KNOWLEDGE AND ATTITUDE OF HEALTHCARE WORKERS TOWARDS HEALTHCARE WASTE MANAGEMENT AT YUSUF DANTSOHO MEMORIAL HOSPITAL (YDMH), KADUNA, NIGERIA

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Abstract

Introduction:

Waste generated in hospitals has been documented to be poorly managed and handled by the administration and staff respectively, leading to environmental and health consequences within hospitals and to the outside population.

Aim:

To assess the knowledge and attitude of healthcare workers towards healthcare waste management (HCWM) at YDMH, Kaduna, Nigeria.

Materials and methods:

A cross-sectional study was conducted amongst skilled workers (doctors, nurses and medical laboratory scientists/technicians) and unskilled workers (ward attendants and cleaners) of YDMH. Seventy-three (73) health workers, randomly selected, consented to an interview. 39 males (53.4%) and 34 females (46.4%) participated in this study, the mean age of participants was 36.8±8.3 years. The data was obtained through the administration of a pre-tested questionnaire on the knowledge and attitude of the health workers towards HCWM. The data were collected and collated using Microsoft Excel and analysed using IBM, SPSS version 23.0, t-test for the significance of the results.

Results:

The knowledge of HCWM of skilled workers was significantly higher (p=1.06E-05) than the knowledge of unskilled workers. Nurses (88.18%) had the best knowledge of HCWM while the cleaners (17.5%) had the least knowledge. The attitude of HCWM of skilled workers was significantly higher (p=8.6E-05) with medical doctors possessing the best attitude towards proper HCWM and ward attendants possessing the worst attitude. The overall comparison of knowledge and attitude was significantly better (p=2.21E-06) among skilled workers than unskilled workers.

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Inadequacies of knowledge and attitude toward proper healthcare waste management (HCWM) among healthcare workers were observed. The healthcare workers with the best knowledge were the doctors, nurses, and medical laboratory scientists/technicians while the ward attendants and cleaners had poor attitudes. These findings call for the need to train and retrain all health workers, with greater emphasis and attention on the ward attendants and cleaners.

Keywords—knowledge; attitude; healthcare; health worker; healthcare waste management; Nigeria

I. INTRODUCTION

Hospitals at different hierarchies generate infectious wastes such as syringes, live vaccines, laboratory samples, body parts, body fluids waste, sharp needles, cultures, and lancets. These wastes are primarily generated by patients' management (diagnosis, treatment, prevention, and research). At different units of the hospital, varieties of wastes are generated and they have the tendency to contaminate body fluids (e.g. blood, saliva) and tissue of patients because they may contain infectious microorganisms [18] while some wastes might be considered noninfectious [2].

Owing to the rapid population growth in Nigeria, the demand for healthcare has increased significantly. Simultaneously, the numbers of hospitals, small and medium-scale nursing homes, and clinics have rapidly increased, generating large quantities of infectious wastes. 10-25% of infectious wastes are generated in hospitals, but due to improper management of healthcare wastes (HCW), the infectious wastes contaminate the non-infectious waste thus increasing the proportion of infectious waste being generated [13]. The problem is aggravated by a marked increase in disposable healthcare materials.

Conclusion:

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Diseases like Hepatitis B, HIV, Lassa fever, tuberculosis, etc could be spread by improperly managed infectious hospital wastes. Used sharp objects such as needles, and surgical blades could cause a physical injury. More so, mismanagement of other wastes like pathological, chemical, pharmaceutical, cytotoxic, radioactive and general wastes results in environmental pollution and severe health complications, therefore these wastes need special attention for their proper disposal.

The safe handling and disposal of healthcare wastes have gained the attention of not only healthcare providers but also public health administrators, in order to have healthier societies [20]. The World Health Organisation (WHO) estimates that 15% to 25% of healthcare wastes generated through various procedures done in healthcare facilities is detrimental to health and the environment at large [10]. In 2000, WHO estimated the global occurrence of the following infections due to injections with contaminated needles and syringes: 21 million hepatitis B virus (HBV) infections, 2 million hepatitis C virus (HBC) infections and 260,000 HIV infections [6]. Health workers, patients, waste pickers and recyclers, and general masses are prone to develop these infections.

To ensure infection prevention and control (IPC), there is a need for the optimum management of wastes by minimising the quantity produced and ensuring adequate waste treatment, collection, segregation, transportation, storage, and disposal [18]. Aside from household wastes and industrial wastes, HCWs are also among the most dangerous wastes generated in the world that need to be properly disposed of, by trained healthcare staff [12].

Knowledge and proper attitude of medical staff towards waste management are essential while managing these wastes. Recycling and reuse of syringes are serious public health problems reported globally, resulting in potential threats to the general public [13]. The main threat is needle-prick injuries, especially among the healthcare workers who are handling the waste. A worker who gets injured by a needle stick used on an HBV, HCV, or HIV-infected patient has risks of 30%, 1.8%, and 0.3% respectively of becoming infected with the respective viruses [21]. It has been reported that the healthcare waste generation rate ranges from 0.5 to 2.0 kg per bed, per day globally [13]. HCWs comprise 15-20% of general wastes, but due to poor segregation by hospital staff, this results in contamination of the general wastes that emerge in many infectious diseases and other environmental hazards if not properlydisposed of [12].

To this day, many neighbourhoods practice substandard waste disposal. This act attracts scavengers who pick up waste items. These items include papers, metals, and plastics and they have the ability to litter their components around in the course of being transported, thus risking the health of the inhabitants. Hospitals without a well-designed waste disposal medium within their facility, such as incineration, can lead to open dumping of human organ waste in an open field. Most populous countries like China, India, Pakistan, Bangladesh, and Nigeria are facing poor infectious waste management practices in hospitals that result in occupational and public health challenges for the general masses [21].

Management of HCW is a contemporary global issue with regard to its resultant effect on health, the immediate environment, socio-economic impact, and global warming. HCWM is also vital in the attainment of the sustainable millennium development goals. Locally, there are just a few studies related to infectious HCWM among different groups of health workers. The knowledge and attitude of these workers are also yet to be compared. Hence, this study has focused on the evaluation and analysis of the knowledge and attitude of all health workers working at Yusuf Dantsoho Memorial Hospital (YMDH), Kaduna, Nigeria.

II. MATERIALS AND METHODS

The study was conducted from January to February 2022 at Yusuf Dantsoho Memorial Hospital (YDMH), Kaduna, Nigeria. The study setting was YDMH, a secondary healthcare facility commissioned in 1975 mainly to treat residents of Kaduna North Local Government Area (LGA), Kaduna State, and

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people around the LGA. This hospital has male and female wards, a theatre, laboratories, maternity, administrative, laundry, catering, and other units, and the total bed space is 300 beds.

This study is a cross-sectional, descriptive, and hospital-based study conducted among doctors, nurses, medical laboratory scientists and technicians, ward attendants and cleaners working in all the wards and maternity at YDMH.

The sample size of this study was calculated using the formula for estimating the sample size for crosssectional descriptive studies [5, 18, 19]:

$$n = \frac{Z^2 p q}{d^2}$$

Where:

n = minimum sample size

Z = value of standard normal deviate set at 1.96 corresponding to 95% confidence level.

p = proportion of healthcare providers with good knowledge of HCWM based on previous studies or a pilot study. A pilot study was conducted with 10% of the proposed sample size (n=100) from doctors, nurses, and cleaners working outside Kaduna. The proportion for their knowledge was set at 95% = 0.95

q = 1-p = proportion of healthcare providers without good knowledge and practice of HCWM = 0.05

d = desired degree of precision = 5% = 0.05

Therefore,

 $n = \frac{1.96^2 \times 0.95 \times 0.05}{0.05^2}$

$$n = \frac{3.8416 \times 0.0475}{0.0025}$$
$$n = \frac{0.18925}{0.0025}$$
$$n = 72.9$$
$$n \sim 73$$

A 10% (0.10) non-response rate of the sample size was added to the calculated sample size to make it 80 respondents. The respondents included healthcare workers working in the study area who agreed and consented to partake in the study. Every participant must have worked in the health facility for over 6 months, and must have had direct dealings with waste generation, segregation, storage, transportation and disposal of medical wastes. Due to the heterogeneous characteristics of the study population, respondents were selected from each stratum through simple random sampling. Workers who were absent on the day of data collection were excluded. Data were collected by the administration of pre-tested questionnaires by trained research assistants to the participants who met the study's inclusion criteria.

Data were analysed using IBM, SPSS (Statistical Package for Social Sciences) version 23.0. The level of knowledge and attitude of healthcare workers towards HCWM were evaluated and presented in proportions using a percentage score above 50%: scores \geq 50% were interpreted as good and scores <50% as poor. The knowledge and attitude of HCWM among these workers were analysed using the t-test, and the significance level was set at *p*<0.05.

Ethical approval was obtained from the Research and Ethics Committee, Ministry of Health and Human Services, Kaduna State, Nigeria. The respondents were all assured that the information received from them will be kept confidential. In addition, sensitive information was avoided as much as possible and written informed consent was obtained from each of the respondents.

III. RESULTS

Seventy-three (73) healthcare workers were interviewed giving a response rate of 91.3%. The results of the study discussed are demographic data of participants shown in Table 1, knowledge of the healthcare workers on HCWM is shown in Table 2 and practice of healthcare workers on HCWM is shown in Table 3.

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Characteristics	Options	Frequency, n (%)		
Age (year range)	20-30	23 (31.5)		
	31-40	27 (37.0)		
	41-50	15 (20.5)		
	51-60	8 (11.0)		
	Total	73 (100)		
	Mean age = 36.8 ± 8.3			
Gender	Male	39 (53.4)		
	Female	34 (46.6)		
	Total	73 (100)		
Profession	Doctors	9 (12.4)		
	Nurses	33 (45.2)		
	Med. Lab. Scientists/Technicians	12 (16.4)		
	Ward Attendants	11 (13.7)		
	Cleaners	8 (12.3)		
	Total	73 (100)		
Ward/department	Medical	23 (31.5)		
	Surgical	11 (15.1)		
	Gynaecology	14 (19.2)		
	Microbiology	7 (9.6)		
	Haematology	11 (15.0)		
	Chemical Pathology	7 (9.6)		
	Total	73 (100)		
Duration of work experience	6 months - <5 years	26 (35.6)		
(years)	5-10	28 (38.4)		
	>10	19 (26.0)		
	Total	73 (100)		

Table 2: Knowledge of healthcare waste management (HCWM)

Statements	Scores	Doctors n (%)	Nurses n (%)	Scientists n (%)	Attendants n (%)	Cleaners n (%)
Item 1: What do you mean by	Correct	100	90.9	83.3	9.1	12.5
biomedical waste?	Incorrect	0	9.1	16.7	90.9	87.5
Item 2: How should biomedical	Correct	88.9	84.8	83.3	9.1	12.5
wastes be disposed of?	Incorrect	11.1	15.2	16.7	90.9	87.5
Item 3: Are there any guidelines	Correct	100	97.0	100	0	0
for biomedical wastes disposal by the hospital management?	Incorrect	0	3.0	0	100	100
Item 4: Correct sequence of biomedical wastes segregation	Correct Incorrect	88.9 11.1	87.9 12.1	83.3 16.7	18.2 81.8	12.5 87.5

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Item 5: According to government	Correct	55.6	69.7	58.3	27.3	25.0
guidelines, untreated biomedical	Incorrect	44.4	30.3	41.7	72.7	75.0
wastes should not be treated						
beyond?						
Item 6: Is training on waste	Correct	100	100	100	90.9	75.0
management very important?	Incorrect	0	0	0	9.1	25.0
Item 7: Infectious sharps and	Correct	88.9	97.0	83.3	9.1	0
needles are disposed of in?	Incorrect	11.1	3.0	6.7	90.9	100
Item 8: Biomedical waste	Correct	100	90.9	91.7	9.1	25.0
handlers should?	Incorrect	0	9.1	8.3	90.9	75.0
Item 9: In order to prevent needle	Correct	88.9	84.8	58.3	0	0
sticks, the safety boxes should be closed. How full should they be?	Incorrect	11.1	15.2	41.7	100	100
Item 10: Infectious						
biodegradables (human tissues,	Correct	55.6	78.8	33.7	18.2	12.5
membranes, extracted teeth,	Incorrect	44.4	21.2	66.3	81.8	87.5
cotton dressing, etc.) are disposed of in						

Source: Field Survey





Table 3: Distribution of attitude of study respondents, n = 73

Respondents	Doctors (n=9)	Nurses (n=33)	Scientists (n=12)	Attendants (n=11)	Cleaners (n=8)
Questions	Agree Disagree (%)	Agree Disagree (%)	Agree Disagree (%)	Agree Disagree (%)	Agree Disagree (%)
Item 1: I always put waste in the	52.9	36.4	41.7	14.3	0
correct plastic bags	47.1	63.6	58.3	85.7	100
Item 2: I believe that correct waste segregation and	100	95.5	95.8	42.9	0
disposal are of utmost importance for preventing infection transmission	0	4.5	4.2	57.1	100
Item 3: I feel that wearing personal protective	100	95.5	100	14.3	33.3
equipment reduces the risk of contracting an infection	0	4.5	0	85.7	66.7
Item 4: Waste disposal is a teamwork effort and	100	90.9	83.3	14.3	0
not a hospital management responsibility only	0	9.1	16.7	85.7	100
Item 5: Efforts in safe waste disposal are a	82.4	50	58.3	28.6	66.7
financial burden on the administrative department of the hospital	17.6	50	41.7	71.4	33.3
Item 6: Are biomedical waste disposal charts in	88.2	100	95.8	0	0
your department helpful?	11.8	0	4.2	100	100
Item 7: Do you follow colour coding while	94.1	86.4	50.0	28.6	100
disposing biomedical wastes?	5.9	13.6	50.0	71.4	0
Item 8: Do you believe that inappropriate biomedical waste disposal causes health hazards?	100 0	90.9 9.1	87.5 12.5	0 100	0 100

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T4	00 F	06.0	00.0	20.0	20.0	
Item 9: Segregation of waste at the source increases	98.5	96.0	99.0	30.0	20.0	
the risk of injury to waste handlers	1.5	4.0	1.0	70.0	80.0	
Item 10: I feel that safe management of healthcare	75.0	86.0	88.0	55.0	30.0	
waste is the responsibility of the government	25.0	14.0	12.0	45.0	70.0	
G F: 11 G						

Source: Field Survey

Table 4: Comparison of knowledge and attitudes towards HCWM among healthcare workers at YDMH

Parameter	Profession	Mean ± SD	Comparing	<i>p</i> -value	
	Doctors 86.68±17.20	86.68±17.20	Nurses	Doctors	0.331
Knowledge of	Nurses	88.18±9.21			
HCWM	Med. Lab.	77.48±21.19	Nurses	Med. Lab.	
among	Scientists			Scientists	0.026
healthcare	Ward	19.1±26.57			
workers	Attendants		Skilled	Unskilled	
	Cleaners	17.5±22.2	workers	workers	1.06E-05
Attitude of	Doctors	89.11±15.43	Doctors	Nurses	0.0741
healthcare	Nurses	82.76±21.54			
workers	Med. Lab.	79.94±21.68	Doctors	Med. Lab.	0.0576
towards	Scientists			Scientists	
HCWM	Ward	22.8±17.69			
	Attendants		Skilled	Unskilled	8.6E-05
	Cleaners	25±34.33	workers	workers	
Knowledge	Doctors	87.9±12.75	Doctors	Nurses	0.198
and attitude	Nurses	85.47±13.33			
of healthcare	Med. Lab.	78.71±15.74	Doctors	Med. Lab.	0.003
workers	Scientists			Scientists	
towards	Ward	20.95±13.02			
HCWM	Attendants		Skilled	Unskilled	2.212E-06
	Cleaners	21.25±16.98	workers	workers	

Seventy-three (73) healthcare workers (respondents) participated in this study. Respondents within 31 to 40 years were the largest (37%) while the participants between 51 to 60 years were the least in number (11%) (Table 1). The mean age of respondents was 36.8 ± 8.3 years. The gender proportion was 53.4% males and 46.6% females. Nurses were most represented in this study (45.2%) and participants with 5 to 10 years of experience were the largest (38.4%).

Using a percentage score ≥50% as good knowledge and a percentage score <50% as poor knowledge, the hierarchy of good knowledge of HCWM among health workers was nurses (88.18%), doctors (86.68%), medical laboratory scientists and technicians (77.48%), ward attendants (19.1%), and cleaners (17.5%). Nurses and cleaners have the best

and worst knowledge of HCWM respectively (Table 2

and Figure 1).

Similar to the percentage score rating as knowledge (a percentage score ≥50% is a good attitude and a percentage score ≥50% is a poor attitude), the hierarchies of good attitude towards proper HCWM among health workers were doctors (89.11%), nurses (82.76%), medical laboratory scientists and technicians (79.94%), cleaners (25%), and ward attendants (22.8%). Doctors and ward attendants have the best and worst attitudes towards HCWM respectively (Table 3 and Figure 2). Table 4 identifies the significant difference in knowledge and attitude between the various professions.

IV. DISCUSSION

This study reveals that there were differences in knowledge and attitude of healthcare workers towards healthcare waste management among the five categories of healthcare workers studied. The knowledge of biomedical waste management was proportional to the level of education of the workers in the health facility: the skilled workers viz nurses (88.18%); doctors (86.68%), and medical laboratory scientists and technicians (77.48%) had good knowledge of HCWM as they all scored over 50%, while the unskilled workers viz ward attendants (19.1%) and cleaners (17.5%) had very low knowledge of HCWM as they scored below 50%. This finding is true as the t-test gives a p-value of 1.06E-05 when the values between skilled and unskilled workers were analysed. The statement also correlates with Deo, *et al.* study in 2006 and Anna, *et al.* study in 2016. These studies highlighted that the average scores were higher in medical personnel than in paramedical staff [4, 7, 13].

A good percentage of doctors (88.9%), nurses (87.9%), and medical laboratory scientists and technicians (83.3%) have good knowledge of the correct sequence of segregating biomedical wastes. This is in line with an Indian study in which the knowledge of colour-coding containers and waste segregation was found to be better among nurses and doctors as compared to that of other staff [15]. The ward attendants (18.2%) and cleaners (12.5%) poorly understood the correct sequence of biomedical waste segregation. All the unskilled workers (0%) did not know how full the safety boxes should be to prevent needle-stick from pricking a waste handler or if there were any guidelines for biomedical waste disposal by the hospital management.

Comparing the knowledge on waste segregation in this study with other studies in Northern India and Pakistan, the findings in this study were fair. The Northern India study conducted in 2013 revealed that about 85% and 81% of the consultants and resident doctors respectively, had relevant knowledge of biomedical waste management [3]. The study in Pakistan conducted in 2013 showed that 61% of doctors had knowledge regarding biohazards symbols recognition, proper segregation (86%) and waste collection coding and proper disposable (86%) [12]. Similar studies conducted in Ethiopia and India indicated that attitude and knowledge among health workers such as doctors, nurses and cleaners could also play a vital role in waste management and could vary between different health professionals [11].

Further analysis of the results of this study shows that there was no significant difference between the knowledge of nurses and doctors (p=0.331), but comparing nurses and medical laboratory scientists/technicians, the former had a significantly higher (p=0.026) knowledge of HCWM compared to the latter. Knowledge of health personnel on the segregation of waste is important to appropriately segregate all types of waste and to limit the spread of infections. This pre-requisite benefits the health workers, patients and their relatives, visitors and the community. and it also reduces costs and unnecessary spending.

This study shows that 93.2% of these workers received training on HCWM. This value is higher when compared to studies conducted in 2011 and 2019 in two different tertiary facilities in Nigeria which revealed that the proportion of respondents who had been trained on HCWM was 11.5% and 57.3% respectively [1]. The training the respondents received on HCWM only manifested among the skilled workers. The unskilled workers viz the cleaners, who handle biomedical wastes all the time could barely correctly answer the ten questions on knowledge of HCWM correctly. Re-training of the unskilled workers is therefore important as it will impart knowledge, give information, and make a real difference in alleviating health hazards.

Regarding the attitude of healthcare workers towards HCWM, the attitude of the healthcare workers was proportional to their educational levels. Doctors (89.11%), nurses (82.76%), and medical laboratory scientists and technicians (79.94%) had a proper attitude towards HCWM as they all scored over 50%, while the cleaners (25%) and ward attendants (22.8%) who are unskilled had a very poor attitude towards HCWM. This finding is true as the t-test gives a pvalue of 8.6E-05 when the values between skilled and unskilled workers were analysed. An average of 43.67% (skilled workers) and 7.15% (unskilled workers) agreed that they always put biomedical wastes in the correct plastic bags while an average of 97.1% (skilled workers) and 21.45% (unskilled workers) agreed that proper waste segregation and disposal are of utmost importance for preventing infection transmission. WHO assessed HCW management practices in developing countries and reported that between 18% and 64% of the healthcare facilities (HCFs) did not use proper waste disposal methods [22], and another study done in Namibia showed that most of the healthcare workers strongly agreed that safe biomedical waste disposal is of utmost importance for preventing infections, and their transmission [4]. 98.5% of skilled workers agreed that wearing personal protective equipment (PPE) reduces the risk of contracting infection, although the unskilled workers barely agree, with just 23.8% expressing the attitude. All the doctors (100%) agreed that waste disposal is a teamwork and not a hospital management responsibility, while 90.9% of nurses, 83.3% of medical laboratory scientists and technicians, 14.3% of ward attendants, and none of the cleaners agreed with the statement. These findings agree with the report of another study conducted in Egypt that reports waste disposal is a teamwork and that disposal of waste is a financial burden on the hospital [9].

The t-test analysis shows that there was no significant difference in the attitude of doctors and nurses (*p*=0.0741), and doctors and medical laboratory scientists/technicians (p=0.0576) towards HCWM, but the attitude of skilled workers was significantly better (8.6E-05) than unskilled workers. There was a positive attitude of the skilled healthcare workers towards waste management. This attitude could influence the way waste is managed. The findings of the two studies in India suggest that the biomedical waste management programme cannot successfully be implemented without the willingness and cooperation of health professionals. It was concurred that for healthcare workers to have the correct knowledge and attitude towards hospital waste

management, there should be a continuing training programme along with constant monitoring, so that it leads to a safe, protected, biohazard-free environment [11].

Finally, the key strength of this study was that the assessment of knowledge and attitude towards waste management gave a unique opportunity to provide information about a topic which is lacking in the hospital. This study shows that the knowledge and attitude of skilled workers are significantly higher (2.212E-06) when compared to the same attributes of unskilled workers. Also, of all the professions involved in this study, doctors have overall best knowledge and attitude of 87.9%, a value not significantly higher (p=0.198) than those of nurses (85.47%), but significantly higher (p=0.003) than those of medical laboratory scientists and technicians (78.71%). This study also helped to identify the gaps between the current knowledge and attitude of healthcare workers towards healthcare waste management and the future desired state that should be reached.

V. CONCLUSION

It can be stated that there is good knowledge and attitude of healthcare workers towards healthcare waste management: good knowledge and attitude among medical laboratory scientists/technicians, better knowledge and attitude among nurses, and best knowledge and attitude among doctors. Unskilled health workers (ward attendants and cleaners) have knowledge of healthcare verv poor waste management. The training on healthcare waste management that the waste handlers received was insufficient, as such there is need for proper orientation, re-orientation, proper training, re-training which should be organised regularly for them and all other hospital staff.

CONFLICT OF INTEREST

The authors guarantee responsibility for everything published in this manuscript, as well as the absence of a conflict of interest and the absence of their financial interest in performing this research and writing this manuscript. This manuscript was written from an original research work and has never been published, neither is it under consideration for publication elsewhere.

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