

Research Article

Household Hazardous Materials Identification and Management Practices Among Residents of Irewole Local Government Area, Osun State, Nigeria

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Abstract

Most emerging world contaminants have been linked to improper management of household hazardous materials and are currently receiving global attention due to the threat they pose to public health and the environment. There are guidelines for the entire management of household hazardous materials, but there exist inadequate information on its identification and management practices at household level. Therefore, the present study was conducted to fill the gap. A descriptive cross-sectional study was conducted among 346 randomly selected households in Irewole Local Government Area, Osun State, Nigeria. A validated semi-structured questionnaire and observational checklist were used to gather information. Quantitative data were analyzed using descriptive statistics and chi-square at $p < 0.05$. Respondents' mean age was 34.5 ± 12.8 years, 54.3% were female while 66.8% had attained tertiary education. The major hazardous materials observed in most of the houses were laundry and dish washing detergents (94.1%), insecticide (90.7%) and household disinfectants (88.3%). Fifty-nine percent of the participants mentioned open burning as the most preferred method of disposal of household hazardous materials. The mean practice score was 6.4 ± 1.9 , 62.0% had inappropriate practices towards household hazardous materials management. Significantly, 78.5% of the respondents with tertiary education had appropriate practice towards managing household hazardous materials than those who had attained secondary (16.9%) and primary education (4.6%). Laundry and dish washing detergents, insecticide and household disinfectants were observed in most of the houses. Also participants were engaged in inappropriate practices for the management of household hazardous waste. Households should have access to hazardous waste management facilities, and educational information and communication materials to improve their management practices.

Keywords

Hazardous Material, Household, Management Practices

1. Introduction

Rapid global urbanization and rapid increase in living standards, buying power and easier access to products that are

convenient has led to acquisition of several Household Hazardous Materials (HHMs) [12]. Household Hazardous Mate-

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Received: 17 January 2024; **Accepted:** 18 February 2024; **Published:** 29 February 2024



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rial is any item or agent (biological, chemical, radiological, and/or physical), which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors [24]. The majority of poisoning cases around the world have been linked to a variety of household cleaning products [23]. Some emerging contaminants have been detected in drinking water in most parts of the world example of which includes: pharmaceuticals and personal care products, flame retardants, endocrine disrupting compounds, pesticides, hormones, and disinfection by-products [19]. Most of these contaminants have been linked to improper handling and disposal of household hazardous materials and are currently receiving global attention due to the potential danger they pose to public health and the environment.

In developing countries, one of the problems with household products management is that the content of the products are not known. Localized environmental pollution can also result from the inappropriate use of a wide range of household hazardous products, although it is typically the disposal of these products that cause the greatest risk and product labeling can help consumers to identify potentially hazardous products [23]. However, certain populations and groups are more vulnerable to the effects of hazardous chemicals especially children under five years of age due to their unique activities of crawling and practice of hand-to-mouth ingestion [1, 11]. In Asian countries, the estimated levels of lead exposure due to hazardous waste were attributable to a decrease in Intelligence Quotient (IQ) among the children between the age of 0-4years [8].

Improper disposal of HHW may change the way the biosphere functions, depletes the ozone layer and causes irreversible damage to domestic water sources. This could result in the reduction of global productivity in the ecosystems [20]. In addition, household chemicals are trapped in houses causing further deterioration of indoor air quality. Varieties of substances common in household products are potentially hazardous and can affect human health through inhalation [26]. The indiscriminate use of household products and exposure to specific substances has been linked to the development of respiratory hypersensitivity or asthmatic symptoms in some susceptible individuals. Also, due to their comparatively longer time spent indoors in homes than adults, infants and toddlers are unintentionally exposed to these substances by inhalation [14].

Due to the danger and risk posed by household hazardous material, good practices of handling, storage, and disposal of these materials should begin in the household. Furthermore, household should be aware of the reasons behind the hazardous status of most of the materials used at the household in order to initiate active steps to limit their exposure to any dangerous properties possessed by the product or waste. Also, they should be fully aware of the environmental consequences arising from inappropriate use and disposal of these dangerous materials. There are guidelines for the entire management

of household hazardous materials, but there exist inadequate information on its identification and management practices at household level. Therefore, this study was conducted to document Household Hazardous Materials Identification and Management Practices among Residents of Irewole Local Government Area, Osun State, Nigeria.

2. Methodology

2.1. Study Area

The study was carried out in Ikire, Irewole local government, Osun state. It geographical coordinates are 7 °22' 20.68" North, 4 °11' 14.60" East and 228 meters above the sea levels. The Local Government Area shares boundaries with Ayedire to the north, to the south with Isokan, to the east with Ayedaade, and to the south east by Ife-North Local Government Areas of Osun state respectively. It also bounds with Egbeda Local Government Area of Oyo state to the west. The availability of fine climate has broadly enhanced the cultivation of Arable and local cash crops, which has further contributed to the economic development of the area. The presence of evergreen luxuriant forest has aided the rearing of cattle and other domestic/livestock animals. The principal inhabitants of the city are the Yoruba's and Benue people, as well as other tribes from other parts of the country. Cotton weaving is a traditional industry of its Yoruba inhabitants. The LGA has an estimate population of 142,806 by population census in 2006 as computed by National Population Commission [35]. The projected population figure as at 2022 was 185,400 based on population growth rate of 2.6% [7]. The climate of the area is humid and tropical with a mean annual temperature of about 27 °C and a mean annual rainfall of over 1,400 mm. The study area falls within the rainforest belt of Nigeria, with a wet season (April to October) and a dry season (November to March) [18].

2.2. Study Design and Population

A cross-sectional study was carried out among randomly selected 346 households at Irewole Local Government Area, Osun State, Nigeria. Only residents who have stayed for at least 2 years and were 18 years and above were recruited to participate in the study. The study utilized both the questionnaire and an observational checklist for data collection.

2.3. Data Collection Procedure

A validated semi-structured questionnaire was used to collect information on respondents' sociodemography, knowledge on household hazardous material storage and disposal, attitudes towards managing household hazardous materials and practices towards household hazardous materials. The knowledge and practices were measured on 14-point

and 10-point scales, respectively while scores of <7 and <5 were rated as poor knowledge, and inappropriate practices, respectively. The instrument was developed in English Language and a local translator help translate the questionnaire to Yoruba for proper data collection. Also, an observational checklist was used to elicit information on identification of the common hazardous material in the selected household. Relevant and most recent literature was reviewed and the information obtained was used to develop both the questionnaire and the checklist. Furthermore, the instrument was reviewed by the experts in the field of the environmental Health and useful corrections and suggestions from the experts were used to improve the quality of the instruments before the commencement of the data collection. In addition, a pretest was conducted among 34 households at Ibadan North East Local Government Area. Reliability measurement was carried out on the questionnaire using Cronbach Alpha method and a coefficient of 0.7 was obtained.

Entry to the LGA was made through the Department of Community Development Inspectorate (CDI) and Environmental Health Unit in the Department of Health in the LGA. Information about the Community Development Association (CDA) was collected. Also, the research team collected contacts of the CDA chairman in all the selected communities. The CDA chairman in the selected community later introduced the team to the Head of each community (*Baale*). Appropriate and adequate introduction and protocols was made to the Head of the community (*Baale*) and permission was granted to carry out the study in all the communities visited. Three research assistant were recruited and trained on data collection in order to ensure that they have good understanding of the research instrument and data collection methods. All the participants are university graduates who have experience in community survey. They were also trained on how to secure informed consent, interviewing skills and how to explain the questions to the participants.

2.4. Data Analysis

Data collected was compiled and entered for analysis using Statistical Package for Social Science (SPSS) version 22.0. Descriptive statistics was conducted to obtain frequencies, percentage, mean and standard deviation. Knowledge and practices were measured on 14 point and 10 point scales, respectively. Scores of <7 and <5 were rated as poor knowledge and inappropriate practices respectively. Chi-square test was used to test for statistical association between sociodemography and knowledge, attitude and practices score category. Level of statistical significance was set at $\alpha=0.05$.

2.5. Ethical Consideration

This study was approved by Institutional Review board of University of Ibadan/University College Hospital before the

commencement of the field work. Informed consent was obtained from the Local Government before commencement of the study while written/verbal informed consent was collected from the participants.

3. Results

3.1. Sociodemographic Characteristics

Table 1 presents the socio-demographic characteristics of the respondents. Respondents' mean age was 34.5 ± 12.8 years, 54.3% were female while 59.2% were married. Majority 66.8% were self-employed while 17.6% were engaged in civil service. Majority (66.8%) of the participants had attained tertiary education, 25.1% had completed secondary education, 5.2% had completed primary education while 2.9% had no formal education.

Table 1. Socio-demographic characteristics.

Characteristics	Frequency	Percentage
Age in years		
< 25	89	25.7
25 – 34	106	30.6
35 – 44	78	22.5
45 – 54	40	11.6
55+	33	9.6
Mean \pm SD=34.5 \pm 12.8		
Gender		
Male	158	45.7
Female	188	54.3
Marital status		
Single	124	35.8
Married	205	59.2
Divorced	17	4.9
Occupation		
Self-employed	231	66.8
Civil servant	61	17.6
Student	54	15.6
Level of education		
Primary	28	8.1
Secondary	87	25.1
Tertiary	231	66.8

3.2. Household Hazardous Materials Identified

The three major hazardous materials identified in the households by the respondents were sharp objects (21.4%), pesticides (15.0%) and gas cylinders (11.0%) as seen in Table 2. Also, chemical (9.4%), automotive products (9.4%), battery (7.5%), electric appliances (5.3%) and beauty products were mentioned. Other hazardous materials identified were cleaning agent including hypo, izal, bleach and sniper (4.1%), household disinfectant (3.1%), paints (2.3%) and drug and medicine (1.6%). Onsite observations revealed the presence of laundry & dish washing detergents (94.1%), gas cylinder/stove (91.2%), insecticide (90.7%), household disinfectants (88.3%), cleaning agents (85%), beauty products (81.5%), batteries (82.5%) and air freshener (82.5%) in the house.

Automotive product (71.7%), rat anti-flea (70.7%) and camphor (71.2%) were also found in the house. Other hazardous materials observed in the houses were generator black oil (52.2%), used electronics & light bulbs (65.4%), shoe polish/sprays (64.9%), expired drugs (44.9%), herbicides (40.5%), nail polish & plant remover (44.9%), fertilizers (21.5%) and paints (10.0%) as shown in Table 3. Some of the potential harms caused by household hazardous materials are depicted in Figure 1. The three major potential harms perceived and mentioned by the respondents were death (31.0%), accidents from fire outbreaks, explosions, and injuries (24.0%) and harm to health through blood loss, poisoning, and dangerous installation (20.0%). Others were diseases and infection (14.0%) and burns and scald (9.0%) and burns and scald (9.0%) and burns and scald (9.0%).

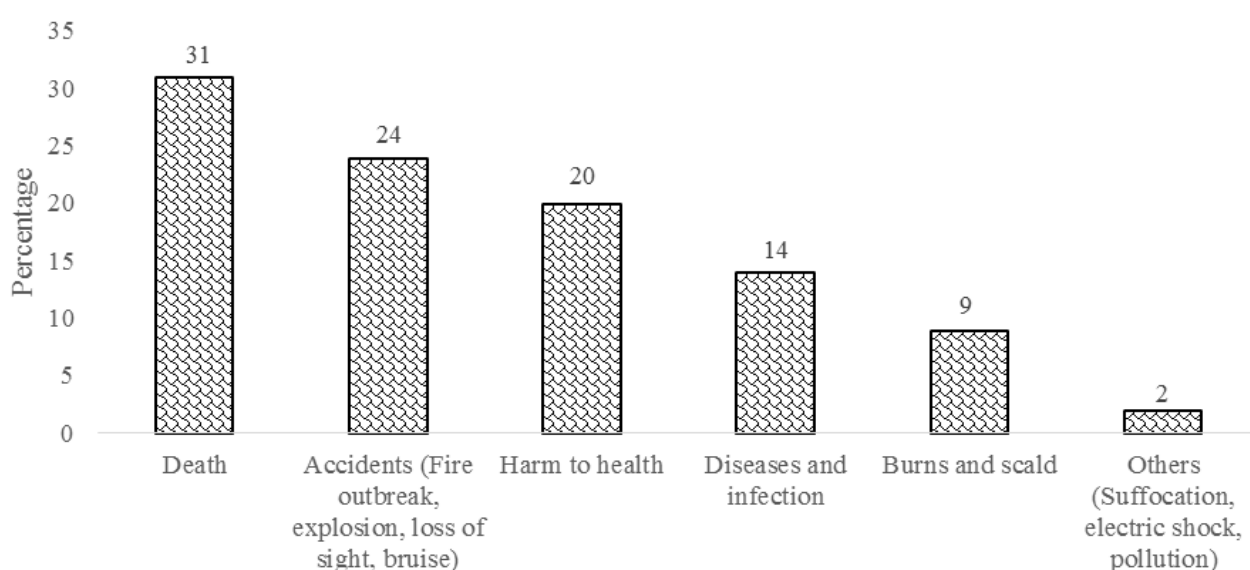


Figure 1. Potential harms caused by household hazardous materials.

Table 2. Reported hazardous materials.

Hazardous materials	Frequency*	Percentage
Sharp objects	146	21.4
Pesticides	102	15.0
Gas cylinders	75	11.0
Chemicals	64	9.4
Automotive products	64	9.4
Batteries	51	7.5
Electrical appliances	36	5.3
Beauty products	31	4.6
Cleaning agents (Hypo, Izal, Bleach, sniper)	28	4.1
Household disinfectants	21	3.1
Paints	16	2.3

Hazardous materials	Frequency*	Percentage
Drugs and medicines	11	1.6
Others	36	5.3

* Multiple responses

Others: Fertilizer, Nylon, Expired products, Glue, Toiletry materials, Charcoal, Cement, Formaldehydes, asbestos, Potash

Table 3. Observed hazardous materials.

Observed hazardous materials*	Frequency	Percentage
Laundry & dish washing detergent	193	94.1
Gas cylinder/ stove	187	91.2
Insecticides (Raid, Swan, Baygon)	185	90.7
Household disinfectants	181	88.3
Cleaning agents (Hypo, IZAL, Bleach)	175	85.4
Air fresheners	170	82.5
Batteries (Radio & Phone batteries)	170	82.5
Beauty products (body spray, perfume, relaxers, cosmetics, hair spray)	167	81.5
Automotive products	147	71.7
Camphor	146	71.2
Rat anti-flea/rat traps	145	70.7
Electronics & light bulbs	134	65.4
Shoe polish/sprays	133	64.9
Used black motor/ generator oil	107	52.2
Drugs & medicines	92	44.9
Nail polish & paint removers	92	44.9
Herbicides	83	40.5
Fertilizers	44	21.5
Paints	2	10.0

3.3. Knowledge About Household Hazardous Materials

Respondents' knowledge about household hazardous materials is presented in Table 4. Majority (93.9%) of the respondents stated that it is good to store household hazardous materials away from children while 92.5% said that improper storage of household hazardous material can cause poisoning/injury among children. About eighty-eight percent (87.9%) of the respondents revealed that the households have a role to play in the management of hazardous materials, 84.1% said that im-

proper disposal of household hazardous waste can cause environmental threat while 75.1% stated that some of the materials have storage mechanism on their leaflet or container. About two-thirds (66.8%) reported that they read the leaflets on the household hazardous materials for the storage and disposal condition before storage while 37.9% said that there are guidelines for storage and disposal of households' hazardous materials. Slightly more than half (52.2%) of the respondents said it is appropriate to store Household hazardous materials in shelves and dumping in refuse bin. The mean knowledge score was 7.9 ± 2.8 and 82.7% had good knowledge about household hazardous materials as depicted in Figure 2.

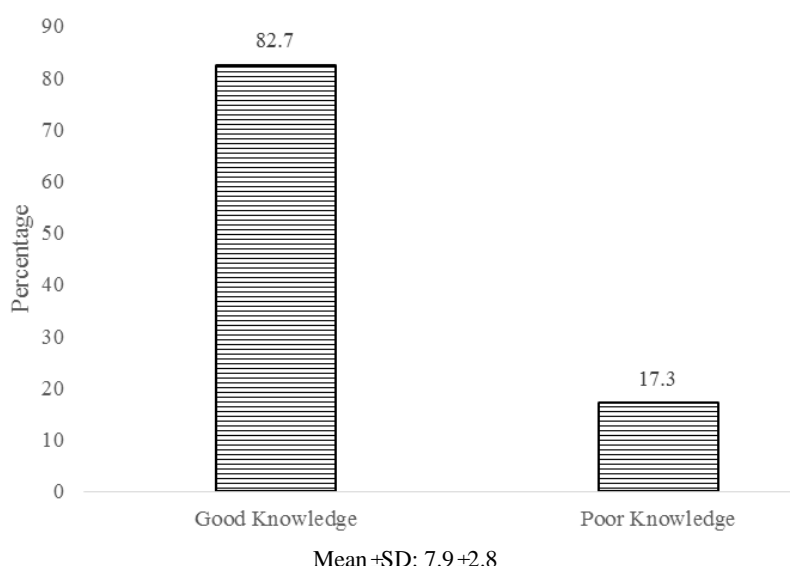


Figure 2. Knowledge on household hazardous materials.

Table 4. Knowledge about household hazardous materials.

Knowledge Statements	Frequency	Percentage
It is good to store household hazardous materials away from children	325	93.9
Improper storage of household hazardous material can cause poisoning/injury among children or probably death	320	92.5
Households have a role to play in the management of these hazardous materials	304	87.9
Improper disposal of household hazardous waste can cause environmental threat	291	84.1
Some of those materials have storage mechanism on their leaflet or container	260	75.1
Read the leaflet on the household hazardous materials for the storage and disposal condition before storing in the house	231	66.8
Household hazardous materials management should start from the house	296	85.5
There are guidelines for storage and disposal of households' hazardous materials	131	37.9
It is appropriate to store Household hazardous materials in shelves and dumping in refuse bin	107	52.2

3.4. Household Hazardous Materials Management Practices

The study revealed that 72.3% of the respondents said they had usually checked the instructions on any of the hazardous material before usage and storage as shown in Table 4. Majority (82.7%) of the respondents stated that they check for hazardous content and expiration date of materials before usage and storage while 58.4% revealed that they keep children away from the aerosols that comes from spraying body products. The three major method of disposal identified by the respondents burning (48.0%), through waste management authority (35.0%) and burying (12.7%). However, 59.0% of the participants

mentioned open burning as the most preferred method of disposal of household hazardous materials as shown in Figure 3. The mean practice score was 6.4 ± 1.9 , 62.0% had inappropriate practices towards household hazardous materials management (Figure 4).

Practice towards managing household hazardous materials was compared with sociodemographic characteristics and knowledge level as seen in Table 5. Gender, age category and marital status did not show any significant association with the respondent's practice towards managing household hazardous materials. Significantly, 78.5% of the respondents with tertiary education had good practices towards managing household hazardous materials than those who had attained secondary (16.9%) and primary education (4.6%). However, there is no significant association between respondents practices and

knowledge about household hazardous materials management.

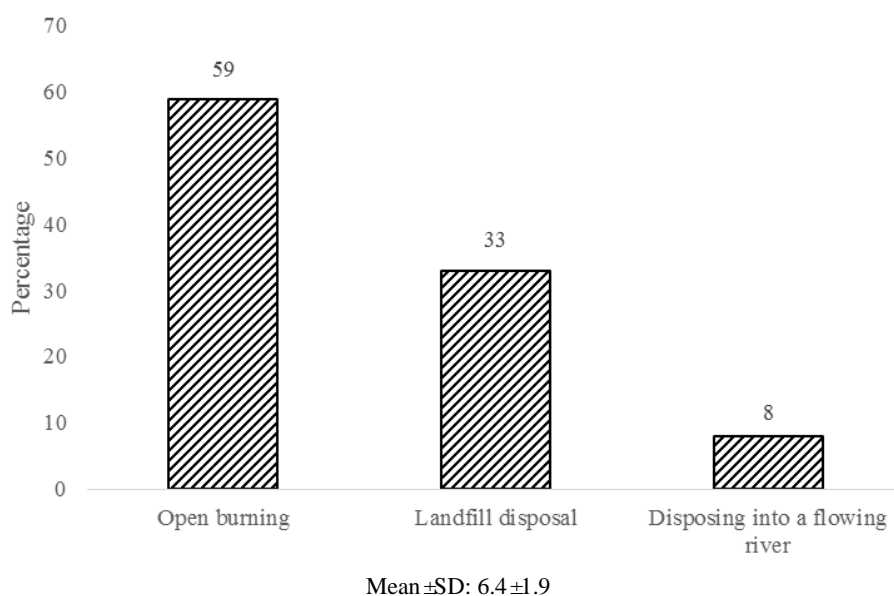


Figure 3. Preferred method of household hazardous materials disposal.

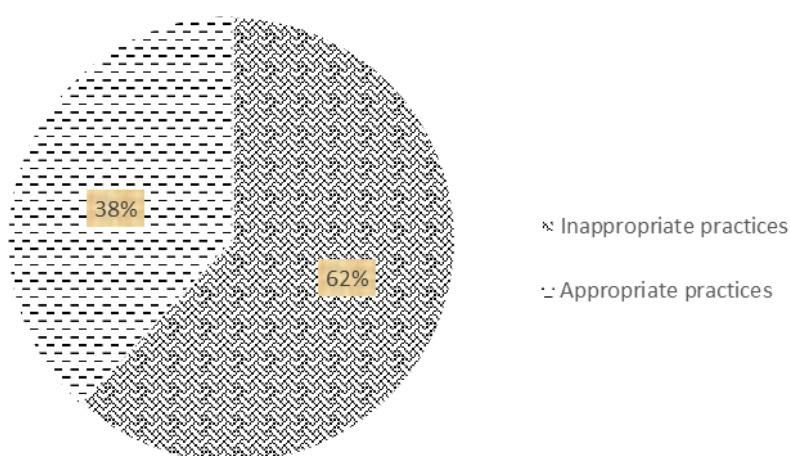


Figure 4. Level of practice towards managing household materials.

Table 5. Household hazardous materials management practices.

Practices variables	Frequency	Percentage
Check the instruction on any of the hazardous material before usage and storage	250	72.3
checking for hazardous content and expiration date of materials before usage and storage	286	82.7
Keep children away from the aerosol that comes after spraying	202	58.4
Method of disposal		
Burning	166	48.0
Through waste management authority	121	35.0
Burying	44	12.7
Dump into a flowing river	15	4.4

Table 6. Correlation of practice towards managing household hazardous materials with sociodemographic characteristics and knowledge.

Variables	Inappropriate Practice	Appropriate Practice	Chi-Square	p-value
Gender				
Male	98 (62.0)	60 (38.0)	0.02	0.887
Female	118 (62.8)	70 (37.2)		
Age				
< 25 years	54 (60.7)	35 (39.3)	7.05	0.215
25 – 34 years	57 (53.8)	49 (46.2)		
35 – 44 years	52 (66.7)	26 (33.3)		
45 – 54 years	29 (72.5)	11 (27.5)		
55+ years	24 (72.7)	9 (27.3)		
Marital status				
Single	72 (58.1)	52 (41.9)	1.86	0.396
Married	134 (65.4)	71 (34.6)		
Divorced	10 (58.8)	7 (41.2)		
Level of education				
Primary	22 (10.1)	6 (4.6)		
Secondary	65 (30.1)	22 (16.9)	13.465	0.004
Tertiary	129 (59.7)	102 (78.5)		
Knowledge category				
Poor	36 (16.7)	24 (18.5)	0.182	0.669
Good	180 (83.3)	106 (81.5)		

The study identified common household hazardous materials and management practices among residents of Irewole Local Government Area, Osun State, Nigeria. The study revealed the presence of cleaning agent (hypo, izal, bleach), sniper, laundry and dish washing detergents, household disinfectant and paints in most of the houses. Several studies have identified home cleaning agents and/or home maintenance products such as detergent and bleach as household hazardous wastes [27-29, 32, 33]. Furthermore, Insecticide, pesticides, rat anti-flea, herbicides were observed. Killing agents such as pesticides, herbicides, and/or insecticides have been identified as Household hazardous waste [30, 33, 34]. The study also observed automotive product from majority of the houses. Studies have reported automotive maintenance products such as antifreeze, grease, and motor oil as an household hazardous waste [32-34]. Other hazardous materials observed in the houses were used electronics & light bulbs, expired drugs and batteries. Similar findings have been reported [28, 30, 31].

This study highlighted some of the potential harms that household hazardous materials can cause. These includes;

death, accidents from fire outbreak, explosion, injury, harm to health through blood loss, poisoning, diseases and infection, burns/scald, suffocation, electric shock, and pollution. This findings indicated that households were aware of the harm that hazardous materials can cause if mismanage. Previous studies has pointed out that improper handling of household hazardous material can cause serious health issues and even death [1, 9]. However, a study emphasized that health risks from improper storage of household hazardous waste are greater in children than in adult due to their vulnerability and curiosity [17]. This study revealed that most of the respondents were aware that improper disposal of HHW can cause environmental threat. Studies have reported that large proportion of households were aware about adverse effects of improper waste disposal [21, 25]. Several respondents revealed that they knew the guidelines for storage and disposal of households' hazardous materials. This is consistent with [22] report in Kenya that households had little knowledge on the identification of correct household hazardous waste management methods. The study however found that high proportion of the participants claimed that it is appropriate to

store household hazardous materials in shelves and dumping in refuse bin. This might be a misconception and the finding corresponds to the result of Awosan et al.'s study who explained that household misinterpret storing in refuse bin as a management method [5].

Large proportion of the respondents reported that they read the leaflet on household hazardous materials for storage and disposal condition before storage. The findings was similar to report which explained that reading the leaflet of HHM is important for it storage and disposal as both are important in the management of HHM [23]. The study found that improper disposal of HHW can cause environmental threat. Previous studies have reported that majority of people have the knowledge about household waste disposal and aware about adverse effects of improper waste disposal [3, 21, 25]. Most developing countries are known to lack modern household waste management systems and do not even know the appropriate disposal method for household hazardous material. The major method of household hazardous materials disposal identified in this study were open burning, disposal through waste management team, burying and dumping into a flowing river. This findings agree with argument that the public is often unaware of their options for reducing and recycling method of disposal for their household hazardous waste [10, 13, 23]. The study revealed that high percentage of the respondents had good knowledge about the management of household hazardous materials. This is consistent with findings where majority of its participants had good knowledge of household solid waste management [6].

This study revealed that most respondents usually check for hazardous content and expiration date of materials before usage and storage. Similar findings had been reported that most participants did not read the instruction labels that were written on the container [16]. High proportion of participants claimed that they keep children away from the aerosol that comes from spraying body products. This is very important to keep children away from having direct and indirect contacts with the hazardous materials at homes. Infants and toddlers are unintentionally more exposed to these household products by inhalation, due to relatively longer periods of time spent indoors in homes than adults [14, 17]. The study also revealed that open burning was the most reported and preferred method of disposal of household hazardous materials. This correspond to some previous studies study that has reported open burning, burying and open dumping as the commonly known method of refuse disposal [6] and open burning as the most preferred [2]. This might be an indication that there is unavailability of household waste management systems in the study setting. High percentage of the respondent had a poor practices toward the management of household hazardous materials. Previous studies had reported similar findings that the respondents' waste management practice are harmful to the health and the environment [4].

This study found that respondents' gender, age category

and marital status did not show any significant association with the practice towards managing household hazardous materials. Furthermore, no significant association existed between respondents' practices and knowledge about household hazardous materials management. However, high proportion of the respondents with tertiary education had appropriate practices towards managing household hazardous materials than those who had attained secondary and primary education. This shows that education has important role to play in the management of hazardous waste at the household level.

5. Conclusion

The study revealed the presence of several hazardous materials in most of the houses that were observed. These include cleaning agent (hypo and izal), bleach and sniper, laundry and dish washing detergents, household disinfectant and paints. Other hazardous materials observed in the houses were insecticide, pesticides, rat anti-flea, herbicides and automotive product. Majority of the participants were aware about the harm associated with the improper management of the hazardous materials. These includes; death, accidents from fire outbreak, explosion, injury, poisoning, diseases and infection, burns/scald, suffocation, and pollution. Open burning was the most reported and preferred method of disposal of household hazardous materials. It was also found that high percentage of the respondents had good knowledge about the management of household hazardous materials but inappropriate practices toward its management. Large proportion of the respondents with tertiary education had appropriate practices towards managing household hazardous materials than those who had attained secondary and primary education. In order to improve their management practices, households should have access to communication materials, instructional information, and facilities for managing hazardous waste.

Acknowledgments

The author wish to acknowledge all the participants who gave informed consent to participate.

Author Contributions

All authors passed the four criteria for authorship contribution based on recommendations of the International Committee of Medical Journal Editors.

Conflicts of Interest

The authors declare no conflict of interest.

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