Biomedical waste handling and knowledge of its health hazards among waste handlers in a tertiary hospital in Sokoto, Nigeria

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Abstract

Background: Biomedical wasteshave negative effects on human health and environment; therefore all persons exposed to the waste are potentially at risk, especially waste collectors that handle poorly segregated and containerized waste. The study aim was to describe the pattern of biomedical waste handling and assess knowledge of its health hazards among handlers in a Tertiary Hospital in Sokoto, Nigeria. Materials and Method: A descriptive cross-sectional study design was used. A total of 180 waste handlers were selected using a simple random sampling method and close-ended interviewer-administered questionnaires were used to collect data. Data was analyzed using SPSS version 23.0 and result presented in table. Results: Nearly half of the respondents were aged between 25-29 years and majority (81%) of the waste handlers are private employees while the public employees accounted for 19%. Wastes from different unit of the hospital were poorly segregated and commonly collected using inappropriate containers without lining. Although only 11% of the respondents received training on waste handling, 98% had good knowledge of health hazards of biomedical waste. All the handlers reported wearing personal protective equipment when handling biomedical waste but only 19% were on PPE during work through inspection. Conclusion: Biomedical wastes from different units were poorly segregated and collected using inappropriate containers. Nearly all the respondents had good knowledge of its health hazards but only few (11%) had received training on biomedical waste handling. Waste should be properly segregated into appropriate containers, PPE to be made readily available and ensure compliance to their use. Keys words: Biomedical waste, Handling, Knowledge, Risk perception

Introduction

Biomedical wastes are generated during the diagnosis, treatment, or immunization of human beings or in research activities pertaining to testing of biological sample [1]. Although all individuals exposed to hazardous health care waste are potentially at risk, the principal group at risk include healthcare providers, waste handlers, patients, visitors to healthcare facilities, workers in support service including laundry, and scavengers [2-4]. Hazards from infectious waste and sharps may spread Human immuno deficiency virus (HIV), hepatitis B and C virus, and other blood-borne pathogens. WHO estimated that each year there are about 8 to 16 million new cases of hepatitis B Virus (HBV), 2.3 to 4.7 million cases of hepatitis C Virus (HCV) and 80,000 to 160,000 cases of HIV due to unsafe injection and mostly due to poor healthcare waste management system [5,6]. Lassa fever and Ebola virus, endemic in West Africa, have also joined the league of blood borne pathogens. Health facilities in Nigeria, have become source of dissemination of disease-causing materials, through the enormous quantities of improperly managed health care wastes being generated in the course of providing health services [7]. A study carried out in Jos, Nigeria showed that waste handling practice fell below waste
management practices prescribed by WHO and other regulatory authorities as wastes were not segregated and were in appropriately disposed [8]. Proper waste handling helps to ensure appropriate hospital hygiene and safety of health care waste handlers, healthcare providers and communities at large [9]. The best practice is to segregate at source into colour coded containers for proper disposal as the waste poses high risk to the group [10].

All categories of health workers are exposed to the hazards of biomedical waste however, the level of exposure varies from one category of health workers to another and from one health facility to another within the same country. Of these categories, the waste handlers are the least educated as such their knowledge and risk perception of biomedical waste varies and such may affect their ability to use personal protective equipment as at when necessary. Characteristically, wastes are rarely segregated at the point of generation and inappropriately packaged and ultimately the waste handlers are expected to dispose this waste. Because also of a desire to improve service delivery and productivity, waste handling and disposal is outsourced to private companies who in turn had to employ readily available manpower to provide the cleaning services. It is on this background that the study is carried out to describe the pattern of biomedical waste handling and assess knowledge of its health hazards among handlers in a Tertiary Hospital in Sokoto, Nigeria. The outcome is expected to help the hospital management and managers of cleaning companies to make an informed decision about infection prevention and control.

Materials and Methods

Place of Study: The study was conducted in a tertiary hospital in Sokoto and study population comprised of all the biomedical waste handlers in the hospital both the public and private.

Type of Study: A descriptive cross-sectional study design was used and a required sample size was determined using formula for descriptive epidemiological study design for population less than ten thousand [11]. A sample size of 180 was obtained and all the number were enrolled into the study.

Sampling Method: A simple random sampling method (balloting technique) was used to select the study respondents. A ‘yes’ or ‘No’ option were written on pieces of papers and folded. This was rolled and a respondent asked to pick a paper from the pool. Any one that picked a piece of paper labelled ‘yes’ and having met the other inclusion criteria was enrolled into the study. This process continued until the required sample size of 180 respondents was selected.

Sample/ Data Collection: Field data was collected using questionnaire. The questionnaire was structured and contained close-ended questions. The questionnaire was pretested among waste handlers in different hospital that was not part of main study. Trained research assistants used face-to-face interview methods to collect the data.

Inclusion Criteria: Waste handlers involved in handling medical wastes generated during the process of diagnosis and patient/client treatment including hospital environment; willing to participate in the study and present at the time of field data collection.

Exclusion Criteria: Newly recruited waste handlers with less than a month waste handling experience were excluded.

Statistical Methods: The questionnaires were manually sorted out for completeness daily. Those questionnaires that were accurately filled and suitable for analysis were entered into computer and analyzed using statistical package for social science (SPSS) version 23.0.

Continuous data (respondents’ age) was summarized with less than a month waste handling experience were excluded.

Scoring and grading of responses on respondent’ knowledge- Each correct response of knowledge question was scored 1 mark while zero (0) was awarded to wrong answers and or no-response. The respondents’ knowledge was graded as either good or poor knowledge. Knowledge score of less than 50% and equal to or greater than 50% was adjudged poor and good knowledge respectively.

At the end of scoring, the proportion of respondents with good and poor knowledge was determined. Continuous data were summarized using mean and standard deviation while categorical data expressed in frequencies and percentage. Result was presented in simple tables for clarity.
Results

Table 1 result showed that the median age of respondents was 35 years, Interquartile rage (IQR) of 28 - 44. There were more males, 54.4% compared to females, 45.6% and a significant proportion (39.4%) had only Qur’anic education, followed by those that had secondary education (35.6%).

Majority (81%) of waste handlers were private employee while the remaining proportion (18.9%) were public employees.

With respect to trainings, only 20 out of 34 public employee received training about five years ago while none of the private employee have been formally trained.

Table-1: Socio and demographic characteristics of the waste handlers.

| Variables                     | Number | Percentage |
|-------------------------------|--------|------------|
| Age Group (Years)             |        |            |
| 18 - 19                       | 6      | 3.4        |
| 20 - 24                       | 18     | 10.0       |
| 25 – 39                       | 86     | 47.8       |
| 40 – 64                       | 70     | 38.9       |
| SEX                           |        |            |
| Male                          | 98     | 54.4       |
| Female                        | 82     | 45.6       |
| Marital Status                |        |            |
| Married                       | 119    | 66.1       |
| Single                        | 32     | 17.8       |
| Divorcee                      | 11     | 6.1        |
| Widow                         | 18     | 10.0       |
| Educational Level             |        |            |
| Qur’anic                      | 71     | 39.4       |
| Primary                       | 37     | 20.6       |
| Secondary                     | 64     | 35.6       |
| Tertiary                      | 8      | 4.4        |
| Employment Status             |        |            |
| Public                        | 34     | 18.9       |
| Private                       | 146    | 81.1       |
| TRAINING                      |        |            |
| Have you had any training on medical waste handling since working in this facility? | 20 | 11.1 |
| How long ago did you receive your last training? | 5 years |
| Number of public employee trained | 20 | 59 |
| Number of private employee trained | 0 | 0 |
Table 2: Knowledge of some aspects of biomedical waste Health hazards.

| Variables                                      | Frequency | Percentage |
|------------------------------------------------|-----------|------------|
| Knowledge of biomedical waste hazards          |           |            |
| Good knowledge                                 | 178       | 98.9       |
| Poor knowledge                                 | 2         | 1.1        |
| Knowledge of some aspects of Healthcare waste hazard |           |            |
| Biomedical waste are generated while treating sick persons |           |            |
| Yes                                            | 168       | 93.3       |
| No                                             | 12        | 6.7        |
| Biomedical waste include:                      |           |            |
| Used needle syringe                            |           |            |
| Yes                                            | 173       | 96.1       |
| No                                             | 7         | 3.9        |
| Used cotton wool                               |           |            |
| Yes                                            | 176       | 97.8       |
| No                                             | 4         | 2.2        |
| Used injection bottles                         |           |            |
| Yes                                            | 175       | 97.2       |
| No                                             | 5         | 2.8        |
| Dead tissue from a wound                       |           |            |
| Yes                                            | 151       | 83.9       |
| No                                             | 29        | 16.1       |
| Expired drugs                                  |           |            |
| Yes                                            | 145       | 80.6       |
| No                                             | 35        | 19.4       |
| Used I.V line/blood giving set                 |           |            |
| Yes                                            | 177       | 98.3       |
| No                                             | 3         | 1.7        |
| A person can get infected if in physical contact with these waste |           |            |
| Yes                                            | 163       | 90.6       |
| No                                             | 17        | 9.5        |
| Some diseases contacted through infected waste include: |           |            |
| Hepatitis B                                     |           |            |
| Yes                                            | 105       | 58.3       |
| No                                             | 19        | 10.6       |
| Don’t Know                                     | 56        | 31.1       |
| HIV infection                                  |           |            |
| Variables                  | Frequency | Percentage |
|---------------------------|-----------|------------|
| Yes                       | 132       | 73.3       |
| No                        | 18        | 10.0       |
| Don’t Know                | 30        | 16.7       |

**Ebola Virus Disease**

| Yes       | 112       | 62.2       |
| No        | 31        | 17.2       |
| Don’t Know| 37        | 20.6       |

**Lassa fever**

| Yes       | 69        | 38.3       |
| No        | 32        | 17.8       |
| Don’t Know| 79        | 43.9       |

**Use of PPE reduce chance of contacting infection from waste**

| Yes       | 177       | 98.3       |
| No        | 3         | 1.7        |

**PPE appropriate for use by waste handlers includes**

| Face mask  | 180       | 100        |
| Eye goggles| 122       | 67.8       |
| Hand gloves| 177       | 98.3       |
| Rubber boots| 173      | 96.1       |
| Plastic apron/uniform | 171  | 95.0       |

**What part of body does each of these PPE protect?**

| Face mask: is to protect face (mouth and nose) | 179  | 99.4   |
| Rubber boot is to protect the foot            | 163  | 90.6   |
| Hand gloves are to protect hands              | 178  | 98.9   |
| Eye goggle is to protect eyes                  | 34   | 18.9   |
| Apron is to protect the body                   | 127  | 70.6   |

Result in table 2 revealed that very large proportion (90%) of the respondents knew that biomedical wastes are generated when treating sick person and also different form of waste while 91% reported a person can get infected if in direct physical contact with infected waste.

Although a good number do not know whether some of the diseases conditions listed can be contacted from infected waste, nearly all of the respondents reported that use of personal protective equipment (PPE) may reduce the chance of coming in direct physical contact with the waste and contracting diseases.

Majority of respondents identified the appropriate PPE for use by waste handlers and also different part of body they protect.

Table 3 result showed that nearly all the respondents (99%) feel it’s very necessary to use personal protective equipment while handling hospital waste and 88% are willing to buy PPE on their own for personal use if not provided by the employer. Majority (98.3%) also reported that it is good to wash hands with soap and water at the end of the day work.
Table-3: Waste handlers’ attitude to waste handling and risk perception of the waste hazards.

| Variables                                                                 | Frequency | Percentage |
|---------------------------------------------------------------------------|-----------|------------|
| **Attitude to waste handling**                                            |           |            |
| It is necessary to use personal protective equipment while handling hospital waste |           |            |
| Yes                                                                       | 178       | 98.9       |
| No                                                                        | 2         | 1.1        |
| Will you advise your colleagues to always wear their PPE while working in the hospital |           |            |
| Yes                                                                       | 176       | 97.8       |
| No                                                                        | 4         | 2.2        |
| Are you willing to buy PPE with your own money for your personal use if not provided by your employer |           |            |
| Yes                                                                       | 159       | 88.3       |
| No                                                                        | 21        | 11.7       |
| It is good to wash hands with soap and water at the end of the day work  |           |            |
| Yes                                                                       | 177       | 98.3       |
| No                                                                        | 3         | 1.7        |
| **Risk perception of the waste hazards**                                 |           |            |
| Waste handlers are at increased risk of injuries and infections from the healthcare waste | 172       | 95.6       |
| Poorly disposed infected waste can be a source of diseases outbreak       | 179       | 99.4       |
| Proper segregation at the point of waste production, help reduce the risk of exposure to contaminated materials | 170       | 94.4       |
| Sharp biomedical waste like used needles & syringes, broken bottles, used surgical blades carry more risk of injury | 175       | 97.2       |
| Materials contaminated with patient body fluid like blood, urine should be considered infectious regardless of patient diagnosis? | 175       | 97.2       |
| Waste handlers if not properly protected, can be infected and also transfer infectious agent to their family members at home | 173       | 96.1       |
| Hospital acquired infectious agent are usually drug resistance and their infection could be fatal | 143       | 79.4       |

Respondents’ perception of risk is high as 96% perceived that the handlers are at increased risk of injuries and infections from the contaminated waste and that sharp biomedical waste like used needles & syringes, broken bottles, used surgical blades carry more risk of injury and infection (97%).

Proper segregation of waste at the point of production is perceived by majority of respondents’ (94%) to help reduce the risk of exposure to contaminated materials and that if handlers are not properly protected, can be infected and also transfer infectious agent to their family members at home.

Table 4 results revealed that all the respondents reported the use of PPE while handling biomedical waste but only 19% of them were found to use appropriate PPE during work through inspection aspect of the survey. Most reported PPE to be used always was facemask by 73% of respondents followed by hand gloves (65%), and 56% wear their uniform while none had ever used plastic apron.
Table 4: Practice of occupational safety by biomedical waste handlers

| Variables                                         | Frequency | Percentage |
|---------------------------------------------------|-----------|------------|
| Do you wear Personal protective equipment while handling waste in the hospital |            |            |
| Yes                                               | 180       | 100        |
| No                                                | 0         | 0          |
| If yes, how often do you use these Personal protective equipment: |          |            |
| **Face mask**                                     |           |            |
| Always                                            | 132       | 73.3       |
| Most times                                        | 41        | 22.8       |
| Occasionally                                      | 7         | 3.9        |
| **Eye goggles**                                   |           |            |
| Always                                            | 8         | 4.4        |
| Most times                                        | 16        | 8.9        |
| Occasionally                                      | 156       | 86.7       |
| **Hand gloves**                                   |           |            |
| Always                                            | 117       | 65.0       |
| Most times                                        | 31        | 17.2       |
| Occasionally                                      | 32        | 17.8       |
| **Rubber boots**                                  |           |            |
| Always                                            | 81        | 45.0       |
| Most times                                        | 29        | 16.1       |
| Occasionally                                      | 69        | 38.3       |
| **Uniform**                                       |           |            |
| Always                                            | 101       | 56.4       |
| Most times                                        | 13        | 7.3        |
| Occasionally                                      | 65        | 36.3       |

Waste handler practice of occupational safety

| Use appropriate Personal protective equipment (PPE) always | 35 | 19.4 |
| Use PPEs most times or occasionally | 145 | 80.6 |

Findings from work through inspection at different areas of the hospital revealed that appropriate receptacles for different categories of waste collection were not available and largely improvised particularly for the sharps. Wastes were poorly segregated, as mixture of all kind of waste in one receptacle is a common finding. Loose sharps inside and outside the wards, clinics including overflowing sharp box are seen during the work through inspection of different units in the hospital. Waste is transported from these service points to temporary dumpsites commonly with plastic containers without cover while few uses wheeler bins.

Discussion

Biomedical waste (BMW) carries a high potential of infection and injury than any other type of waste and it is important that waste handlers should have proper knowledge and practice of handling and disposal of these wastes [12]. Almost all the respondents in the study had overall good knowledge of biomedical waste hazards. Although a good proportion of the waste handlers had only Qur’anic level of education, they still exhibited good knowledge. This very likely to be attributed to their interaction with trained health worker who informally provide them with some information on best practices about health care waste. This is unlike studies in India that showed inadequate knowledge of biomedical waste among the waste handlers [12 – 13]. The study demonstrated that majority of the respondents knew the sources of BMW. This is in tandem with studies carried out in Agartala and in Central India, which found that most of the respondents answered correctly about the sources of BMW [14–15]. In this study, most of the respondents did not have the knowledge that exposure to BMW, there were chances of transmission of HIV, hepatitis, Lassa fever and Ebola virus disease. This is not surprising, as most of the respondents had not been trained on biomedical waste handling and so, this deficiency in knowledge is expected. Their lack of knowledge could predispose
them to increased risk of these blood-borne infectious diseases which could be potentially life threatening. This finding concurs with similar studies in India that demonstrated that only few sanitary workers had knowledge regarding the potential transmission of disease on exposure to BMW [12, 16]. Regarding attitude towards BMW, most of the respondents felt that proper segregation at the point of waste production could help reduce the risk of exposure to contaminated materials. This same perception was shared by participants in similar studies in India [13,14]. Segregation of BMW at the point of generation has been described as one of the first five steps in proper healthcare waste management [17].

All the respondents attested to wearing Personal protective equipment (PPE) while handling waste in the hospital although only very few used the appropriate PPE always. This finding is disheartening as one of the requirements for avoiding the prevalence of workplace hazards is the use of protective equipment to avoid direct contamination [18]. Though most of the respondents in this study knew the PPE appropriate for use by waste handlers, it is evident that their knowledge did not translate to practice as only few used the appropriate PPE always. However, non-availability of PPE / insufficient PPE in the hospital could be the reason why the respondents did not utilize appropriate PPE always. A study carried out in Karnataka, India reported that only about a third of the waste handlers used PPE [13] and in another similar study in Bangladesh, respondents identified insufficient PPE in the hospital as a possible barrier to biomedical waste management. Every worker deserves protection from hazardous wastes to live a healthy life, therefore, biomedical health facility must provide or purchase PPE and also educate their employees on the importance of always using PPE while handling BMW [20].

**Conclusion**

Although significantly large proportion of respondents demonstrated good knowledge of the health hazard of biomedical waste, equally very large number of them does not use this personal protective equipment as revealed by work through survey. These have serious implication for the control of nosocomial infection and prevention of spread nosocomial microorganism through person to person. All these on a background of lack of appropriate receptacles for different categories of waste collection in different areas of the hospital and were largely improvised particularly for the sharps. Wastes were also poorly segregated, as mixture of all kind of waste in one receptacle is a common finding.

**Contributions to knowledge:** This study was able to document the actual situation of waste handling and collection and serious implication for potential nosocomial infection in the health facility. In spite of the global and national efforts toward sanitary health care waste management and tertiary nature of the hospital with respect to service delivery, rudimentary methods of waste handling and collections are still in practice and health workers exposed to the danger of physical contact with biomedical waste.

**Authors Contribution**

Aminu Umar Kaoje: Conceptualized the study and developed the study proposal including questionnaires

Salihu Jega Garba: Contributed significantly in the proposal development and filed data collection coordination

Nneka Christina Okafagou: Wrote the entire discussion and conclusion sections of the article

Mansur Olayinka Raji: Conducted the data analysis and description of the finding (result section)

Yahaya Mohammed: Harmonized the entire document and also coordinated field data collection

Umar Mohammed Ango: Coordinated field data collection and report writing

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