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An appraisal of the handler awareness of electrical and electronic equipment toxicity in Nigeria

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Some developing countries in Africa are waking up to the broadband race by providing public access to information communications technologies (ICTs) to instigate social and economic development and to narrow the digital divide. One of such countries is Nigeria, which ranked 60th in 2006 in e-readiness report by the Economist Intelligence Unit. Consequently, the market, marketers and repairers of electrical electronic equipment (EEE) are growing geometrically in Nigeria. Incorporated in EEE are about 46 separate chemical substances or elements, some of which are hazardous. Their emission from EEE translates to toxicity through inhalation of the polluted air, especially by marketers and repairers. Becoming aware of this danger is key to exercising the necessary caution in handling EEE. This study assessed the awareness of marketers and repairers of EEE toxicity and adoption of safety measures against the same. Questionnaires were administered on 80 purposively selected marketers in Alaba International Market, Lagos and on 20 repairers in C-to-C Plaza, Enugu. Data were analysed using average mean score technique. Results show that all participants were completely ignorant of the toxicity associated with EEE and did not associate it with various symptoms of ill-health.The study recommends education programmes for marketers and repairers of EEE and developing policies on how to handle EEE.

Key words: Hazardous chemical components, electrical electronic equipment, toxicity awareness, handlers, safety measures.

INTRODUCTION

Some developing countries in Africa are adopting the information communications technologies (ICTs) for the needed leverage in their development trajectory in the belief that it will contribute to social and economic development and in narrowing the digital divide. Little wonder, the 2006 global e-readiness rankings positioned South Africa 35th, Egypt 55th, Nigeria 60th and Algeria 63rd. This is an indication that Africa is waking up to the broadband race (Gomez et al., 2009; Mutula, 2005; Nkamnebe, 2010).

Also, a World Bank publication reports that “the digital divide” between the rich and poor nations is narrowing fast; telecommunications services to poor countries were growing at an explosive rate and the digital divide was rapidly closing. “People in the developing world were getting more access, especially to cell phone communi-

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cations, far faster than they got access to new technologies in the past" (Mutula, 2005).

In the information age, EEE drive development and have consequently become ubiquitous even in developing countries. Therefore, their markets, marketers and repairers are growing geometrically. Researches have shown that about forty-six (46) separate chemical substances or elements are incorporated in EEE. Some are toxic by inhalation of the air polluted by gaseous emissions of these chemical components from EEE (Slade, 2006; Murali, 2009). For instance, the emission of lead from EEE constitutes health hazards.

An earlier study revealed a perfect positive correlation between the log dose of crude lead-extract from waste-EEE materials and % mortality of the rats to which the crude lead-extract from waste-EEE had been exposed by oral administration. The degree of confidence that crude lead-extract had lethal effect on rats was high, as well as the reliability. The lethal dose for rat was higher than the reported lowest lethal dose for man and the lowest lethal dose for guinea pig and dog.

Since the EEE marketers and repairers spend greater part of their time in the presence of EEE, the lethal concentrations of the various chemical components of EEE are easily attained (by inhalation). Osibanjo and Ogundiran (2010), submit that risk is the sum of hazard and exposure. In this case, emissions of various chemical components of EEE constitute the toxicity. The exposure or regular inhalation is high beacuse the EEE marketers and repairers keep close with the equipment most day. Thus, the risk is high. This is a serious cause for worry over the toxicity of EEE. More so, as indoor air pollution and urban air quality, of which emission is a factor, are listed as two of the world's worst pollution problems in 2008 World's Worst Polluted Places report (Blacksmith Institute, 2008).

Awareness of this danger is key to being informed, enlightened, knowledgeable, mindful of and alert or alive to the need for exercising the necessary caution in handing EEE. The present study was aimed at minimising the environmental health effects of the chemical components of EEE on marketers and repairers in Nigeria. The specific objectives of the study were to (i) assess the awareness of EEE toxicity by marketers and repairers, (ii) assess the adoption of safety measures in handling EEE by marketers and repairers, and (iii) recommend measures to ameliorate the environmental health effects of EEE on marketers and repairers. The study assumed that EEE makrters and repairers (i) were not aware of the toxicity of EEE, and (ii) were not adopting safety measures for handling EEE.

The study will greatly benefit EEE marketers and repairers, as it offers them a thought regarding EEE toxicity and adopting safety measures for handling the equipment. The findings will guide government and non-governmental organisations on the need to create awareness on safety practices among EEE marketers and repairers. Policy makers will find the results of the study useful in formulating policies for ameliorating the environmental health effects of EEE on marketers and repairers.

METHODOLOGY

Key informant technique was used to elicit information from purposively selected fifty (50) EEE marketers in Alaba International Market, which is famous for EEE trading business, and twenty (20) repairers in C-To-C Business Plaza, Nkpokiti Street, Enugu, Nigeria, where significant EEE repairing activities take place at commercial scale. All trader respondents had lasted 20 years upwards in the business, while repairers had lasted ten (10) years upwards on the job, to qualify for participation. Questionnaire copies were administered to the key informants to elicit information from them.

Part A of the questionnaire elicited demographic information on participants, while the Part B elicited information on the awareness of the participants of the toxicity of EEE and their adoption of safety measures for handling them. Answer options to each question were rated on a five-point lycert scale: strongly agree (5), agree (4), not sure (3), disagree (2) and strongly disagree (1).

The Average Mean Score test technique was used to analyse the data using the formula (Osuala, 2007):

$$\text{Calculated value (CV)} = \frac{\sum Fx}{\sum F}$$

Where, F is frequency and x is scale point. The CV was compared with the decision value (DV) of 3 (neutrality value). If CV was greater than DV, then the answer was regarded as being in the affirmative, otherwise it was in the negative. Similarly, null hypothesis was rejected if CV was greater than DV, and accepted if otherwise.

RESULTS AND DISCUSSION

Table 1 contains demographic information on participants. No woman owned EEE marketing shop or repairs workshop; but, their spouses did. All 100 participants were male. Therefore, the businesses were not gender-balanced, but that of males.

All participants were literate, having obtained the first School Leaving Certificate (FSLC) (7%), attained secondary education (21%), obtained the Ordinary/Higher National Diploma (OND/HND) (45%), bagged a degree (25%) and/or obtained a higher degree (2%). Therefore, the businesses were for the literate class of the society.

The mode age bracket of participants was 18 to 25 (28%), followed by 26 to 35 (24%), 36 to 45 (23%), 46 to 55 (15%), 56 to 65 (8%) and above 65 years (3%). Thus, the businesses were for the youth (18^+ years) and productive age (25 to 45 years) in the society. Although, 37% of the participants were single, 56% were married, and 7% either separated or divorced, showing that most of the participants were married. This implies that victims of EEE toxicity were mostly married people and the brunt of its ugly effects was borne by families. These ugly effects include loss of breadwinners, ophaning children,

Table 1. Personal data of participants.

Subject		% Score
Sex	Female	0
	Male	100
Highest educational level	FSLC	7
	Secondary education	21
	OND/HND	45
	Degree	25
	Above degree	2
Age bracket	18-25	28
	26-35	24
	36-45	23
	46-55	15
	56-65	8
	Above 65	3
Marital status?	Single	37
	Married	56
	Separated/divorced	7
No.of years on the business involving EEE	11 - 20	68
	21 - 30	21
	31 - 40	7
	41-50	4
	50 upwards	-

Source: Field work, 2012.

child labour, street children, widowing women, widow-hood practices, among others (Eneh and Nkamnebe, 2011).

Sixty-eight per cent of participants had been in the businesses for between 11 and 20 years, 21% for between 21 and 30 years, 7% for between 31 and 40 years, 4% for between 41 and 50 years, and none of them for above 50 years. Thus, people drop from the businesses as years go by, and hardly continued till old age. Those of them who drop into joblessness and idleness may get into addictions, thereby creating some problems in the society.

Table 2 shows the data on the awareness of the marketers and repairers of the toxicity of EEE and their adopton of safety measures. Forty-nine (49) or 49% of participants strongly disagreed that EEE emit hazardous gases that they inhale, 29 disagreed, and 21 were not sure. None of them (0%) agreed and none (0%) strongly agreed. The CV (1.70) was less than DV (3.0), showing that the answer was in the negative. That is, all participants were completely ignorant of the fact that EEE emit toxic gases. And, this ignorance is suicidal.

Forty-eight (48) or 48% of participants strongly disagreed that inhaling the emissions from EEE caused them some health problems, 33 disagreed, and 19 were not sure. None of them (0%) agreed and none (0%) strongly agreed. The CV (1.71) was less than DV (3.0), showing that the answer was in the negative. Therefore, all participants were completely ignorant of the fact that their inhalation of hazardous gases emitted from EEE caused them some health problems. In their ignorance, more havock would likely result because they would not care to take precaution.

Thirty-eight (38) or 38% of participants strongly disagreed that inhaling emissions from EEE had anything to do with some symptoms of ill-health, 31 disagreed, 28 were not sure, 3 agreed, and none (0%) strongly agreed. The CV (1.76) was less than DV (3.0), showing that the answer was in the negative. That is, most (97%) of the participants did not associate any symptoms of ill-health with inhalation of emissions from EEE. This ignorance would only occasion more harm.

Fifty-nine (59) or 59% of participants strongly disagreed that some EEE marketers and repairers have had to quit the trade because of EEE toxicity and its effects on them, 39 disagreed, and 2 were not sure. None (0%) agreed and none strongly agreed. The CV (1.43) was less than DV (3.0), showing that the answer was in the negative.

Table 2. Awareness of health effects and compliance with manufacturer's guides.

Parameter	Lycert scale (x)					∑F	∑Fx	CV	Remark	Decision
EEE gas emission	**1**	**2**	**3**	**4**	**5**	100	170	1.70	CV < DV.	Accept null
Frequency (F)	49	29	21	0	0				Answer is neg.	hypothesis (i)
Fx	49	58	63	0	0					
EEE toxicity						100	171	1.71	CV < DV.	Accept null
Frequency									Answer is neg.	hypothesis (i)
Fx	48	33	19	0	0					
	48	66	57	0	0					
Symptoms knowledge						100	176	1.76	CV < DV.	Accept null
Frequency									Answer is neg.	hypothesis (i)
Fx	38	31	28	3	0					
	38	62	64	12	0					
People quiting trade						100	143	1.43	CV < DV.	Not apllicable
Frequency	59	39	2	0	0				Answer is neg.	
Fx	59	78	6	0	0					
Need to quit trade						100	144	1.44	DV > CV.	Not applicable
Frequency	61	34	5	0	0				Answer is	
Fx	61	68	15	0	0				affirmative	
Quiting trade before old age						100	168	1.68	CV < DV.	Not applicable
Freuency	48	38	12	2	0				Answer is neg.	
Fx	48	76	36	8	0					
Need for precaution						100	155	1.53	CV < DV.	Accept null
Frequency	63	26	5	4	2				Answer is neg.	hypothesis (ii)
Fx	63	52	15	16	10					
Knowledge of caution						100	156	1.56	CV < DV.	Accept null
Frequency	60	31	4	3	2				Answer is neg.	hypothesis (ii)
Fx	60	62	12	12	10					

Source: Field work, 2012.

That is, although all participants were aware of some of their colleagues quiting the trade, they were certain that none of such cases had to do with EEE toxic effects on them. But, this ignorance would not stop the harm.

Sixty-one (61) or 61% of participants strongly disagreed that they could be required to quit the EEE trade on account of EEE toxic effects on them, 34 agreed, and 5 were not sure. None (0%) agreed and none strongly agreed. The CV (1.44) was less than DV (3.0), showing that the answer was in the negative. That is, most (95%) participants were certain it would not come to their being required to quit the trade on account of EEE toxic effects on them. This ignorance would not help matters.

Forty-eight (48) or 48% of participants strongly disagreed with the speculation that they would not last on EEE business till old age of retirement because of EEE toxic effects on them, 38 disagreed, 12 were not sure, and 2 agreed. None (0%) strongly agreed. The CV (1.68) was less than DV (3.0), showing that the answer was in the negative. That is, most (86%) participants were certain it would not come to their being required to quit the trade before their retirement age because of EEE toxic effects on them. This ignorance is as dangerous as the harm precursor.

Sixty-three (63) or 63% of participants strongly disagreed that they needed to adopt some safety measures for handling EEE, 26 disagreed, 5 were not sure, 4 agreed, and 2 strongly agreed. The CV (1.53) was less than DV (3.0), showing that the answer was in the negative. That is, most (91%) participants were certain that there was no need for adopting some safety measures for handling EEE in order to minimise toxic effects. Again, this ignorance is as dangerous as the harm precursor.

Sixty (60) or 60% of participants strongly disagreed with the safety measures for handling EEE, 31 disagreed, 4 were not sure, 3 agreed, and 2 strongly agreed. The CV (1.56) was less than DV (3.0), showing that the answer was in the negative. That is, most (95%) participants disregarded the safety measures for handling EEE and did not apply them. This attitude was not helpful, but suicidal.

Tests of hypotheses

Questions B1-3 probed the awareness of participants of the toxicity of EEE. Their respective CVs were 1.70, 1.71 and 1.76, each being lower than the DV of 3.0. Therefore, null hypothesis (i) was accepted for each of the cases. That is, marketers and repairers were not aware of EEE toxicity.

Questions B7 and B8 probed the adoption of common safety measures for handling EEE. Their respective CVs were 1.53 and 1.56, each being lower than the DV of 3.0. Therefore, null hypothesis (ii) was accepted for each case. That is, marketers and repairers were not adopting safety measures for handling EEE.

Woolf et al. (2007), shows that lead is a very strong poison. When lead dust is inhaled, some of the poison can stay in the body and cause serious health problems. Worse still, it is more common for lead poisoning to build up slowly over time from repeated exposure to small amounts of lead. In this case, there will be no obvious symptoms. In adults, lead can increase blood pressure and can cause digestive problems, kidney damage, nerve disorders, sleep problems, muscle and joint pain, and mood changes.

Classification of the consequences of lead poisoning by toxicity levels has shown decreased learning, decreased verbal ability, early signs of attention-deficit/hyperactivity disorder (ADHD) and low intelligence quotient (IQ), as general effects. Mild toxicity produces abdominal discomfort, lethargy, mild fatigue, myalgia, and paresthesia. Moderate toxicity produces constipation, irritability, difficulty concentrating, diffuse abdominal pain, mild fatigue, headache, muscular exhaustibility, tremor, vomiting, and weight loss. Severe toxicity produces colic, encephalopathy (seizures, coma, death), lead line on gingival tissue, and paresis or paralysis.

Reports by Karri et al. (2008), Timbrell (2008) and Marshall and Bangert (2008) show that the symptoms and signs of lead poisoning vary according to the individual and the duration of lead exposure. They may be subtle, and someone with elevated lead levels may have no symptoms. Symptoms usually develop over weeks to months as lead builds up in the body during a chronic exposure, but acute symptoms from brief, intense exposures also occur.

The main symptoms in adults are headache, abdominal pain, memory loss, kidney failure, male reproductive problems and weakness, pain, or tingling in the extremities. The classic signs and symptoms in children are loss of appetite, abdominal pain, vomiting, weight loss, constipation, anaemia, kidney failure, irritability, lethargy, learning disabilities, and behavior problems.

In acute poisoning, typical neurological signs are pain, muscle weakness, paraesthesia, and, rarely, symptoms associated with encephalitis. Abdominal pain, nausea, vomiting, diarrhoea, and constipation are other symptoms of acute lead poisoning. Lead's effects on the mouth include astringency and a metallic taste. Gastrointestinal problems, such as constipation, diarrhoea, poor appetite, or weight loss, are common in acute poisoning. Absorption of large amounts of lead over a short time can cause shock (insufficient fluid in the circulatory system) due to loss of water from the gastrointestinal tract. Haemolysis (the rupture of red blood cells) due to acute poisoning can cause anaemia and haemoglobin in the urine. Damage to kidneys can cause changes in urination, such as decreased urine output. People, who survive acute poisoning, often go on to display symptoms of chronic poisoning.

Chronic poisoning usually presents with symptoms affecting multiple systems, but is associated with three main types of symptoms: gastrointestinal, neuromuscular, and neurological. Central nervous system and neuromuscular symptoms usually result from intense exposure, while gastrointestinal symptoms usually result from exposure over longer periods.

Signs of chronic exposure include loss of short-term memory or concentration, depression, nausea, abdominal pain, loss of coordination, and numbness and tingling in the extremities. Fatigue, problems with sleep, headaches, stupor, slurred speech, and anemia are also found in chronic lead poisoning. A "lead hue" of the skin with pallor is another feature. A blue line along the gum, with bluish black edging to the teeth is another indication of chronic lead poisoning. Children with chronic poisoning may refuse to play or may have hyperkinetic or aggressive behaviour disorders.

According to the reports by Hu et al. (2007), about 35-40% of inhaled lead dust is deposited in the lungs, and about 95% of that goes into the bloodstream of adults. Guidotti and Ragain (2007), report that the complications arising from lead poisoning show that lead affects every one of the body's organ systems, especially the nervous system, but also the bones and teeth, the kidneys, and the cardiovascular, immune, and reproductive systems. Hearing loss, tooth decay and cataracts have been linked to lead exposure.

Findings, Conclusions and Recommendations

Summary of results showed that:

1) All participants were completely ignorant of the fact that EEE emit hazardous gases.

2) All participants were completely ignorant of the fact that their inhalation of the hazardous emissions from EEE caused them some health problems.
3) Most (97%) of the participants did not associate any of the common symptoms of ill-health with inhalation of emissions from EEE.
4) Although all participants were aware of some of their colleagues quiting the trade, they were certain that none of such cases had to do with EEE toxic effects on them.
5) Most (95%) participants were certain it would not come to their being required to quit the trade on account of EEE toxic effects on them.
6) Most (86%) participants were certain it would not come to their being required to quit the trade before their retirement age because of EEE toxic effects on them.
7) Most (91%) participants were certain that there was no need for adopting some safety measures for handling EEE in order to minimise toxic effects.
8) Most (95%) participants disregarded the safety measures for handling EEE and did not apply them.

Toxic substances are ubiquitous; no one can run away from them. Their uses are getting increasingly important; people need to use them for personal and society development at various levels. EEE workers are exposed to toxic components of EEE through several pathways (gases emission, dust, water, food contami-nation, and so on). Therefore, exercise of caution is what is required from EEE marketers and repairers. They need to know that their stock contains chemical components that emit hazardous gases and that their inhalation of these emissions leads to adverse health effects that manifest in various symptoms of ill-health. If, through awareness campaign, they are made to know about the hazardousness of WEEE and the need to adopt recommended safety measures, they would exercise caution as they continue with the trade in less risky manners.
It is recommended, therefore, that:

1) EEE shops/workshops be well ventilated;
2) EEE marketers and repairers should take breaks from their shops/workshops;
3) EEE marketers and repairers should take vacations from their jobs;
4) EEE marketers and repairers should wear nose masks and gloves in workplace;
5) The government and non-governmental organisations should conduct awareness creation fora to enlighten the EEE marketers and repairers on proper professional practice to minimise the toxic effects of EEE on them;
6) Policies should be made to control the careless handling of EEE by marketers and repairers, in order to curb health diseases, life tolls and socio-economic loses attendant upon growing EEE sales and services businesses in the era of idiosyncratic adoption of ICTs.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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