

Knowledge, Attitude and Practice of Health Care Waste Management among Healthcare Workers in Health Facilities in Central River Region, The Gambia

¹Jallow, M. and

²Uyamadu, E.A.

¹Ministry of Health
Directorate of Planning and
Information Monitoring and
Evaluation Unit
CMS Complex, Kotu,
The Gambia
E-mail: moosaajallow@gmail.com

²Department of Public and
Environmental Health,
School of Medicine and
Allied Health Sciences
The University of the Gambia,
The Gambia.

E-mail: euyamadu@utg.edu.gm

Corresponding Author:
Uyamadu, E.A., as above

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Abstract

Healthcare waste (HCW) poses a great danger to public health and the environment if it is not properly managed. This study was carried out to identify gaps in the knowledge, attitude and practice of healthcare workers on healthcare waste management. An institution based cross-sectional study design was used in this study. A total of 148 self-administered questionnaires were used in 13 health facilities including Bansang Hospital. Respondents were drawn from different cadres of health staff (nurses, public health officers, laboratory technicians and other auxiliary staff). Univariate analysis was used to summarize the data in frequency tables, percentages and proportions while bivariate analysis through the use of chi-square was used to determine statistically significant associations with the study outcome variables at 95% confidence level and $p < 0.05$. The study revealed that 79.7% of the participants had poor knowledge (awareness) about HCW. Majority of the participants (95.3%) had good attitude towards HCW while 62.2% had good practice towards HCW. Educational level and cadre were found to be significantly associated with participants' knowledge, attitude and practice towards HCW management ($P < 0.05$). The study therefore concludes that it is necessary for healthcare workers to be continuously trained on health and safety issues while managing hazardous healthcare waste. It also establishes the need for healthcare institutions to conduct continuing education on health and safety in the management of healthcare waste.

La connaissance, l'attitud et la pratique de la gestion des déchets de soins de santé, chez les travailleurs de la sante dans les établissements de santé de la région de central river de la, Gambiae

Abstrait

Les déchets de soins de santéreprésentent un grand danger pour la sante publique et l'environnement s'ils ne sont pas correctement gérés. Cette étude a étéréalisé pour identifier les lacunes dans la connaissance, l'attitud et la pratique des agents de santé sur la gestion des déchets. Un plan d'étude transversal base sur l'établissement a étéutilisé dans cette étude. Au total, 148 questionnaires, auto administrés ont étéutilisé dans 13 établissements de santé (infirmières, agents de santé publique, techniciens de laboratoire et autre personnels auxiliaires. Une analyse univariée pour résumer les données dans des tableaux de fréquence, des

pourcentages et des proportions, tandis qu'une analyse bivariée par l'utilisation du chi carrée a été utilisée pour déterminer les associations statistiquement significatives avec les variables des résultats de l'étude à un niveau de confiance de 95% et $P \leq 0,05$. L'étude a révélé que 99,9 % des participants avaient une mauvaise connaissance (sensibilisation) sur les déchets du soin de santé. La majorité des participants (95,3%) avaient une bonne attitude envers la gestion de déchets, tandis que 62,2% avaient de bonnes pratiques envers la gestion de déchets. Le niveau d'éducation et le cadre étaient significativement associés aux connaissances, à l'attitude et à la pratique des participants à l'égard de la gestion des déchets. ($P \leq 0,05$). L'étude conclut donc qu'il est nécessaire que les travailleurs de la santé soient formés dans la pratique de gérer des déchets de soins de santé qui posent du danger et qu'il y ait un établissement de santé qui mènerait une formation continue sur la santé et de sécurité et sur la gestion des déchets de soins de santé.

Introduction

Healthcare activities are means of protecting health, treating patients and saving lives. Healthcare activities generate waste, 20% of which entails risks either of infection, trauma, and chemical or radiation exposure. Health care waste (HCW) is defined as all the waste whether hazardous or not, generated by health institutions during medical activities, preventive, curative and/or diagnostic (Manyele, 2010). Health care waste includes but not limited to body fluids, soaked-bandages, culture dishes, discarded surgical gloves, instrument, sharps, lancets etc., (Gyan *et al.*, 2014). Globally, health care waste, which is also called biomedical waste or clinical waste poses a great danger to public health and the environment.

Health Care Waste is categorized into; pathogenic waste, radioactive waste, general waste, chemical waste, infectious waste, pharmaceutical and sharps (Salve *et al.*, 2013). About 10-25% of HCW is categorized as infectious/hazardous waste that requires special treatment and is of greatest concern at healthcare facilities due to the risks it poses both to human health and the environment. The poor management of this waste exposes healthcare workers, waste handlers and the community at large to infections, toxic effects, injuries and diseases. Exposure to HCW can result in diseases or injury (World Bank, 2014). In as much as people aim to reduce health care waste related problems, during the course of

treatment of sick people, healthcare would continue to indisputably create waste which could be hazardous to the health of the public.

The generation of HCW is dependent on numerous factors such as type of healthcare facilities, availability of options for waste segregation, seasonal variation, the number of hospital beds, and the number of patients treated or offered medical services per day (Mesfin *et al.*, 2011).

In most developing countries like The Gambia, the volume of health care waste produced is very high, yet there is no available data on the volume of waste produced per bed per day at healthcare facilities (World Bank, 2014). In India, it is estimated that between 0.1kg and 4.5kg of health care waste is generated per bed each day and this varies depending on the method of calculation per bed (Gyan *et al.*, 2014). This varies from one hospital to another. For instance, in Ethiopia, the volume of HCW generated in Amanuel specialized hospital was 0.668 kg/patient/day (Salve *et al.*, 2013).

Knowledge of healthcare workers as regards the disposal of medical waste plays a role in its improvement. Assessment of knowledge gaps should be made and addressed with required training. A study conducted among hospitals of Allahabad City in India on knowledge about medical waste revealed that doctors, nurses and laboratory technicians had better knowledge than general assistants regarding disposal of medical waste (Prashanth *et al.*, 2017).

Another study conducted in the Mazandaran Province in Iran reported that lack of knowledge and low understanding of universal precautions by healthcare workers were the contributing factors to poor waste management (Khalilian *et al.*, 2006). According to another study in India, lack of knowledge contributed to poor waste management practices and it was suggested that there was a need to develop waste management protocol for health and develop waste management audits after realizing that waste management was generally poor (Mostafa *et al.*, 2009).

In a study at North West Cameroon by Mochungong *et al.*, (2010), it was reported that due to the infectious nature of some clinical wastes, poor disposal practices have sparked concerns regarding the impact on public health. The study further suggested that lack of sufficient knowledge of the associated risk may be a strong factor contributing to the inadequate disposal practices. According to Mochungong *et al.* (2010), 47.5% of HCWs lacked sufficient awareness of any policy, national or international on safe disposal of medical wastes. Also, levels on medical waste management amongst health care workers were low and training on medical waste management.

Globally, most communities are facing a high level of pollution. The situation in developing countries such as The Gambia is more acute, partly because of the lack of adequate solid waste disposal facilities and people's negative attitude towards the environment. There is strong evidence suggesting that individuals or group awareness and attitudes towards solid waste generation and management is critical in the effort to respond to waste management challenges (Sachan *et al.*, 2012). The negative attitude of communities towards the environment also affects waste management strategies; which is aggravated by constant changes, in which the act of waste management and sanitation can be learnt. In management of solid waste, awareness, attitude and behaviour of people in the community are crucial. Reasons for individual participation in management of solid

waste are related to environmental motivation, social pressures, attitudes and economic incentives (Mathur *et al.*, 2015).

According to the study that was conducted in Gondor Town, North west of Ethiopia on factors associated with the risk perceptions of healthcare workers towards health care waste management, health care waste in developing countries including Ethiopia are treated equally like any other general waste. It was observed that health care facilities had no health care waste management guidelines, however only a small number of health care workers had health care waste management guidelines. The study recommended that training on health care waste should be offered to improve the perception of healthcare workers and facilities should have waste management plans and guidelines (Muluken *et al.*, 2012).

Improper management of wastes generated in health care facilities can severely affect the health of caregivers, patients and other members of the community (Lakbala, *et al.*, 2012). Pollution from poor treatment and handling of waste can indirectly affect the health of the community. If not handled properly, medical waste is very hazardous because of its negative effects on society and public health. There are many diseases that can be transmitted by medical waste such as viral hepatitis B, viral hepatitis C and Human Immunodeficiency Virus (HIV) (Al-Azzawi, 2012). Each hospital has the responsibility to ensure that waste generated is disposed safely to prevent harm to the people and the environment. Hospitals must appoint waste officers and have an approved designated waste storage area. All healthcare workers are expected to follow the policies and guidelines for waste disposal. Each hospital must develop a waste management strategy to ensure that all relevant regulatory requirements are met. Waste management plans should also be developed as part of the overall strategy. A designated waste officer or committee must ensure that the waste management plan is implemented (Bello and Ismail, 2016).

The analyses of waste management practices showed that increased population and poor medical waste management system as well as the expanded use of disposables were the main reasons for increased medical waste in hospitals; many had low incineration capacity with few of them having bricks (Manyele and Anecitus, 2006). A study in the urban area of Karachi on healthcare personnel reported that general waste and infectious waste were collected together and disposed of in landfills where liquid waste was disposed without treatment. It was therefore concluded that knowledge, attitude and practices of health care workers were extremely poor and proper facilities for management of hospital waste was almost non-existent in Karachi (Sultana and Salahuddin, 2007).

A study on disposal of medical waste in Ghana revealed that both public and private hospitals have waste management policies and teams. They have internal storage facilities for storing the waste before it is finally disposed of, which is in line with the waste management guidelines (Abor and Bouwer, 2008). On the other hand, there are some countries whose practices regarding medical waste are poor. For instance, a study on the reality of waste management in primary health care units in Brazil in 2014 revealed that waste containers were filled beyond the recommended limits; temporary storage of waste was in makeshift areas, usually in more isolated places of the facility and wastes were left exposed to potential environmental, human and animal actions (Makhura, 2016).

Most countries and institutions are faced with challenges of disposing medical waste; this is evident in several studies in various areas. A survey of medical waste disposal in Lagos, Nigeria in 2012 indicated that waste was collected in a mixed form, transported and disposed of along with municipal solid waste. Most hospitals in the area lacked appropriate systems for medical waste management due to some reasons e.g., inadequate funding, little or no priority for medical waste management as well as a lack of competent waste managers (Garba, 2013).

Effective medical waste management is of more importance than how it was previously. In developing countries, medical wastes have not received adequate attention (Patwary *et al.*, 2011). In many countries, hazardous and medical wastes are still handled and disposed together with domestic wastes, thus creating a great health risk to health workers, the public and the environment (Diaz *et al.*, 2008). According to a comparative study of management of medical waste in Alexandria, results revealed that the most common problems associated with medical wastes are the absence of waste management, lack of awareness about their health hazards, insufficient financial and human resources for proper management as well as poor control of waste disposal (Al Emad., 2011).

Materials and Methods

Description of Study Site

Central River Region (CRR) is one of the seven administrative regions of The Gambia. It has a Regional Health Directorate (RHD/CRR) coordinating all healthcare activities within the region except the Bansang referral hospital which has its board and management. The RHD office is located in Bansang about 20km from the administrative town of Janjangbureh. The region is divided into north and south with the furthest health facility in the north about 105km from Bansang and that of the south 110km from Bansang. It is the biggest region in terms of healthcare service administration. The frequency of supervision and mentoring by the directorate to health facilities is low due to the limited human resource and mobility. Unlike other regions where either (north or south) is bigger than an entire Regional Health Directorate catchment area like Lower River Region, North Bank East and North Bank West. The RHD currently has only two functional operational vehicles, while others are not fully functional. The Region has 1 hospital, 8 minor health centres, 1 major health centre, 11 health posts and 3 private clinics. It has a total population of 225,018. The Regional Health Team is headed by a Regional Health

Director with core workers namely; The Regional Public Health Officer, Regional Public Health Nurse, Regional Health Education and Promotion Officer, Regional Vector Control Officer, Operation Officer for Expanded Programme on Immunization, Senior Administrative Officer, Senior Community Health Nurse Tutor, Nutrition Field Officer, and other support staff (CRR-RHD, 2015). The hospital is headed by a Chief Executive Officer supported by other co-workers such as Administrator, Principal Nursing Officer and various units' heads.

Study Design and Study Population

The study design used was institution-based cross-sectional using quantitative research approach. The design was selected for this study as it was intended to systematically and factually describe the knowledge, attitude and practice of respondents on health care waste management in CRR. The respondents of this study included nurses, laboratory personnel, public health officers, orderlies and health labourers within the public and private health facilities of the RHD/CRR.

Inclusion and Exclusion Criteria

Inclusion Criteria

Healthcare workers that are currently working within CRR that are 18 years old and above at the start of the study; married or unmarried and of any ethnic group or nationality, present during the time of the study and who have consented to participate in the study.

Exclusion Criteria

Healthcare workers who were unwilling to participate in the study or in any health/mental condition rendering it impossible to obtain informed consent or perform the interview were excluded from participating in the study.

Sample Size Determination

The size of the population and amount of error determines the size of a randomly selected

sample. The Krejcie and Morgan table helped the researcher determine (with 95 percent confidence level) what the results would have been if the entire population had been surveyed.

Based on the human resource data for the facilities (public and private), there are an estimated 240 personnel for the target staff. Using the Krejcie and Morgan's random sample size table, 148 respondents were enrolled in the study.

Sampling Technique

Since the number of all the other participant categories except nurses and orderlies is small, the researcher decided to enroll laboratory personnel, all Public Health Officers and Health Labourers in the selected facilities for the study. However, orderlies and nurses were clustered based on their designation and a simple sampling technique was employed to select 59 orderlies and 51 nurses on the basis of proportionate population reference. For the hospital, 46 orderlies and 23 nurses were randomly selected to participate in the study using Microsoft office 2016 Excel randomization function. The same procedures were also employed for the selection of nurses in the study. With regards to the other facilities, they were clustered according to Minor Health Centres, Health posts and Private (8, 11 and 3) respectively. All the names of these facilities were written on a separate paper and clustered. A simple random sampling of the first 4 Minor Health Facilities, the first 5 Health posts and the first private health facility were selected respectively. Thus, 13 orderlies and 27 nurses were selected from these 11 facilities. Using a purposive sampling technique, the number of orderlies per facility, 3 for Major Health Facility and 1 for each of the remaining ten facilities were selected respectively. With regards to nurses using the same sampling technique, 7 nurses were selected for the Major Health Facility, 3 nurses from each of the four Minor Health Facilities, 1 nurse from each of five Health Posts and 3 nurses from the sole private clinic.

Health Facilities and Number of Healthcare Workers

S/N	Health facilities	Number of Health care Workers
1	Sami Karantaba	8
2	Kudang	8
3	Pinai	4
4	Nana	2
5	MadinaUmfally	2
6	Ballanghar	2
7	Njoben	2
8	Firdawsy	2
9	Kuntaur	9
10	Kaur	9
11	Jahally	11
12	Brikamaba	9
13	Bansang	80

Data Collection Instrument and Methods

Structure interview

The data was collected using semi-structured questionnaire with both open- and closed-ended questions. The tool consisted of about 45 questions designed to obtain information about the KAP on healthcare waste management. It took 15 to 25 minutes to administer the tool.

Observation

Observational method using a checklist questionnaire was also used to obtain data in this research. The researcher selected 5 out of the 10 public health facilities and 2 out of the 3 private health facilities for the observational checklist. The researcher also observed the type of waste generated, storage, composition, labelling and segregation at source and collection point and further assessed the personal protective equipment used during collection and the mechanism of collection and as well observed the mechanism of transferring the health care waste for transportation to the disposal site. Finally, the researcher also observed how the health care waste is disposed of and the methods used whether it was incineration, burying or open dumping. In the case of incineration, the smoke generated in relation to the immediate environment was observed. At the disposal site, the researcher observed the composition of waste generated at the facility, management of waste by the health labourers and orderlies in order to

assess whether they use protective gears properly or not at all.

Validity and Reliability

The questionnaire was pilot-tested in similar health facilities on a small group of staff capturing the entire target category outside the study area before finally commencing the study. They were asked to complete the questionnaire and indicate any questions they found unclear. This idea was adopted from a similar study in India (Imaad *et al.*, 2013).

Possible confounders

Highly educated healthcare workers are known to have a higher chance of having knowledge on proper health care waste management compared with the least educated or illiterates. Variation of age, length of service and types of cadre would have an influence on their knowledge, attitude and practice on HCW management. In order to address these, potential confounders, participants' specific type of work and educational background were disaggregated during data collection and analysis. Length of services and age of the participants were also categorized in order to address the rule of homogeneity and reduce the effect of age on the phenomenon under study. With regards to the types of cadre in conjunction to the nature of work, they were both disaggregated in order to reduce the effect of confounders in the study.

Data Processing and Analysis

The data was first examined through univariate analyses for the frequency distributions of the socio-demographic variables among the subjects, knowledge (awareness), attitude and practice variables, data was further examined by bivariate analyses using chi-square for each of the selected independent variable (educational level and cadre) with the outcome variable in order to establish statistically significant associations since 95% confidence interval and a P-value <0.05 were used to determine statistically significant associations. All data entry and analysis were performed using IBM Statistical Package for Social Sciences (SPSS) version 24 software.

Results

Socio-demographic features of the respondents

A total of 148 healthcare providers across all the health facilities in the Central River Region of The Gambia were recruited for the study with a response rate of 100%. Participants from Bansang hospital constituted 80 (54.1%), Jahally11 (7.4%), Kuntaur, Kaur and Brikamaba 9 (6.1%) each. Sami Karantaba and Kudang constituted 8 (5.4%) each, Pinai 4 (2.7%) while Nana, Madina Umfally, Ballanghar, Njoben and Firdawsy constituted 2 (1.4%) each respectively.

The mean age of the study participants was 36.7 years with standard deviation of ±3.1 as shown in Table 1. Sixty-five (43.9%) of the

Table 1: Socio-demographic characteristics of the study participants (n=148)

Variables	Frequency (n=148)	Percent (%)
Cadre of profession		
Nurse	61	41.2
Orderly	49	33.1
Health Labourer	18	12.2
Public Health	10	6.8
Lab Personnel	10	6.1
Age of respondents in years		
15 – 25	18	12.2
26 – 35	65	43.9
36 – 60	6	43.9
Educational status		
Never attended school	10	6.8
Arabic education	28	18.9
Primary	7	4.7
Secondary	24	16.2
Tertiary	65	43.9
Length of services in years		
0 – 5	71	48
6 – 10	38	25.7
more than 10	39	26.4
Sex of the respondents		
Male	100	67.6
Female	48	32.4
Marital Status		
Married	108	73
Single	37	25
Divorce	2	1.4
Widow	1	0.7

respondents were equally within the age group 26 – 25 and 36 – 60 years old. Majority of the respondents, 61 (41.2%) were Nurses while 49 (33.1%) were Orderlies. In terms of their educational background, 65 (43.9%) had tertiary education while 10 (6.8%) never attended school. The mean length of service reported was 6.9 with a standard deviation of ± 2.6 . Slightly less than half of the respondents 71 (48.0%) had a 0 – 5 years service. Majority of the healthcare providers in the region, 100 (67.6%) were males and about 73% of the respondents were married at the time of the study.

Awareness on HCW among participants

As shown in Table 2, the composite score for level of knowledge (awareness) showed that 7 (4.7%) of the healthcare workers had good knowledge on HCW while 118 (79.7%) had poor knowledge.

Table 3 summarized the analysis of educational status and cadre as factors influencing the awareness

on HCW. Majority of the participants with poor knowledge (awareness) were found to be health labourers (88.9%) and followed by orderlies with 87.8%). On the contrary, Doctors had the highest score with good knowledge (awareness) on HCW category which was followed by public health officers with 20.0%. These differences were statistically significant ($p=0.007$) as indicated by the chi-square test.

Educational status of the respondents was not found to be statistically associated with their level of knowledge (awareness) on HCW as reported by chi-square test ($p=0.250$).

Attitude of participants towards HCW

As shown in Table 4, the composite score for attitude showed that 141 (95.3%) of the healthcare workers had good attitude towards HCW while 5 (3.4%) had poor attitude towards HCW.

Table 5 summarized the analysis of educational status and cadre as factors influencing attitude

Table 2: Awareness on HCW among participants

Composite knowledge (awareness) score	Frequency (n=148)	Percent (%)
Good knowledge (awareness)	7	4.7
Fair knowledge (awareness)	23	15.5
Poor knowledge (awareness)	118	79.7

Key: Poor =<50%, Fair =50-59%, Good=>60%

Table 3: Participants educational status and cadre influence on knowledge of HCW

Variables	Knowledge on HCW			Statistic test	p-value
	Poor n (%)	Fair n (%)	Good n (%)		
Cadre of the participants					
Nurse	48 (78.7)	12 (19.7)	1 (1.6)	†	0.007*
Public health officer	5 (50.0)	3 (30.0)	2 (20.0)		
Health labourer	16 (88.9)	1 (5.6)	1 (5.6)		
Lab personnel	6 (66.7)	3 (33.3)	0 (0.0)		
Orderly	43 (87.8)	4 (8.2)	2 (4.1)		
Educational level					
Never attended school	9 (90.0)	0 (0.0)	1 (10.0)	†	0.250
Arabic education	25 (89.3)	3 (10.7)	0 (0.0)		
Primary education	6 (85.7)	0 (0.0)	1 (14.3)		
Secondary education	21 (87.5)	3 (12.5)	0 (0.0)		
Tertiary education	46 (70.8)	15 (23.1)	4 (6.2)		

* =Statistical significance at $p<0.05$

†Fisher's exact test

Table 4: Attitude of participants towards HCW

Composite attitude score	Frequency (n=148)	Percent (%)
Good attitude	141	95.3
Fair attitude	2	1.4
Poor attitude	5	3.4

Key: Poor =<50%, Fair =50-59%, Good=>60%

Table 5: Participants educational status and cadre influence on attitude towards HCW

Variables	Attitude towards HCW			Statistic test	p-value
	Poor n (%)	Fair n (%)	Good n (%)		
Cadre of the participants					
Doctor	0 (0.0)	0 (0.0)	1 (100.0)	†	0.039*
Nurse	0 (0.0)	0 (0.0)	61 (100.0)		
Public health officer	0 (0.0)	0 (0.0)	10 (20.0)		
Health labourer	1 (5.6)	2 (11.1)	15 (83.3)		
Lab personnel	0 (0.0)	0 (0.0)	9 (100.0)		
Orderly	4 (8.2)	0 (0.0)	45 (91.8)		
Educational level					
Never attended school	0 (0.0)	0 (0.0)	10 (10.0)	†	0.042*
No formal education	1 (7.1)	0 (0.0)	13 (92.9)		
Arabic education	3 (10.7)	2 (7.1)	23 (82.1)		
Primary education	0 (0.0)	0 (0.0)	7 (100.0)		
Secondary education	1 (4.2)	0 (0.0)	23 (95.8)		
Tertiary education	0 (0.0)	0 (0.0)	65 (100.0)		

* =Statistical significance at p<0.05

†Fisher's exact test

towards HCW. Majority of the participants with poor attitude were found to be orderlies (8.2%) and followed by health labourers with 5.6%. On the other hand, Doctor, Nurse and Lab personnel had the highest score for attitude towards HCW at 100%. These differences were statistically significant (p=0.039) as indicated by the chi-square test. In terms of educational status of the respondents and their attitude towards HCW, these were found to be statistically associated at p=0.042 as reported by chi-square test in Table 5.

Practice of participants towards HCW

As shown in Table 6, the composite score for practice showed that 92 (62.2%) of the healthcare workers had good practice towards HCW while 17 (11.5%) had poor practice towards HCW.

Table 7 summarized the analysis of educational status and cadre as factors influencing the practice towards HCW. Majority of the participants with poor attitude were found to be public health officers (100.0%) and followed by health labourers with 22.2%. On the other hand, Lab personnel and Nurse had the highest score for practice towards HCW at 88.9% and 75.4% respectively. These differences were statistically significant (p=0.011) as indicated by the chi-square test.

In terms of educational status of the respondents and their practice towards HCW, majority of those with poor practice were those with no formal education at 28.6% which was followed by those with Arabic education at 25.0%. These were found to be statistically associated at p=0.034 as reported by chi-square test in Table 7.

Table 6: Practice of participants towards HCW

Composite practice score	Frequency (n=148)	Percent (%)
Good practice	92	62.2
Fair practice	39	26.4
Poor practice	17	11.5

Key: Poor =<50%, Fair =50-59%, Good=>60%

Table 7: Participants educational status and cadre influence on practice towards HCW

Variables	Practice towards HCW			Statistic test	p-value
	Poor n (%)	Fair n (%)	Good n (%)		
Cadre of the participants					
Doctor	0 (0.0)	0 (0.0)	1 (100.0)	†	0.011*
Nurse	2 (3.3)	13 (21.3)	46 (75.4)		
Public health officer	1 (100.0)	3 (30.0)	6 (60.0)		
Health labourer	4 (22.2)	8 (44.4)	6 (33.3)		
Lab personnel	0 (0.0)	1 (11.1)	8 (88.9)		
Orderly	10 (20.4)	14 (28.6)	25 (51.0)		
Educational level					
Never attended school	0 (0.0)	5 (50.0)	5 (50.0)	†	0.034*
No formal education	4 (28.6)	3 (21.4)	7 (50.0)		
Arabic education	7 (25.0)	9 (32.1)	12 (42.9)		
Primary education	1 (14.3)	2 (28.6)	4 (57.1)		
Secondary education	2 (8.3)	6 (25.0)	16 (66.7)		
Tertiary education	3 (4.6)	14 (21.5)	48 (73.8)		

* =Statistical significance at $p<0.05$

†Fisher's exact test

Distribution of types of HCW incinerated and various health facilities in CRR

As shown in Table 8, Madina Umfally, Ballanghar, Njoben and Firdawisy recorded the highest in terms of sharps been incinerated. Brikamaba reported the

highest in vials/ampules been incinerated while Nana and Kaur recorded 50.0% and 22.2% for gloves/cotton/swabs been incinerated respectively. Bansang reported the highest in terms of all waste generated across health facilities in CRR which accounted for 13 (16.3%).

Table 8: Distribution of types of HCW incinerated and various health facilities in CRR

Health Facilities	Type of HCW incinerated (n=148)						Total
	Sharps	Vials/ampules	Gloves/cotton/swabs	All waste generated	I don't know	Others	
Sami Karantaba	6 (75.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (25.0)	8 (100.0)
Kudang	7 (87.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (12.5)	0 (0.0)	8 (100.0)
Pinai	3 (75.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (25.0)	4 (100.0)
Nana	0(0.0)	0 (0.0)	1 (50.0)	0 (0.0)	0 (0.0)	1 (50.0)	2 (100.0)
MadinaUmfally	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)
Ballanghar	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)
Njoben	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)
Firdawisy	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)
Kuntaur	9 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	9 (100.0)
Kaur	5 (55.6)	0 (0.0)	2 (22.2)	0 (0.0)	2 (22.2)	0 (0.0)	9 (100.0)
Jahally	10 (90.9)	1 (9.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	11 (100.0)
Brikamaba	5 (55.6)	1 (11.1)	0 (0.0)	0 (0.0)	2 (22.2)	1 (11.1)	9 (100.0)
Bansang*	43 (53.8)	1 (1.3)	1 (1.3)	13 (16.3)	21 (26.3)	1 (1.3)	80 (100.0)

*Bansang Hospital is 54.1% of the respondents in the study.

Discussion

A key strength of this study was that this assessment of KAP related to healthcare waste management among health workers in CRR gave us a unique opportunity to provide information about such topic with very minimal literature in The Gambia. It also helps to identify the gaps between the current KAP among the healthcare workers involved in healthcare waste management at health facility levels.

Knowledge of healthcare workers about HCW

In the current study, it was found that knowledge about HCW at the level of health facility was reasonably better as well as the need to segregate these wastes at source of generation. On the other hand, healthcare workers understanding of safe disposal of HWC were significantly very good as compared with their knowledge regarding specific details of disposal and management of HCW. Furthermore, about 1 in every 4 healthcare workers in this study knew about the colour codes of HCW. This is in contrast with a study in north-west region of Cameroon, where most of the respondents involved in collecting, segregating, transporting and disposing clinical waste had relatively low knowledge on safe clinical waste management. A study in 5 government and 12 private hospitals in Sana'a, Yemen showed poor awareness among healthcare workers regarding medical waste handling, and could not differentiate between domestic and medical waste disposal (Prashanth *et al.*, 2017).

The findings of this study showed that, overall, the percentage of knowledge among healthcare waste regarding HCW disposal was significantly higher than that of healthcare workers' knowledge with regards to categorizing waste at the source of generation. A cross-sectional study in 8 surgical departments at Al-Mansoura University Hospital in Egypt showed that 36.8% of doctors, 32.1% of housekeepers and 27.4% of nurses had satisfactory overall knowledge of HCW disposal and management (Mostafa *et al.*, 2009). These variations could be addressed when more in-depth and detailed series of trainings on waste management including

HCW among healthcare workers in The Gambia is done. A study from Mangalore, India, in 2012 found that the highest rate of correct knowledge about biomedical waste management was among nurses (61.3%) followed by doctors (46.6%), non-teaching staff (37.7%) and laboratory technicians (27.9%) (Bhasker *et al.*, 2012). A study from Nigeria revealed that majority of all professional health workers (doctors, nurses and pharmacists) had good knowledge of collection, minimization and personal risks associated with hospital wastes (93.4%, 94.4% and 97.2% respectively) (Samuel *et al.*, 2010). In another study on knowledge about medical waste among hospitals of Allahabad City in India, it was revealed that doctors, nurses and laboratory technicians had better knowledge than general assistants regarding disposal of medical waste (Prashanth *et al.*, 2017).

Attitude of healthcare workers towards HCW

As regards the attitude of healthcare workers towards HCW disposal and management at health facility level, it was found that overall, majority of them disagreed that HCW management is not an issue and also admitted that it is an extra burden on their work. Healthcare workers significantly agreed that HCW should be segregated and sorted as it is of utmost importance to prevent infection transmission at facility level. Similar to a tertiary healthcare centre in India, a positive attitude towards the need for measures for safe collection and final disposal of biomedical waste was higher among other healthcare workers (100%) than nurses (60%) (Sachan *et al.*, 2012). This is in contrast to another study from India where nurses had better attitudes toward collection and disposal of biomedical waste (Shafee *et al.*, 2010).

On the other hand, for some items such as the following — that safe waste disposal should be a priority, that waste disposal is teamwork and not a hospital responsibility, and that disposal is a financial burden on the hospital - the proportion of housekeeping staff showing approval of these items was significantly higher than that of physicians and nurses. In another study in India (Bhasker *et al.*, 2012), general practitioners were

of the opinion that disposing biomedical waste was very expensive but could not be compromised as the waste was hazardous and improper handling could lead to the spread of infectious diseases. Furthermore, a study in a district of Gujarat, India, found that 98% of the nurses and 79% of the housekeeping staff had positive attitudes as opposed to only 59% technical staff (Pandit, 2005). On the contrary, in a study in a tertiary care rural hospital in India, the majority of the sanitary staff felt that the management of biomedical waste was not an issue at all and was purely the responsibility of the institution and not individual's responsibility. They also felt that the safe management of waste was an extra burden at work (Radha, 2012).

Practice of healthcare workers towards HCW

The study found that there was relevant handling practice of healthcare workers on HCW management at work place and utilization of PPE at health facilities. This undoubtedly reflects healthcare workers' high level of awareness of the benefits and potential risks or problems in waste management in particular. This may be attributable to the responsive trainings of healthcare workers on infection control procedures and practices across health facilities in the country. Adequate supplies or level of interest in participating in training programmes might also contribute to effectiveness of the practices. Moreover, it was found that nurses in Bangalore practiced biomedical waste management significantly better than the other technical staff categories among the healthcare teams (Madhukumar, and Ramesh, 2012)..

Waste handling is detrimental to the health of individuals and healthcare workers. This study assessed health risks associated with waste handling among sanitation workers at Prampram. Most of the respondents perceived that they could get injured/sick from handling waste. The majority of healthcare workers were injured/sick at least once since their handling of waste. This may be a true reflection of their health status. This is consistent with a study in Denmark where it

was found that a higher incidence rate of musculoskeletal complaints for sanitation workers was reported in Denmark than for the total Danish workforce (Poulsen, 1995). In comparison with this study, healthcare workers are also exposed to injuries based on the type of work they do at health facility level.

Types of Injures and HCW Generated at Health Facilities

Another study among municipal workers in Rio de Janeiro depicts the fact that 80% of all workers had suffered an accident during their employment in waste collection; among these, 58% had to be suspended from work for some time (Porter *et al.*, 1997). Healthcare workers are also exposed to deplorable conditions and experience hardships. Porter *et al.*, (2004) carried out a study on the health conditions of waste pickers at the largest landfill in Rio de Janeiro; it was found that the nature of the work environment generates specific kinds of risks and accidents. The majority (71.7%) of the waste pickers at this site had already suffered an accident. Of the 267 accidents referred to in the study, most were related to cuts from glass (37%), followed by perforations due to other materials (19%), and falls (15%) (Porter *et al.*, 1997). In contrast to this study, more than 95% of healthcare workers were at risk of infecting themselves including poisoning of any form.

The main methods of prevention for employee exposure to hazardous HCW materials are administrative controls. Where these control methods are not in place, personal protective equipment (PPE) is required; though there is no one to ensure that personal protective equipment are worn during waste handling activities. However, most (94.2%) of the respondents wear PPE to work. This may be due to the fact that it is being provided for them by the government. Only 1.4% do not use personal protective equipment. Most of the respondents who do not wear PPE claimed they feel uncomfortable wearing them. This research found that some personal protective equipment may be uncomfortable and hence harmful.

Conclusion

The study identified gaps in the knowledge, attitude and practice of healthcare workers on healthcare waste management, and concluded that greater proportion of the healthcare workers had poor knowledge about HCW, good attitude towards HCW and good practice towards HCW at the time of the study.

The findings revealed low knowledge of HCW management among healthcare workers, hence a need for health facility waste management implementation policies. It was found that the current approach to healthcare waste management at facility levels was not very comprehensive. Most of them acquired this through on-the-job training, from seminars and informally through organized talks at workplaces. The study therefore concludes that it is necessary for healthcare workers to be continuously trained on health and safety issues while managing hazardous healthcare waste. The study also establishes the need for healthcare institutions to conduct continuous education on health and safety in the management of healthcare waste. Therefore, the findings of this study will also help to address the issue more appropriately, and inform plans for better training programmes and monitoring of healthcare waste management systems in health facilities.

Recommendations

Based on the results and conclusion drawn from the study, the following recommendations were made:

1. There should be proper and intensive training programmes regarding awareness and practices of waste disposal for all healthcare staff, with continuous monitoring at regular intervals.
2. Research must be undertaken to seal existing low knowledge about healthcare waste management.
3. Short informal courses and seminars as an option would help in upgrading the knowledge on health-care waste management in the health training institutions in the Gambia.

4. Apply measures to strengthen health education and in-service training to increase the level of existing knowledge among healthcare workers.
5. Ensure continuous monitoring and evaluation of medical waste disposal control measures/practices for further improvement.

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