		

Table 3 Factors associated with knowledge of hospital waste management

Variables	Knowledge of Hospital waste		χ ²	p-value	COR	AOR (95%CI)	p-value
	Satisfactory	Unsatisfactory					
Age(years)							
<35	59(78.7)	16(21.3)	0.5	0.5			
≥35	64(83.1)	13(16.9)					
Sex							
Male	86(79.6)	22(20.4)	0.4	0.5			
Female	37(84.1)	7(15.9)					
Ethnic group							
Hausa/Fulani	81(78.6)	22(21.4)	3.0	0.2	0.1	1.1(0.4-2.5)	0.9
Yoruba	23(79.3)	6(20.7)					
Igbo	19(95.0)	1(5.0)					
Religion							
Islam	96(78.0)	27(22.0)	3.4	0.06	1.5	4.6(0.7-31.5)	0.1
Christianity	27(93.1)	2(6.9)					
Educational status							
No tertiary	7(100)	0(0)					
Tertiary	116(80.0)	29(20.0)		0.2†			
Marital status							
Married	72(87.8)	10(12.2)	5.5	0.02*	-0.9	0.4(0.1-1.2)	0.09
Un married	51(72.9)	19(27.1)					
Profession							
Doctors	35(79.5)	9(20.5)	0.7	0.9			
Nurses	20(80.0)	5(20.0)					
Laboratory scientists	25(86.2)	4(13.8)					
Others	43(79.6)	11(20.4)					
Department							
Medicine	12(70.6)	5(29.4)					
Surgery	22(80.0)	3(12.0)					
Obstetrics and gynecology	9(75.0)	3(25.0)					
Pediatrics	16(80.0)	4(20.0)					
Others	64(82.1)	14(17.9)					
Number of years in service							
<10	82(78.1)	23(21.9)	1.8	0.2	-0.1	0.9(0.3-3.3)	0.9
≥10	41(87.2)	6(12.8)					
Presence of biohazard symbols in the ward							
Yes	101(83.5)	20(16.5)	2.5	0.1	-0.4	0.7(0.2-2.1)	0.5
No	22(71.0)	9(29.0)					
Training on hospital waste							
Yes	50(69.4)	22(30.6)	11.7	0.001*	1.3	3.7(1.3-10.8)	0.02*
No	73(91.3)	7(8.7)					
Practice							
Satisfactory	17(53.1)	15(46.9)	30.4	<0.001*	2.2	9(2.9-28.4)	<0.001*
Unsatisfactory	12(10.0)	108(90.0)					

*Statistically significant COR=Crude odds ratio AOR= Adjusted odds ratio CI=Confidence interval

Table 4 Factors associated with safe hospital waste management practices

	Practice of Hospital waste management			p-value	COR	AOR (95% CI)	p-value
	Satisfactory	Unsatisfactory	²				
Age(years)							
<35	55(73.3)	20(26.7)	2.8	0.09	2.5	12.4(1-157.5)	0.05*
=35	65(84.4)	12(15.6)					
Sex							
Male	82(75.9)	26(24.1)	2.0	0.2	-0.5	0.6(0.1-2.8)	0.5
Female	38(86.4)	6(13.6)					
Ethnic group							
Hausa/Fulani	81(78.6)	22(21.4)	0.02	1.0			
Yoruba	23(79.3)	6(20.7)					
Igbo	16(80.0)	4(20.0)					
Religion							
Islam	97(78.9)	26(21.1)	0.03	1.0			
Christianity	23(79.3)	6(20.7)					
Educational status							
No tertiary	7(100.0)	0(0)	2.0	0.2†			
Tertiary	113(77.9)	32(22.1)					
Marital status							
Married	70(85.4)	12(14.6)	4.4	0.04*	-0.2	0.8(1.1-4.5)	0.8
Un married	50(71.4)	20(28.6)					
Profession							
Doctors	40(90.9)	4(9.1)	11.1	0.01*	-0.6	0.5(0.2-1.1)	0.09
Nurses	17(68.0)	8(32.0)					
Laboratory scientists	24(82.8)	5(17.2)					
Others	5(50.0)	5(50.0)					
Department							
Medicine	12(70.6)	5(29.4)					
Surgery	22(88.0)	3(12.0)					
Obstetrics and gynecology	8(66.7)	4(33.3)					
Pediatrics	16(80.0)	4(20.0)					
Others	62(79.5)	16(20.5)					
Number of years in service							
<10	80(76.2)	25(23.8)	1.6	0.2	-0.7	0.5(0.2-1.1)	0.7
=10	40(85.1)	7(14.9)					
Presence of biohazard symbols in the ward							
Yes	99(81.8)	22(18.2)	3.0	0.09	1.3	3.5(0.5-22.6)	0.2
No	21(67.7)	10(32.3)					
Training on hospital waste							
Yes	49(68.1)	23(31.9)	9.8	0.002*	1.6	5.1(1.2-22.3)	0.03
No	71(88.8)	9(11.3)					

*Statistically significant COR=Crude odds ratio AOR= Adjusted odds ratio CI=Confidence interval

DISCUSSION

Adequate Knowledge of various types of waste generated in the healthcare system during service provision is important in the prevention of hospital acquired infections. However, this is only possible if the healthcare workers employ the use of correct and standard hospital waste management practices.

More than three-quarter of the healthcare workers studied in this study had satisfactory knowledge 123(80.9%) and acceptable 120(78.9%) hospital waste management practices. This may be attributed to the fact that the study area is a teaching hospital with possibility of having a functional infection prevention and control team that may be involved in surveillance activities for proper hospital waste management. In addition, the findings may also be explained by the fact that a self-administered questionnaire was used and the respondents may checkup answers to the questions thereby giving correct responses. However, the use of various color coded bags for waste disposal were found to be low, below expected. This may be related to training on hospital waste management among the respondents. Trainings are expected to give detail information on the need for hospital waste segregation and the use of dedicated color coded containers as one of the key practices in the management of hospital wastes. This will help in the prevention of hospital acquired infections associated with poor hospital waste management. This is further buttressed by the finding of a statistically significant association between attending training on hospital waste management and having satisfactory knowledge of hospital waste management ($\chi^2=11.8$, p -value=0.001). Those who had previous training on hospital waste management being about 4 times more likely to have satisfactory knowledge of hospital waste management than those with no previous training on hospital waste management {AOR=3.7, 95%CI= (1.3-10.8)}.

Findings from this study was better than what was reported in a study conducted in Cairo that reported total satisfactory knowledge scores (68.3%) among doctors to be significantly higher than among nurses (60.9%).¹¹ Nurses were however

found to have slightly better satisfactory knowledge than doctors 20(80%) vs 35(79.5%) which was slightly similar to what was obtained in a study conducted in India 82(79.9%).¹²

Similarly, Satisfactory knowledge of hospital waste was found to be statistically associated with correct hospital waste management practices ($\chi^2=30.4$, p -value<0.001). Healthcare workers that had satisfactory knowledge being about 9 times more likely to correctly practice hospital waste management {AOR=9, 95%CI= (2.9-28.4)}. Therefore, satisfactory knowledge of hospital waste is an independent predictor of correct hospital waste management practices among the healthcare workers studied. The finding emphasized the importance of satisfactory knowledge of hospital waste among healthcare providers. In comparison with what was found by a study conducted in Pakistan, sanitary staff were found to be unaware of the safety practices measures required for hospital waste, however, knowledge regarding transmission of diseases and color coding was more among nurses and doctors.¹³

In the same vein, waste segregation at the site of production was not according to standards in this study due to significant number of reports by the respondents in this study that does not provide correct answer to the question on hospital waste segregations. This may be explained by limited training on hospital waste management among healthcare workers studied.

This study found the practice of satisfactory hospital waste management to be highest among doctors 40(90.9%), followed by laboratory scientists and nurses; 24(82.8%) and 17(68.0%) respectively. In addition, we report an overall "satisfactory" score of 120(78.9%) which is similar to "satisfactory" score of 74.4% reported in a study conducted in Oman. However, the study in Oman reported higher satisfactory score among nurses, followed by doctors and laboratory technicians; (80%), (72.2%) and (57.1%) respectively.¹⁴

Majority 123 (80.9%) of the respondents in this study reported the awareness of an existing hospital waste management guideline. This is a

good finding that can significantly reduce the burden of hospital acquired infections associated with poor management of hospital wastes. A study conducted in Indonesia revealed that the key determinants of hospital waste segregation were availability of budget, central policy, management policy and availability of standard operating procedures in the hospital wards.¹⁵

CONCLUSION AND RECOMMENDATIONS

Knowledge of hospital waste and safe hospital waste management practices among healthcare

workers studied were encouraging with prior formal training on hospital waste management to be significantly associated with satisfactory knowledge of hospital waste. Therefore, government in collaboration with hospital managements should ensure regular training and re-training of healthcare workers on recommended hospital waste management guidelines. Further, periodic evaluation of these practices will help in identifying areas that may need specific intervention.

REFERENCES

1. Nagaraju B, Padmavathi GV, Puranik DS, Shantharaj MP, Sampulatha SP. A study to assess the knowledge and practice on bio-medical waste management among the health care providers working in PHCs of Bagepalli Taluk with the view to prepare informational booklet. *Int J Med Biomed Res* 2013;2(1):28-35
2. Olukanni DO, Azuh DE, Toogun TO, Okorie UE. Medical waste management practices among selected health-care facilities in Nigeria? A case study. *Acad journals*. 2014;9(10):431-9.
3. Morenikeji OA, Inyang AB, Udobia IU. Hospital waste management practice alertness among health practitioners in secondary and tertiary care facilities in Uyo metropolis, Akwa Ibom. 2017;5(2):44-53
4. Adogu P, Ubajaka CF, Nebuwa EJ Knowledge and practice of medical waste management among health workers in a nigerian general hospital. *Asian J Sci Technol*. 2014;5(12):833-8.
5. Merandi R, Williams A. Effectiveness of ' Training Programme ' on Knowledge and Practices of Biomedical Waste Management among Health Care Workers. *Galore Int J Heal Sci Res*. 2017;2(4):45-52.
6. Shareefdeen ZM. Medical Waste Management and Control. *J Environ Prot*. 2012;3(5):1625-8.
7. Muluken A, Haimanot, Mesafint M. Healthcare waste management practices among healthcare workers in healthcare facilities of Gondar town, Northwest Ethiopia. *Health Science Journal*. 2013;7(3):315-26
8. Lawan UM, Iliyasu Z, Abubakar S, Gajida AU, Abdussalam A. Personal and food hygiene practices of subsistence food vendors operating in Kano metropolis, Northwestern Nigeria. *International Journal of Medical Science and Public Health*. 2015;4(2):214-21.
9. Haile DC, A Dessie A, Sintayehu Daba SW. Hospital Waste Handler's Knowledge of Health care Waste Management at Gondar University Hospital: An institutional-based cross-sectional study. *Ethiop. J. Health Dev*. 2018;32(4):1-5.
10. Deress T, Hassen F, Adane K, Tsegaye A. Assessment of Knowledge, Attitude, and Practice about Biomedical Waste Management and Associated Factors among the Healthcare Professionals at Debre Markos Town Healthcare Facilities, Northwest Ethiopia. *Journal of Environmental and Public Health*. 2018(1):1-10
11. Hakim SA, Mohsen A, Bak I. Knowledge, attitudes and practices of health-care personnel towards waste disposal management at Ain Shams University Hospitals, Cairo. *EMHJ*. 2014;20(5):347-54
12. Rao D, Dhakshaini MR, Ameet Kurthukoti A, Doddawad VG. Biomedical Waste Management: A Study on Assessment of Knowledge, Attitude and Practices among Health Care Professionals in a Tertiary Care Teaching Hospital. *Biomed. & Pharmacol. J*. 2018;11(3), 1737-1743
13. Ahmad T, Komal T, Mustafa M, Anjum S. Hospital Waste Management awareness, attitude and practices in twin Cities of Pakistan. *Int J Pharm Bio Sci* 2015 April; 6(2): (B) 503 – 51
14. Al Balushi DA, Ullah MT, Makhmri AA, Sulieman FA, Khalid M, Al Ghafri MH. Knowledge, Attitude and Practice of Biomedical Waste Management among Health Care Personnel in a Secondary Care Hospital of Al Buraimi Governorate, Sultanate of Oman. *Global Journal of*

Health Science.2018;10(3).70-82

15. Irianti S, Prasetyoputra P, Heart

S. Determinants of Hospital waste Management in Indonesia focusing on the importance segregation

at source and color coded collection system.

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