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Knowledge and Practices of E-Waste Management in Urban Households: A Cross-Sectional Study

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Abstract: **Background: Electronic waste or e-waste is a big problem that is getting worse every day. This is because new technology is coming out all the time and people are buying more electronic devices. When we throw away these devices in the way it is very bad for the earth and our health. This is because they have things like lead and mercury inside them. We do not know much about how people deal with e-waste at home. We also do not know what people, in communities think about e-waste or what stops them from getting rid of it. Electronic waste is still an issue.**

Objectives: To assess the knowledge and practices regarding e-waste management in urban households

Methods: A community-based cross-sectional study was conducted among urban households in the field practice area using a pretested semi-structured questionnaire. People above 18 years of residing in the field area were recruited by simple random sampling .Information regarding socio-demographic characteristics, knowledge about e-waste, disposal practices, awareness of health and environmental risks was collected. Data were analyzed using descriptive and inferential statistics.

Results: The study evaluated awareness levels, disposal behaviors, and challenges related to e-waste management among urban residents. Majority of the participants demonstrated moderate knowledge (53.3%) and moderate practices(78.6%) of e- waste management.

Conclusion: Strengthening public awareness, improving accessibility to e-waste collection centers, and implementing incentive-based recycling programs may enhance responsible e-waste disposal practices among urban households.

Keywords: **Electronic waste, electronic devices, recycling programs.**

1. INTRODUCTION

Electronic waste (e-waste) is a term used to describe electrical and electronic equipment and their components that have been discarded as waste without the intention of reuse. The fast-paced technological improvements and frequent upgrades of electronic gadgets have been major drivers for the increasing generation of e-waste globally. (1,2,3)

The World Health Organization says e-waste contains hazardous substances such as lead, mercury, cadmium, chromium and flame retardants that, if improperly managed, can have adverse effects on human health and the environment. In developing countries like India, the challenges in e-waste management are due to lack of adequate recycling infrastructure, poor public awareness and dominance of informal recycling sectors. (4,5,6,7)

Increasing ownership of electronic gadgets such as mobile phones, computers, televisions, batteries and household appliances makes urban households great contributors to e-waste generation. Knowledge, attitudes and disposal practices in households are key for the development of effective interventions and policies. (1,8,9)

Large Domestic Appliances: e.g. washing machines, refrigerators, air conditioners and microwaves. Those older units often end up in scrap yards, with their parts rusting in the open air. Such gases, for example CFCs produced by cooling agents, can damage the ozone layer when improperly dumped. (10) Electronic Miniature Appliances Vacuum cleaners. Microwave ovens. Toasters. Electric kettles. Shavers. Scales. Calculators. Toys. Small medical devices. Much of it is dumped or informally dismantled by scrap dealers for its metal, creating environmental hazards. (4,5) Telecommunication and IT Equipment Computers, cell phones, monitors, printers, routers and office equipment. Some are donated, but many end up with informal recyclers, whose workers handle them without gloves or masks. (3,6).

Consumer electronics. Speakers, radios, DVD players, TVs. But the transition from bulky CRT TVs to flat screens has left millions of tonnes of waste glass and lead-filled components still sitting unregulated in many rural dumpsites. (7) Lighting Equipment: Fluorescent tubes and lamps, and LED bulbs contain mercury and other hazardous materials.

Environmental hazards of electronic waste:

Soil Pollution: The rusting electronics leach dangerous elements like cadmium and lead in to the soil. (7)

Water Pollution: E-waste dumped or burnt near rivers pollutes the water sources. Electronics are taken apart, toxic runoff is released into nearby streams, killing aquatic life and damaging local communities. (7)

Air Pollution: Informal recyclers burn wires and circuit boards to extract copper. Toxic gases are released into the black smoke. (4,7)

Objectives

To assess the awareness of e-waste management in urban households.

To assess the practices of e-waste management in urban households.

2. METHODOLOGY

It was a community based cross sectional study. The study was conducted at the field practice area for a period of 2 weeks. Data were collected using a semi-structured questionnaire consisting of socio-demographic details and questions on knowledge and practices of e-waste disposal. (1,2,3). Data Analysis- Data were entered into Jamovi version 2.7.31. Categorical variables were expressed as frequencies and percentages. Continuous variables were described by mean and standard deviation. Scoring was given for knowledge and practice of e-waste management.

Scoring Method:

Each correct knowledge response and each appropriate practice response was assigned a score of “1”, while incorrect or absent responses were assigned a score of “0” based on binary scoring.

The following scale was used to categorize the respondents into poor, moderate, and good knowledge/practice groups.

Knowledge categorization: TOTAL SCORE =4

- Poor Knowledge : 0-1 of Total score
- Moderate Knowledge : 2-3 of Total score
- Good Knowledge : 4 of Total score

Practice Categorization: TOTAL SCORE=6

- Poor Practice : 0-1 of Total score
- Moderate Practice : 2-4 of Total score
- Good Practice : 5-6 of Total score

3. RESULTS

Table 1. Socio-demographic Characteristics of Participants

Variable	Frequency (n=210)	Percentage (%)
Age (Mean ± SD)	43.41 ± 13.72	—
Gender		
Male	105	50.0
Female	105	50.0
Residential Area		
Urban	210	100

Table 1 shows the background details of the people who took part in the study. There were 210 participants in total. The average age of the participants was 43.41 years with a variation of 13.72 years. This means most of the participants were aged adults.Males and females were equally represented, each making up 50% of the participants.All participants lived in areas, which reflects the type of households the study focused on.These details show that the participants were a mix of males and females and a good example of urban households. This makes them suitable, for studying how people manage e-waste.The study participants details help us understand their e-waste management knowledge and practices.

Table 2. Knowledge Regarding E-Waste

Variable	Frequency	Percentage
Heard of e-waste – Yes	105	50.0%
Heard of e-waste – No	105	50.0%
Aware of hazardous substances – Yes	118	56.2%
Aware of hazardous substances – No	92	43.8%
Aware of environmental impact – Yes	126	60.0%
Aware of environmental impact – No	84	40.0%
Aware of health effects – Yes	121	57.6%
Aware of health effects – No	89	42.4%

Table 2 shows what participants know about e-waste and its bad effects. About half of them (50%) knew about e-waste which is a level of awareness.More than half of the participants knew that e-waste has substances (56.2%) can harm the environment (60.0%) and can cause health problems (57.6%).The results show that while people in households have some idea, about the environmental and health risks of e-waste many still do not know how to handle and dispose of e-waste safely.This means we need programs to make people aware and educated about e-waste.E-waste is a problem and e-waste handling and e-waste disposal are very important.

Table 3. Practices Related to E-Waste Disposal

Practice	Frequency	Percentage
Stored at home	41	19.5%
Sent to recycling center	29	13.8%
Disposed with general waste	36	17.1%
Donated	38	18.1%
Sold to scrap dealer	39	18.6%
Others	27	12.9%

Table 3 shows what people do with their electronic things. A lot of people just keep them at home this is what 19.5% of people do. Some people give their things to scrap dealers this is 18.6% of people. Others give away their electronic devices this is 18.1% of people. And some people just throw them away with their household trash this is 17.1% of people.13.8% of people take their old electronic things to special places that can recycle them. This means that not many people use the system for getting rid of electronic waste. These results show that even though people know a bit about the dangers of electronic waste they still do not get rid of it in a safe way. This is a problem because it can hurt the environment and make people sick. Electronic waste is still a problem and people need to be more careful, with electronic waste disposal and how they get rid of electronic waste..

Table 4. Categorization of E-Waste Management Knowledge Score Mean Knowledge Score = 2.24 ± 1.9.

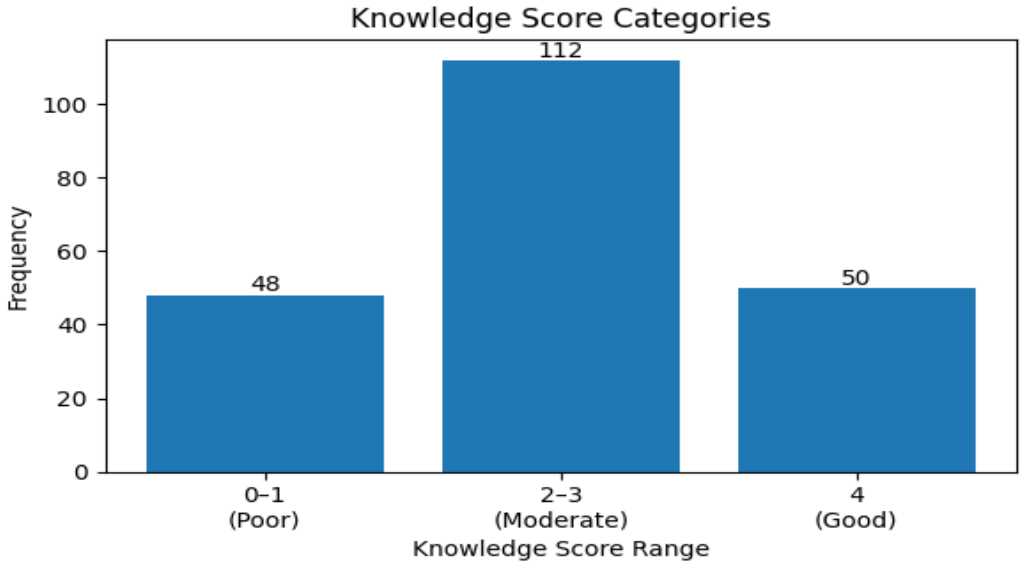

Table 4 shows how people were grouped based on their scores on e-waste management. Most people than half had okay knowledge about e-waste management, which is 53.3 percent. Then 23.8 percent of people knew a lot about e- management and 22.9 percent did not know much about e-waste management.The average score people got was 2.24. This score went up and down by 1.97. This means that people in the study knew a little about e-waste management. Many people knew that e-waste is bad, for us. They did not know how to get rid of e-waste properly or where to take it to be recycled. This is important because it shows that we need to tell people more about e- management and teach them about it in school. We need to make people more aware of e-waste management and how to do it safely..

Table 5. Categorization of E-Waste Management Practice Score Mean Practice Score = 1.01 ± 0.94

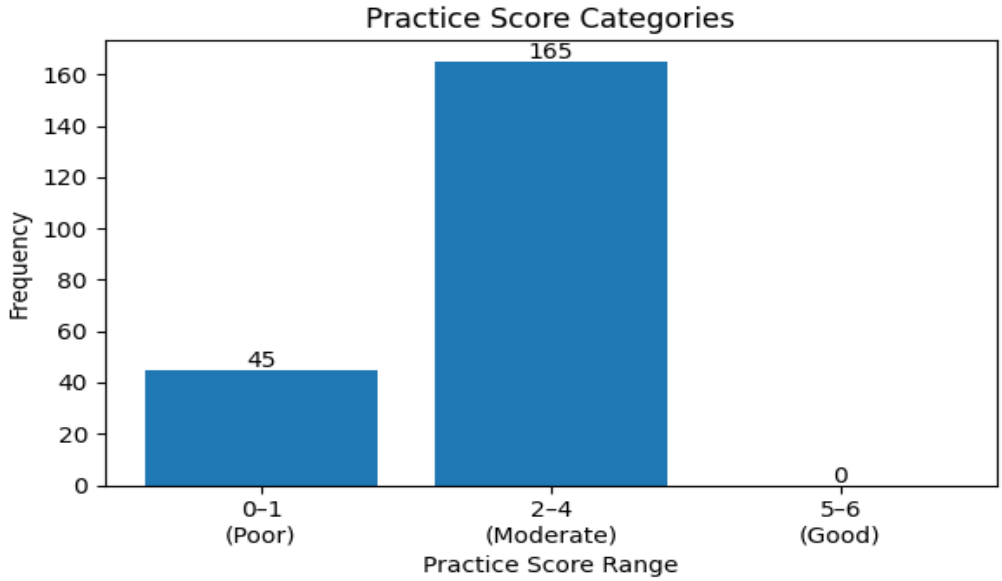

Table 5 shows how people were grouped based on what they do with their e-waste. Most people, 78.6 percent do okay when it comes to managing e-waste. 21.4 Percent do a bad job of getting rid of it. Nobody does a job of managing e-waste.The average score, for managing e-waste was 1.01, which's not very good. This shows that people who live in cities do not do a job of getting rid of e-waste properly. Not many people use recycling centers, which means they might not know about them. They might not want to use them. This tells us that people know about e-waste management. They do not actually do it. E-waste management is not being done well. E-waste management needs to be improved.

4. DISCUSSION

This study evaluated the awareness and practices of e-waste management in urban households.

The results were compared with previous studies conducted in similar settings. Awareness of hazardous substances, environmental impact and health effects (1,2,3) was assessed. The awareness ranged from 56% to 60%. These findings are similar to the study done in semi-urban Tamil Nadu. (2)

A study conducted in New Delhi found that although many respondents were aware that e-waste is harmful to the environment and human health, awareness of the proper disposal method and legitimate recycling centers was still lacking. (3) where the results are similar to this study regarding lack of practice of recycling and proper disposal of e-waste

The people in this study seem to know a bit about the environment. This is probably because they are seeing campaigns, posts on social media and educational programs. But there are still some things that people do not know so we need to teach them about how to take care of the environment in their own communities.

Other studies have shown that when people learn more about the environment they are more likely to do things that help the environment like getting rid of electronics in a responsible way.

When it comes to getting rid of electronics a lot of people in this study said they just keep them at home. A few people take their old electronics to special recycling centers. This is similar to what has been found in countries like India, Malaysia and Brazil. In these countries people often keep their electronics because they are worried, about someone getting their personal information or they do not know where to take them to be recycled or they are not sure how to get rid of them properly. This means that there is more electronic waste and it is taking longer to get rid of it. Electronic waste or e-waste is a problem and these practices are making it worse and they also delay the recycling of materials.

The study found that people who knew about the problems with waste did not always get rid of it properly. Even though most of the people in the study knew that electronic waste was bad for the environment and their health they still did not throw it away in the way. This is not the time that people have noticed this problem. Other studies have seen it too. It seems that just knowing about the issue is not enough to make people get rid of waste in a responsible way. Things like how easy it is to get rid of waste how much it costs and whether there are places to take it make a big difference, in what people do. Electronic waste management is what we are talking about here. It is affected by these things.(10,12)

The results of the study show that urban households have moderate level of awareness but inadequate disposal practices regarding e-waste management. (1,4,7)

The findings insists the need for community -based awareness programs, strengthening of recycling infrastructure and policies to encourage responsible e-waste management.

Limitations

In this study the Cross-sectional design limits causal inference,responses were self-reported and subject to recall bias which may affect the results and the findings may not be generalizable beyond the study area.

5. CONCLUSION

The study findings support the need for implementation of the E-Waste Rules in India. This can be done through awareness campaigns setting up collection centers making producers take responsibility and giving benefits for recycling e-waste Local authorities, schools, healthcare professionals and electronic manufacturers can work together to manage e-waste sustainably.The study shows that urban households have some knowledge about e-waste but do not dispose of it properly.More research with groups and in different areas may help understand what affects e-waste management. Long-term studies can check if education and policy changes help people dispose of e-waste responsibly.The E-Waste (Management) Rules in India are important. E-Waste management is an issue, in India. We need to manage e-waste to protect the environment.The government and people must work together to manage e-waste.

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