

Original research

Effectiveness of Nursing Intervention on Knowledge of Proper Waste Handling Among Commercial Waste Handlers in Akure South Local Government, Ondo State, Nigeria

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Abstract

The study assessed effectiveness of nursing intervention in improving knowledge and practice of commercial waste handler about waste handling. This one group pretest-posttest quasi experimental study was carried out among commercial waste handlers in Akure South Local Government Area of Ondo State, Nigeria. Eighty-five (85) waste handlers participated in the study. Three sectioned structured questionnaire was used for data collection. The waste handlers were trained by the researcher using WHO training manual for waste handlers. Ethical approval was sought and gained from appropriate ethical review board. Both descriptive (mean, standard deviation, frequency and percentages) and inferential (t-test and ANOVA) statistics were used for data analyses. Findings revealed the mean age of the waste handlers was 38.08 ± 8.51 years. A good number of the waste handlers had more primary level of education (44.7%) with mean years of experience of 11.33 ± 4.51 . Knowledge of the participants about waste handling significantly increased from 33.45 ± 6.64 pre-intervention to 36.04 ± 6.2 post-intervention ($t = -7.64, p = 0.01$). Also practice of waste handling improved significantly from 26.74 ± 5.94 pre-intervention to 30.93 ± 4.06 post-intervention ($t = -9.53, p = 0.01$). There is a significant relationship between the waste handler's level of education and their knowledge pre ($f = 4.88, p = 0.01$) and post ($f = 4.18, p = 0.01$) nursing intervention. Also, there is no significant relationship between gender and practice of waste handling, pre and post intervention ($p > 0.05$). Nursing intervention was effective in improving the knowledge and practice of commercial waste handlers about waste handling.

Keywords: Commercial Waster Handlers, Nursing Intervention, Practice of Waste Management, Waste Handling.

1- INTRODUCTION

Human activities give rise to the generation of waste, thus necessitating the need for waste to be properly managed by waste handlers/waste workers. Wastes are viewed as invaluable materials to someone. This implies that what constitute waste to someone can be raw materials to another, hence waste to someone and can be wealth to another.

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This emphasize the importance of waste management among various levels of waste handlers. Waste generation and management arising from different human activities continues to rise correspondingly with population growth, urbanization and industrialization across the globe, and has become a major source of environmental hazards.

According to the World Health Organization (WHO), an estimated 25% of deaths and diseases are linked to environmental and work hazards globally, and 35% in regions Saharan Africa (WHO, 2017). This will continue to rise with urbanization and industrialization without commensurate development and improvement in waste handling abilities of waste handlers. Lamb et al. (2017) submitted that definitions of waste depends on the type or category of waste under consideration. Some of the dominant types of waste includes; solid waste, hazardous waste, and electronic waste. On the other hand, waste collection, transportation, processing, disposal and recycling of waste materials is termed waste management (Singh, Gupta & Chandhary, 2014). Anyone involved in any stage or phase of waste management listed above can be described as waste handlers.

Waste handling practices differ in developed and developing countries; urban, and rural areas, also in residential and industrial areas. The volume and types of waste in these different sources of waste justify the difference in the waste handling practice (Singh et al, 2014). Solid waste management contributes positively in upholding public health by reducing the risks of diseases, however, the job in itself exposes waste handlers to a high risks of fatal and non-fatal occupational accidents and hazards (Chikombe, 2017).

The problem of waste handling is a premodial and it present issues in developing countries, particularly, Nigeria. Municipal waste handling problems in Nigeria cut across concerns for human health, air, water and land pollution among others. The problem of waste handling might be a factor of the level of knowledge and pre engagement training programme on the part of waste handlers. Increasing rate of fatalities among waste handlers which they attributed to lack of awareness of the potential sources of occupational diseases, poor level of compliance to occupational health regulations, and poor practices had been documented by scholars in different settings (Jayakrishnan et l., 2013 ; Rorgoff and Bidderman, 2015).

Othigo (2014) asserted that the level of knowledge of waste handlers about waste handling determines the extent that they comply with waste collection, transportation, and disposal regulations and standards. Anecdotal evidences suggest that most waste handlers in Akure, as obtainable in many other urban setting in Nigeria are usually people with low educational level with little or no pre-employment training on waste handling. Improving the knowledge of waste handlers on their work, health and well-being will help to improve their waste handling skills and practices. Adequate knowledge, proper techniques, and safety practice measures can go a long way toward safe waste disposal and protection of the community from various adverse effects of hazardous wastes (Adogu, *et al.*, 2014).

According to a research conducted on health risks reduction behaviours among waste handlers in Thailand, Thirarattanasunthon, Siriwong, Robson and Borjan (2012) found out that, majority of solid waste collectors had low level of knowledge and alertness on occupational health risks. In countries at all levels of development, at large proportion of deaths and injuries by workers had been attributed to inadequate safety and health information. It was observed that despite the supply of personal protective equipment (PPE) such as gloves, eye goggle, boots and masks, to the waste handlers in Akure South Local Government, anecdotal evidences suggested that these

waste handlers lack knowledge of the safe waste handling practices. This predisposing them to injuries, falls, musculoskeletal morbidities and other fatal and non-fatal occupational accidents and hazards. In addition, anecdotal evidence at the different collection centres in the Akure South Local Government suggested poor waste handling practices ranging from collection of wastes with bare hands, sitting on the collected wastes, eating directly in the waste truck with the same hands, while they also defecate in the truck while pressed.

Previous studies in Nigeria focused majorly on assessing the knowledge and practice of waste handling among waste handlers. Little on nothing is known on whether nursing intervention will improve waste handlers knowledge and practice of waste handling in Nigeria. Few intervention do improve knowledge and practice of waste handling in Asia yielded positive results (Mahapatro, *et al.*, 2011; Kumar, *et al.*, 2015; Kumar, *et al.*, 2016; Ladia and Gupta, 2017; and Corporation and Kulkarni, 2018). This is a clear indication of the lack of knowledge among these workers, hence, the need for this study to assess outcome of nursing intervention on knowledge and practice of proper waste handling among commercial waste handlers in Akure South Local Government Area of Ondo State, Nigeria.

2- MATERIALS AND METHODS

This study used one group pretest-posttest quasi experimental research design to assess effectiveness of nursing intervention on knowledge of proper waste handling among commercial waste handlers in Akure South Local Government Area of Ondo State, Nigeria. Akure South is one of the 18 Local Government Areas and the capital city of Ondo State which is located in Southwestern Nigeria. The community is mostly dominated by civil servants while trading is another major business of the populace. The commercial activities coupled with large number of industries, firms, schools, churches, health institutions and residential areas give rise to the generation of large amount of municipal wastes. Ondo State Waste Management Authority established the integrated waste recycling and treatment project which is directly involved with the collection, transportation, recycling and disposal of wastes. The Ondo State Integrated Waste Recycling Project (OSIWRP) is located in Akure South local government of Ondo State.

Total enumeration method was utilized to include 97 waste handlers on the employment of OSIWRP who follow the waste trucks to the collection centers and return to the dumpsite every day at the OSIWRP, Akure south local government. A self-developed structured questionnaire was used to collect data at the OSIWRP from the respondents on knowledge and the training package was used to give nursing intervention to the respondents whose validity and reliability was ascertained before data collection.

The questionnaire was developed using study objectives and research questions in line with relevant literatures. The questionnaire is divided into three sections. The first section consist of 10 questions that assessed the socio-demographic characteristics of the participants. The second section assessed knowledge of waste management among the participants and it consist of 41 question of “Yes”, “No”, and “I don’t know”. Correct response attract “1” mark while incorrect attract “0”, total mark obtainable is “41” and the least is “0”. A score of “29” and above representing 70% and above of the total obtainable score was regarded as good knowledge; a score of “21 – 28” representing 50 to 69% of the total obtainable score was regarded as fair knowledge while a score less than “20” representing less than 50% was regarded as poor knowledge.

The last section of the questionnaire is 14-item 4-point Likert type question of Always – 3; Sometimes – 2; Rarely – 1; and Never – 0. This section elicited information about practice of waste management among participants. The total obtainable score is “42” while the least is “0”. A score of “30” and above representing 70% and above of the total obtainable score was regarded as good practice; a score of “21 – 29” representing 50 to 69% of the total obtainable score was regarded as fair practice while a score less than “20” representing less than 50% was regarded as poor practice.

Validity of questionnaire was ascertain using face and content validity criteria. Split-half method of reliability check was used to ascertain reliability of the questionnaire. The questionnaire was administer on 25 commercial waste handlers in Ondo East Local Government Area of Ondo State. Their response was analyzed using Cronbach’s Alpha model techniques. The result yielded a Cronbach alpha value of 0.924 for knowledge section, 0.762 for practice section and 0.739 overall, the questionnaire was adjudged reliable.

Training guide was used to implement nursing intervention on waste handling among the waste handlers. The training guide was adapted from WHO training manual for waste handlers. The guide is divided into four modules of 45 minutes each. The modules include; Introduction to Training; Waste handling; Hand hygiene; and personal protective equipment. Pre intervention data was collected from the commercial waste handlers for a period of two weeks. This is followed by four weeks of intervention. One module was taken per week. The post intervention data was collected 6 weeks after the last module.

Ethical approval was sought from appropriate (Babcock University Research Ethics Committee) research and ethic board (BUHREC355/19) Administrative permission was also sought and gained from Ondo State Waste Management Authority. Statistical Package for Social Sciences Version 22 was used to analyse data using both inferential and descriptive statistics of mean, standard deviation, percentages and Analysis of Variance.

3- RESULTS AND DISCUSSION

Findings revealed mean age of the participants to be 38.08 ± 8.51 years (Table 1). Most of the commercial waste handlers that participated in the study were male (65.9%) while only 14.1% completed tertiary level of education. Those that had no formal education were 9 (10.6%) and a little below half (44.7%) completed primary level of education. Years of experience as commercial waste handlers among the participants showed that 12 (14.1%) had been on the job for more than 16 years, 39 (45.9%) for between 11 to 15 years with mean years of experience of 11.33 ± 4.51 years. The average monthly income of the waster handlers in this study was observed to be $31,671 \pm 18,572$ naira with 35 (41.2%) of the participants earning 20, 000 naira or less.

All the commercial waste handlers that participated in this study claimed they had previous training on waste handling. The major method of waste disposal was found to be sanitary landfill (96.5%). Most of the participants in this study (67.1%) were engaged in waste collecting service, 10 (11.8%) were sweepers, 13 (15.3%) were involved in transporting waste while 5 (5.9%) were engage in final waste disposal.

Findings on knowledge of participants about waste management revealed that all the respondents had correct knowledge about respiratory, eye and water borne diseases risk associated with people living close to the waste dumps and landfills areas pre intervention. This is also true about

knowledge of importance of continuing education on their practice and waste handlers. Majority of the participants 83 (96.5%) had correct knowledge about important of person protective equipment in preventing injuries and hazards associated with waste management. Also, majority of the commercial waste handlers in this study 82 (96.5%) had correct knowledge about the epidemic risk of improper solid waste management; and the fact that a poorly handled and disposed waste entails serious health and environmental risks (96.5%). Also, majority of the participants 82 (96.5%) demonstrated good knowledge of the common personal protective equipment. This is also similar to response of the participant about preventability of exposure to hazards and hazard curtailment through compliance with safety rules and regulations (Table 2).

Table 1. Socio Demographic Characteristics of the Participants

| Variable | Characteristics | Frequency (n = 85) | Percentage (%) |
|--|-----------------------------|--------------------|----------------|
| Age in years | 21 – 30 years | 28 | 31.9 |
| | 31 – 40 years | 37 | 43.5 |
| | 41 – 50 years | 16 | 18.8 |
| | 51 years and above | 4 | 4.7 |
| | Mean 38.08±8.51 | | |
| Sex | Male | 56 | 65.9 |
| | Female | 29 | 34.1 |
| Level of education | No formal education | 9 | 10.6 |
| | Primary school completed | 38 | 44.7 |
| | Secondary school completed | 26 | 30.6 |
| | Tertiary school completed | 12 | 14.1 |
| Religion | Christianity | 80 | 94.1 |
| | Traditional | 5 | 5.9 |
| Ethnicity | Yoruba | 71 | 83.5 |
| | Igbo | 11 | 12.9 |
| | Edo | 3 | 3.5 |
| Years of experience | 1 – 5 | 11 | 12.9 |
| | 6 – 10 | 23 | 27.1 |
| | 11 – 15 years | 39 | 45.9 |
| | 16 years and above | 12 | 14.1 |
| | Mean = 11.33 ± 4.51 years | | |
| Average monthly income in naira | ≤ 20,000 | 35 | 41.2 |
| | > 20, 000 – 40,000 | 40 | 47.1 |
| | > 40,000 | 10 | 11.8 |
| | Mean = 31, 671 ± 18, 572 | | |
| Previous training on the job | Yes | 85 | 100.0 |
| Method of waste disposal used | Deep burial | 3 | 3.5 |
| | Sanitary landfill | 82 | 96.5 |
| Type of services that participant participate in | Sweeping | 10 | 11.8 |
| | Collection services | 57 | 67.1 |
| | Transport to disposal sites | 13 | 15.3 |
| | Final disposal | 5 | 5.9 |

However, commercial waste handlers that participated in this study demonstrated poor knowledge about some areas of waste management. Results revealed that only few 34 (40.0%) of the participants demonstrated correct knowledge about composting as method of waste management. Also, 42.4% and 44.7% agreed that incineration is an advanced solid waste

disposal technique and that urbanization leads to increased solid waste generation respectively. Overall pre intervention, 50 (58.8%) of the commercial waste handlers that participated in the study had high knowledge while 35 (41.2%) had low knowledge. The mean knowledge score of the waste handlers' pre intervention was found to be 33.45±6.64.

Table 2: Participants Pre Intervention Knowledge about Waste Management

| | Pre Intervention | |
|--|--------------------|------------------|
| | Incorrect Response | Correct Response |
| People near waste dumps and landfills are suffering from respiratory problems, eye diseases and water borne diseases | 0 (0.0) | 85 (100.0) |
| Continuing training on the job is needed to improve practice | 0 (0.0) | 85 (100.0) |
| Personal protective equipment (PPE) are designed to prevent injuries and work place hazard | 3 (3.5) | 83 (96.5) |
| Improper management of solid waste is responsible for epidemic | 3 (3.5) | 82 (96.5) |
| A poorly handled and disposed waste entails serious health and environmental risks | 3 (3.5) | 82 (96.5) |
| Some wastes contents are hazardous and can cause explosion | 3 (3.5) | 82 (96.5) |
| Example of PPE are gloves, safety boots, eye goggles and lenses, earmuffs, hard hat or helmets | 3 (3.5) | 82 (96.5) |
| Exposure to hazards are preventable | 3 (3.5) | 82 (96.5) |
| Exposure to hazards can be greatly reduced through compliance to safety rules and regulations. | 3 (3.5) | 82 (96.5) |
| Solid waste workers are exposed to high-risk of fatal and non-total occupational hazards | 3 (3.5) | 82 (96.5) |
| Once exposed to injuries, it should be reported immediately | 3 (3.5) | 82 (96.5) |
| Closeness of waste bin/dump makes us highly exposed to health hazards | 5 (5.9) | 80 (94.1) |
| There is need for waste to be separated before its being disposed | 5 (5.9) | 80 (94.1) |
| Sitting with the wastes in the wastes van is harmful | 5 (5.9) | 80 (94.1) |
| Hazard faced by the solid waste worker are chemical, biological, musculoskeletal and psycho social hazards | 5 (5.9) | 80 (94.1) |
| There is need for blood test once exposed to hazard | 5 (5.9) | 80 (94.1) |
| Improper waste management leads to water and air pollution which is a serious environmental problem | 6 (7.1) | 79 (92.9) |
| The odour from waste is hazardous to health | 6 (7.1) | 79 (92.9) |
| Rodents, animals and birds scavenging through waste dumps spread diseases | 6 (7.1) | 79 (92.9) |
| Landfilling of waste should be done after segregation | 6 (7.1) | 79 (92.9) |
| Municipal solid waste is generated from households, office, hotels, shops, schools and other institutions | 6 (7.1) | 79 (92.9) |
| The uses of the PPE reduces risks | 6 (7.1) | 79 (92.9) |
| Burial of waste contaminates water | 8 (9.4) | 77 (90.6) |
| Waste handlers are prone to cuts from sharps | 8 (9.4) | 77 (90.6) |
| Burning waste contaminates air | 11 (12.9) | 74 (87.1) |
| Municipal wastes contain pathological wastes, infections wastes, sharps and chemicals | 11 (12.9) | 74 (87.1) |
| Solid waste is a social menace | 12 (14.1) | 73 (85.9) |
| Waste handlers are prone to respiratory problems, eye diseases and water borne diseases | 15 (17.6) | 70 (82.4) |
| Smoke and dust particles from burning waste consists of carcinogens | 16 (18.8) | 69 (81.2) |
| Hazardous waste should not be mixed up with other wastes | 18 (21.2) | 67 (78.8) |

| | Pre Intervention | |
|---|--------------------|------------------|
| | Incorrect Response | Correct Response |
| The inhalation of hazardous gases expose waste handlers to respiratory diseases | 28 (32.9) | 57 (67.1) |
| Landfill sites and treatment plants adjacent to water bodies and marshy areas pollutes water | 31 (36.5) | 54 (63.5) |
| The odour around waste dumps are due to decomposition of biodegradable waste | 32 (37.6) | 53 (62.4) |
| Improper solid waste management is responsible for eradication of certain species from the very Earth | 33 (38.8) | 52 (61.2) |
| The social status of solid waste workers are comparatively lower and sub standard | 37 (43.5) | 48 (56.5) |
| Quality of a society is based on the quality of its solid waste management | 40 (47.1) | 45 (52.9) |
| Urbanisation leads to increased solid waste generation | 47 (55.3) | 38 (44.7) |
| Incineration is an advanced solid waste disposal technique | 49 (57.6) | 36 (42.4) |
| Composting is the cheapest and most suitable technique to process bio degradable waste | 51 (60.0) | 34 (40.0) |
| The waste dump is very close to residential area | 61 (71.8) | 24 (28.2) |
| Changing life styles and rising income level generates more waste | 69 (81.2) | 16 (18.8) |

Waste management practices among the participants in this study show that almost all the participants 84 (98.8%) wash their hand always; 79 (92.9%) wear glove while handling waste; 76 (89.4%) said they handle waste with adequate safety precaution while 60 (70.6%) said they collected waste is properly packed before transportation. However, only 47 (55.3%) of the participants always wear safety boot while handling waste; and 42 (49.4%) said waste carrying vehicle is always properly covered before transportation. Results further showed that more than half of the participants (58.8%) never segregate hazardous waste or handle them with care; majority never wear earmuff while handling waste 68 (80.0%) or wear hard hat or helmet while handling waste 61 (71.8%). Also, only few (17.6%) always wear eye goggles while handling waste (Table 3). Only 38 (44.7%) of the participants had good was management practices pre intervention. The mean practice score was found to be 26.74 ± 5.94 .

Post intervention, majority of the participants (89.4%) had high knowledge of commercial waste management (Table 4). The knowledge score of the participants increased significantly ($t = -7.64$, $p = 0.01$) post intervention to 36.04 ± 6.20 from 33.45 ± 6.64 (Table 5). Similarly, waste handling practice score of the participants increased significantly ($t = -9.53$, $p = 0.01$) post intervention to 30.93 ± 4.06 from 26.74 ± 5.94 (Table 6).

Results further showed a significant relationship between waste handlers level of education and their knowledge of was management pre and post intervention ($f = 4.88$, $p = 0.01$ and $f = 4.18$ and $p < 0.01$ pre and post intervention respectively) (Table 7). Post hoc tukey test results showed that the relationship is only significant for difference between those with primary and secondary level of education. A significant relationship existed between type of services that participants engage in and their practice of waste management pre and post intervention ($f = 6.126$, $p = 0.01$ and $f = 6.824$ and $p < 0.01$ pre and post intervention respectively) (Table 8). Post hoc tukey test show that the relationship is significant for difference between waste collectors and those involved in final waste disposal; and also between waste transporters and those involved in final waste disposal.

Table 3: Practice of Waste Handling among Participants

| | Pre Intervention | | | |
|---|------------------|-----------|-----------|-----------|
| | Newer | Rarely | Sometimes | Always |
| I handle waste with adequate safety precaution | 3 (3.5) | 0 (0.0) | 6 (7.1) | 76 (89.4) |
| I wear glove while handling waste | 0 (0.0) | 0 (0.0) | 3 (3.5) | 82 (96.5) |
| I wear mask while handling waste | 0 (0.0) | 0 (0.0) | 6 (7.1) | 79 (92.9) |
| We collected waste is properly packed before transportation | 0 (0.0) | 0 (0.0) | 5 (29.4) | 60 (70.6) |
| The waste carrying vehicle is properly covered before transportation | 0 (0.0) | 10 (11.8) | 33 (38.8) | 42 (49.4) |
| We segregate waste into bio degradable and non-degradable before collection | 45 (63.5) | 4 (4.7) | 10 (11.8) | 17 (20.0) |
| We insist on segregation of waste at generation level | 57 (67.1) | 6 (7.1) | 9 (10.6) | 13 (15.3) |
| Hazardous waste is segregated and handled with great care | 50 (58.8) | 8 (9.4) | 2 (2.4) | 25 (29.4) |
| I wear safety boot while handling waste | 0 (0.0) | 11 (12.9) | 27 (31.8) | 47 (55.3) |
| I wash hand | 0 (0.0) | 0 (0.0) | 1 (1.2) | 84 (98.8) |
| Industrial hazardous wastes are lumped with municipal garbage and refuse in landfills | 0 (0.0) | 0 (0.0) | 7 (8.2) | 78 (91.8) |
| I wear eye goggles while handling waste | 57 (67.1) | 3 (3.5) | 10 (11.8) | 15 (17.6) |
| I wear earmuff while handling waste | 68 (80.0) | 0 (0.0) | 7 (11.8) | 10 (11.8) |
| I wear hard hat or helmet while handling waste | 61 (71.8) | 6 (7.1) | 5 (5.9) | 13 (15.3) |

Table 4: Summary of Participants Knowledge of Waste Management Pre and Post Intervention

| | Pre intervention | | Post intervention | |
|----------------|------------------|------------|-------------------|------------|
| | Frequency | Percentage | Frequency | Percentage |
| High knowledge | 50 | 58.8 | 76 | 89.4 |
| Low Knowledge | 35 | 41.2 | 9 | 10.6 |
| Total | 85 | 100.0 | 85 | 100.0 |
| Mean | 33.45 | | 36.04 | |
| Std. Deviation | 6.64 | | 6.20 | |
| Minimum | 3.00 | | 3.00 | |
| Maximum | 41.00 | | 41.00 | |

Table 5: Correlation and T-test Table for Pre and Post Intervention knowledge of Waste Management and Practice of Waste Handling among Participants

| Variable | Time | Mean | SD | r | p | t | p |
|--------------------|-------------------|-------|------|-------|------|-------|------|
| Level of knowledge | Pre Intervention | 33.45 | 6.64 | 0.88 | 0.01 | -7.64 | 0.01 |
| | Post intervention | 36.04 | 6.20 | | | | |
| Level of practice | Pre Intervention | 26.74 | 5.94 | 0.733 | 0.01 | -9.53 | 0.01 |
| | Post Intervention | 30.93 | 4.06 | | | | |

Table 6: Summary of Waste Handling Practices among Participants Pre and Post Intervention

| | Pre intervention | | Post intervention | |
|-----------------------|------------------|--------------|-------------------|--------------|
| | Frequency | Percentage | Frequency | Percentage |
| Good Practice | 38 | 44.7 | 74 | 87.1 |
| Poor practice | 47 | 55.3 | 11 | 12.9 |
| Total | 85 | 100.0 | 85 | 100.0 |
| Mean | 26.74 | | 30.93 | |
| Std. Deviation | 5.94 | | 4.06 | |
| Minimum | 18.00 | | 25.00 | |
| Maximum | 40.00 | | 40.00 | |

Table 7: Analysis of Variance (ANOVA) to Test Relationship between level of Education and the knowledge of waste handling pre intervention and post intervention

| Knowledge | No formal education N = 9 | Primary school N = 38 | Secondary school N = 26 | Tertiary school N = 12 | F (3,81) | p |
|--------------------------|------------------------------|--------------------------|----------------------------|---------------------------|----------|-------|
| Pre Intervention | 31.67±2.34 | 36.11±2.61 | 30.23±10.57 | 33.33±2.06 | 4.88 | 0.004 |
| Post Intervention | 36.56±2.74 | 38.21±1.61 | 32.96±10.13 | 35.41±2.50 | 4.18 | 0.008 |

Table 8: Analysis of Variance (ANOVA) to Test Relationship between Type of Services that Participants engage in and their Practice of Waste Management.

| Practice | Sweeper N = 10 | Waste collector N = 57 | Waste transporter N = 13 | Waste final disposal N = 5 | F (3, 81) | p |
|--------------------------|-------------------|---------------------------|-----------------------------|-------------------------------|-----------|-------|
| Pre Intervention | 28.10±7.08 | 26.75±4.76 | 22.62±7.09 | 34.6±4.93 | 6.126 | 0.001 |
| Post Intervention | 32.4±4.72 | 30.32±3.25 | 29.92±4.94 | 37.6±2.19 | 6.824 | 0.000 |

The mean age of the participants in this study were observed to be 38.08±8.51 years, this is similar to age of waste handlers reported in a study in Ethiopian (Deress, et al 2019). However, contrary to more female waste handlers documented in previous studies (Gebremedhin, et al., 2016; Chercos, et al., 2018), results of this study found out that more male are involved in municipal waste management. The differences in results is probably due to the fact why most previous studies focus more of waste collected, this study assesses all waste handlers engaged in the complete waste management chain.

A good number of waste handlers in this study had post primary level of education that is better than the level of education of waste handlers reported in previous study in Ibadan and similar to what was reported among waste handlers in Lagos (Adeyi and Adeyemi, 2019). Christians and Yoruba ethnic group dominance is not unexpected among the participants in Akure South Local Government in Ondo State; Southwestern Nigerian is dominated by Yoruba who are majorly Christians. Years of experience as commercial waste handlers among the participant showed the mean age of 11.33 ± 4.51 years higher that what was reported in previous study in Ethiopia (Chercos, et al., 2018). The average monthly income of the waster handlers in this study was observed to be 31,671±18,572 naira with 35 (41.2%) of the participants earning 20, 000 naira or

less. This is poor considering the prevailing economic situation in Nigeria. This mean waste handler in this study live on an average wages of less than 2\$ in a day.

Adequate training and retraining is key to effective municipal waste management (David, *et al.*, 2012; Gihan, *et al.*, 2017). Deress *et al.* (2019) in a study among health care waste handlers in Ethiopian documented that less than one third of waste handlers in their study had previous training on waste handling. Results of this study is better than that of Deress *et al.* (2019) in terms of previous training of waste handlers. This comply with international best practices in the management of waste (Chartier *et al.*, 2014). Nwankwo (2018) documented that majority of waste handlers in their study in Nigeria had previous training on the job. This further confirms that waste handlers in Nigeria are better trained.

Knowledge of participants in this study pre intervention about waste management revealed that all the respondents had correct knowledge about respiratory, eye and water borne diseases risk associated with people living close to the waste dumps and landfills areas and this supports the findings of Olayiwola *et al.*, (2017), they submitted that indiscriminate dumping has led to the contamination of surface and groundwater supplies, whilst open burning of waste contributes significantly to urban air pollution. Findings from this study also revealed that all the respondents had correct knowledge about respiratory, eye and water borne diseases risk associated with people living close to the waste dumps and landfills areas.

Majority of the participant had correct knowledge about the importance of personal protective equipment in preventing injuries and hazards associated with waste management. This corroborate Gebremedhin *et al.* (2016) that waste handlers have satisfactory knowledge about occupational health risks associated with waste handling. However, this contradicts the finding of a carried out in Thailand by Thirarattanasunthon *et al.* (2012), they reported that most solid waste collectors had low level of knowledge and alertness on occupational health. In addition, despite the severity of occupational health hazards encountered by solid waste collectors, their provision and usage of personal protective equipment is low. This is similar to findings of Kashyap and Mazta (2018) that provision of personal protective equipment for waste handler in inadequate. Marahatta *et al.* (2017) in a study to assess work-related health hazards and safety practices of waste handlers found out that only half of the waste handlers in their study were knowledgeable about work-related hazards, few were knowledgeable about prevention of work-related health hazards and one third were knowledgeable about personal protective equipment utilization.

The reason for this pre-intervention satisfactory knowledge might not be unconnected with the long duration of experience as waste handler and previous training on waste handling among participants in this study. Results showed that more than half of the waste handlers in the study had high knowledge about waste handling pre-intervention. The mean knowledge score of the participants was found to be 33.45 ± 6.64 , this is better than level of knowledge of waste management documented in previous studies among waste handlers (Anozie *et al.*, 2017; and Chercos *et al.*, 2018). Fairly related to findings of this study Nandimath, *et al.* (2019) that waste handlers had fair good knowledge about segregation and different types of waste but a few lacked knowledge about sanitary waste.

Pre-intervention waste management practices among the commercial waste handler that participated in this study revealed that almost all the waste handler wash their hand, wear glove and practice adequate safety precaution when handling waste. Oli *et al.*, (2016) in a study among medical waste handlers found out that availability of material for waste segregation at point of

generation, compliance of health care workers to health care waste management guidelines is generally low and unsatisfactory among the waste handlers. This is further corroborated by the results of this study. More than half of the waste handlers in this study did not segregate waste only about half wear safety boot and majority never wear earmuff. Ncube *et al.*, (2017) documented Bio aerosols and noise as one of the work-related hazards that waste handler are exposed and so the earmuff is recommended.

The magnitude of having safe occupational health practice among waste handlers was very low (Gebremedhin, et al. 2016), this is also true pre-intervention among waste handlers in this study. The waste is also not usually properly covered while transporting it to the dump sites, exposing the waste handlers to bio-aerosols and other hazards (Ncube *et al.*, 2017). Only few of the participants were eye goggles to protect their eyes while handling waste. Less than half of the participants had good practices of waste handling pre-intervention with mean waste handling practice score of be 26.74 ± 5.94 . This is lower than what was documented by Deress et al., (2019) among waste handlers that participated in their study. It can be explained by the fact that participants in this study are commercial municipal was handlers and against medical waste handlers in previous study.

Knowledge of commercial waste handlers that participated in this study significantly increase from 33.45 ± 6.64 pre-intervention to 36.04 ± 6.2 ($t = -7.64$; $p < 0.01$) post intervention. This implies that the intervention significantly increases the level of knowledge of commercial waste handlers about waste handling. Also the proportion of the waste handlers with high knowledge of waste handling practices increases significantly (58.7% vs 89.45) post intervention further confirming the effectiveness on the intervention. Previous studies had documented significant increase in knowledge of waste handling among waste handlers (Kumar *et al.*, 2015; Bilo et al. 2016; Kumar *et al.*, 2016).

Kulkarni and Kulkarni (2018) in a study to assess effectiveness of planned teaching programme on knowledge of garbage handlers working at selected area in India, they submit that planned teaching was effective among garbage handlers. This further corroborated submissions of this study. This is also closely related to submission of Ladia, and Gupta (2017) were reported that handlers knowledge about waste handling improve from 52.27% to 81.81% post intervention.

Pre and post nursing intervention significant difference was observed between waste handlers level of education and their knowledge of waste handling ($f = 4.88$, $p < 0.01$ and $f = 4.18$ and $p < 0.01$ pre and post intervention respectively). Participants with primary level of education had higher mean knowledge score compared to those with no formal education, secondary or tertiary level of education pre and post nursing intervention. This is similar to findings of Chercos, *et al.*, (2018) that level of education is a determinant of knowledge about waste handling among waste handlers. This is further supported by results of previous studies (Kumar, *et al.*, 2013; Lakbala and Lakbala, 2013; Makkar *et al.* 2014)

Kumar *et al.*, (2015) reported significant improvement in waste handling practices among participants in their study. The proportion of commercial waste handlers in this study with good practice increased from 44.7% to 87.1%. This is similar to increase from 76.13% to 100% improvement in practice of waste handling reported among waste handlers in Pune, India (Ladia and Gupta, 2017). In Ladia and Gupta study the mean practice score increase from 7.3 ± 0.76 to 8.1 ± 0.5 , this is similar to significant increase from 26.74 ± 5.94 pre intervention to 30.93 ± 4.06

post intervention in this study. Therefore the nursing intervention was effective in improving the practice of waste handling among waste handlers that participated in this study.

Results of this study is further corroborated by submission of previous studies (Basarkar 2014; Kumar *et al.*, 2015). Practice of male waste handlers were found to better than their female counterpart pre intervention, although not significant. Post intervention, the mean waste handling practice score of the female waste handlers were found to be higher than the male handlers, although not statistically significant.

Conclusion

Nursing intervention was effective in improving the knowledge and practice of commercial waste handlers about waste handling. This implies that when the knowledge of waste handlers is improved through training and retraining there is high probability that their knowledge and practice of waste management will improve. In order to improve the knowledge and waste handling practices among commercial waste handlers there is need for training and re-training. This will ultimately improve the health and well-being of the waste handlers.

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