Journal of Advanced Research in Medicine
Volume 10, Issue 4 - 2023, Pg. No. 18-23
Peer Reviewed & Open Access Journal

Research Article

A Cross-Sectional Study on Perceptions and Practices of the Management of E-Waste Among the Scrap Dealers of Delhi

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DOI: https://doi.org/10.24321/2349.7181.202309

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How to cite this article:
Singh M M, Borle A L, Gupta T, Bhattacharya C P. A Cross-Sectional Study on Perceptions and Practices of the Management of E-Waste Among the Scrap Dealers of Delhi. J Adv Res Med 2023; 10(1): 18-23.

Date of Submission: 2023-12-01
Date of Acceptance: 2023-12-30

A B S T R A C T

Introduction: In the past decade, rapid technological advancements have flooded the Indian market with affordable electronic devices, especially appealing to young consumers. Consequently, this surge in gadget consumption has heightened electronic waste production, posing significant environmental and health risks.

Objectives:

1. To assess the level of awareness regarding the impact of e-waste among scrap dealers in urban slums in Delhi
2. To study the disposal practices of e-waste among scrap dealers in urban slums in Delhi

Methods: A community-based cross-sectional study was conducted in the urban slums of Delhi among the scrap dealers working in the slums of Central Delhi and Gokalpuri from April to October 2023. The sample size was calculated to be 280. However, due to time and resource constraints, a sample size of 138 was taken. Descriptive and inferential statistical analyses were performed using SPSS version 25.

Results: The study included 138 participants, mostly males aged 20 to 39 years in the scrap dealer demographic (62.3%). A majority had only completed primary school (69.6%). 85.5% sold e-waste to other dealers, while 11.6% disposed of it alongside general waste. Notably, 73.9% were unfamiliar with “e-waste” or “e-waste handling”. The findings revealed that higher education correlated with better e-waste awareness ($p < 0.05$).

Conclusion: Most of the scrap dealers did not have basic knowledge regarding e-waste, its proper management and related hazards. There is a need for those in authority to pay special attention to the sensitisation of scrap dealers regarding the disposal of e-waste practices, ill effects of e-waste, segregation at collection sites, legislation, and laws on e-waste.

Keywords: E-Waste Management, Scrap Dealers, Slums, Delhi

Introduction

The proper management of electronic waste has emerged as a pressing global concern, posing significant challenges to both the environment and public health. E-waste, also known as Waste Electrical and Electronic Equipment (WEEE), comprises loosely discarded, surplus, obsolete, or malfunctioning electrical or electronic devices.[1] It has swiftly become the fastest-growing segment within the formal municipal waste stream worldwide. Despite being discarded, electronics can serve as a valuable secondary resource by virtue of their potential for reuse. The substantial demands for electronic devices, driven by technological innovation, rapid industrial development, economic growth, and evolving lifestyles, encompass personal, office, and household applications.[2] This surge has resulted in a heightened need for electronics, consequently generating a significant volume of e-waste. E-waste comprises both hazardous and non-hazardous components, including precious metals like iron (63%), plastics (21%), glasses, ceramics, wood, rubbers, etc. Hazardous elements such as lead, cadmium, and mercury pose threats to humans, plants, and aquatic life.[3,4] Improper handling of e-waste leads to the release of these toxic components into the soil, water, and air, contributing to the demise of aquatic plants and animals.[5]

Exposure to e-waste constituents occurs through ingestion, inhalation, and dermal contact, with adverse health effects observed, particularly in vulnerable groups such as children, pregnant women, and workers in primitive recycling sites. The prediction of a drastic increase in e-waste generation in the next decade raises concerns about the potential complex interactive effects of its constituents.[2,6,7]

Managing e-waste presents a significant challenge for developing countries, with insufficient public awareness, policies, and inadequate budgets in the waste management sector contributing to the problem.[8] While strict rules against e-waste landfills exist in developed countries, the Basel Convention, established in 1992, allows the export of second-hand items and some e-waste scrap to underdeveloped countries, exacerbating the issue. Developing countries, including China, India, Pakistan, Vietnam, etc., face a substantial influx of e-waste, with South Asia, especially India, Pakistan, Bangladesh, and Sri Lanka, being prominent destinations.[9]

Despite a heightened environmental consciousness among people, there is low awareness regarding e-waste-related rules and regulations, recycling programs, and the formal and informal recycling sector.[10,11] In India, the current e-waste management practices are disorganised and largely run by an informal system, particularly in Delhi, which contributes 9729.2 tonnes of e-waste and ranks among the largest e-waste generators in the country.[11] To the best of our knowledge, there is a paucity of literature among scrap dealers regarding their perception and handling of e-waste in urban areas of Delhi, this study has been conducted.

Material and Methods

Study Area

Delhi, being the capital of India and the second largest e-waste generator city in India, was selected as our study place. The study was carried out in the urban slums of Delhi, with a specific focus on Central Delhi and the Gokalpuri slum. The latter served as the designated field practice area under the Department of Community Medicine at Maulana Azad Medical College.

Study Design and Duration

This study was structured as a community-based cross-sectional study, conducted for 6 months from April 2023 to October 2023.

Study Population

The study encompassed the scrap dealers residing in the specified slum areas for at least the past six months. Certain criteria were established for exclusion, including individuals with known psychiatric illnesses, those unable to actively participate, individuals facing terminal illnesses, and those experiencing hearing or vision problems.

Sample Size Calculation

The sample size for this study was calculated based on a previous study, in which knowledge about e-waste management was 21%.[11] After considering a non-response of 10%, the final sample size came out to be 280. However, due to constraints on time and manpower, only 138 could be studied.

Sampling Technique and Tools

As we did not have a complete list of scrap dealers of the selected areas of Central Delhi and the Gokalpuri slum, so the selection of the scrap dealers was done by intensity purposive sampling. After validation by a pilot study, a pre-tested, semi-structured questionnaire was used as a study tool which was translated into Hindi also.

Data Collection

The study was done by visiting the shops of scrap dealers. Those people who had their shops in the study areas and who consented to give the information were enrolled in the study. If the shop was locked, two informal visits were made and thereafter sequentially the next shop was selected for the study. Information pertaining to the scrap dealers was systematically collected through a three-part questionnaire (pre-tested and partly pre-designed). It was a one-time interview which took 20–25 minutes approximately. Section A1 comprised socio-demographic details and contained 10 questions aimed at capturing key

ISSN: 2349-7181
DOI: https://doi.org/10.24321/2349.7181.202309

information about the participants. Subsequently, Section A2 focused on assessing the occupational details of the scrap dealers. Lastly, Section A3 was designed to delve into the knowledge and perceptions of the participants regarding the handling of electronic waste (e-waste).

Ethical Consideration

Informed written consent was taken from each participant before the interview and the required approval was taken from the competent authority. Attempts were made to raise awareness among those study subjects found to have poor knowledge and perception regarding e-waste.

Statistical Analysis

The collected data was entered in MS Excel, following which data was imported into Statistical Package for the Social Sciences (SPSS) version 25 for analysis. Categorical data was expressed in terms of percentages and proportions. Descriptive analysis was done by calculating proportions, mean and standard deviation. Differences between proportions were assessed using the chi-square test/ Fisher's exact test. A p value less than 0.05 was considered significantly significant.

Results

The study involved 138 individuals, with a predominant presence of males aged 20 to 39 among scrap dealers (62.3%); and a few belonging to less than 19 years though none of them were less than 14 years of age (child labourers). Regarding education, a significant proportion had only completed primary school (69.6%). The majority of participants had 6-10 years of experience in scrap dealing (55.7%). A majority of participants were married (79.0%), and family structures varied, with joint families being the most prevalent (59.4%). The median family size was 4 members, and the median monthly family income was INR 4000, with a range of 3000–20000 (Table 1).

Table 1.Sociodemographic Profile of the Study Participants

(N = 138)

Demographic Characteristics	Categories	Frequency
Age groups (years)	≤ 19	13 (9.4)
	20–39	86 (62.3)
	40–59	25 (18.1)
	≥ 60	14 (10.2)
Education	Primary and below	96 (69.6)
	Secondary	37 (26.8)
	Graduate and above	5 (3.6)
Years of work in scrap-dealing	≤ 5	38 (27.6)
	6–10	77 (55.7)
	11–15	15 (10.9)
	≥ 16	8 (5.8)
Area of origin	Delhi	27 (19.6)
	Outside Delhi	111 (80.4)
Marital status	Married	109 (79.0)
	Unmarried	10 (7.2)
	Divorced/ separated/ widow	19 (13.8)
Type of family	Nuclear	56 (40.6)
	Joint	82 (59.4)
Total number of family members [median (range)]		4 (1–11)
Total monthly income of the family (INR) [median (range)]		4000 (3000–12000)

A significant 86.9% reported experiencing workplace injuries, with accidental injuries being the most common (71.0%), followed by muscle aches (32.6%) and eye irritation (7.9%). Most of these scrap dealers proceeded to sell the e-waste to other scrap dealers (85.5%), while a small percentage disposed of it with general waste (11.6%). Merely one participant chose to deposit the e-waste in e-waste collection centres. The majority of participants did not employ any personal protective measures (76.8%), though a few used masks (16.6%) or glasses (10.1%) (Table 2).

Table 2.Distribution of Study Participants According to Injury Characteristics and Disposal Practices of E-Waste

(N = 138)

Variables	Responses	Frequency
Ever had injuries at the workplace?	Yes	120 (86.9)
	No	18 (13.1)
Types of injuries (n = 120)	Accidental injuries	98 (71.0)
	Eye irritation	11 (7.9)
	Nasal irritation	3 (2.2)
	Pricking with sharp objects	9 (6.5)
	Dermatitis	7 (5.1)
	Muscle aches	45 (32.6)

ISSN: 2349-7181
DOI: https://doi.org/10.24321/2349.7181.202309

E-waste disposal practises	Sold further to scrap dealers	118 (85.5)
	Dissembling and smelting	4 (22.2)
	Disposed with general wastes	16 (11.6)
	Deposited in established e-waste collection centres	1 (0.7)
Usage of personal protective measures	None	106 (76.8)
	Masks	23 (16.6)
	Gloves	10 (7.3)
	Boots	5 (3.6)
	Glasses	14 (10.1)

A noteworthy 73.9% lacked awareness of the terms "e-waste" or "e-waste handling." In terms of understanding the detrimental effects of e-waste, only 22.5% acknowledged them. Additionally, a mere 8.7% were aware of available options for e-waste disposal, and a scant 5.8% of scrap dealers were familiar with e-waste legislation in the country. Regarding beliefs, 17.4% agreed that e-waste has adverse effects on human health, while 10.9% perceived the increasing global demand for electronic devices as a significant problem. A minority (28.3%) emphasised the importance of recycling e-waste before disposal. These findings highlight diverse levels of awareness and perspectives on e-waste-related issues among the surveyed individuals (Table 3).

Table 3.Awareness and Perceptions on E-Waste Among Study Participants

(N = 138)

Questions	Response	Frequency
Are you aware of the term "e-waste" or "e-waste handling"?	Yes	36 (26.1)
	No	102 (73.9)
Are you aware of the ill effects of e-waste on health and the environment?	Yes	31 (22.5)
	No	107 (77.5)
Are you aware of available options for the disposal of e-waste?	Yes	126 (91.3)
	No	12 (8.7)
Are you aware of e-waste legislation available in our country?	Yes	8 (5.8)
	No	130 (94.2)
Do you believe e-waste has a harmful effect on human health?	Yes	24 (17.4)
	No	114 (82.6)
Do you believe the increasing global demand for electronic devices is a serious problem?	Yes	15 (10.9)
	No	123 (89.1)
Do you believe it is important to recycle e-waste before disposal because electronic devices not working are considered waste?	Yes	39 (28.3)
	No	99 (71.7)

The study explored the relationship between demographic factors and e-waste awareness. The results indicated a statistically significant association between education level and e-waste awareness, with higher education levels associated with increased awareness ($p < 0.05$). Among scrap dealers, the study revealed that as age increases, awareness of e-waste also rises. Additionally, awareness tended to increase with the number of years engaged in scrap dealing, although not statistically significant (Table 4).

Table 4.Association of Sociodemographic Variables with Awareness Regarding E-Waste

(N = 138)

Variables	Categories	Aware	Not Aware	p Value
Age groups (years)	≤ 19	1	12	0.28
	20–39	24	62	
	≥ 40	11	28	
Education	Primary and below	7	89	0.00*
	Secondary	25	12	
	Graduate and above	4	1	
Years of work in scrap-dealing	≤ 5	6	32	0.07
	6–10	21	56	
	≥ 11	9	12	

*: Significant ($p < 0.05$)

Discussion

Numerous regulations and awareness initiatives exist for the handling and management of e-waste; however, there persists a deficiency in community awareness regarding these crucial issues. In the contemporary era, consumers frequently replace computers or mobile phones on an

ISSN: 2349-7181
DOI: https://doi.org/10.24321/2349.7181.202309

annual basis.[12–18] Consequently, a substantial volume of hazardous materials enters the waste stream without specific precautions to prevent their well-documented detrimental impacts on the environment and human health.[19] This cross-sectional study investigates the perceptions and practices related to e-waste management among scrap dealers in Delhi. The findings offer a comprehensive overview of the sociodemographic profile, injury characteristics, usage of personal protective equipment, disposal practices, and awareness levels of the participants.

Sociodemographic Profile

The study encompassed 138 individuals, with a predominant presence of males aged 20 to 39 among scrap dealers (62.3%). Regarding education, a significant proportion had completed only primary school (69.6%). The majority of participants had 6–10 years of experience in scrap dealing (55.7%). A substantial majority were married (79.0%), and family structures varied, with joint families being the most prevalent (59.4%). The median family size was 4 members, and the median monthly family income was INR 4000, with a range of 3000-20000.

Injury Characteristics and Usage of Personal Protective Equipment

A significant 86.9% reported experiencing workplace injuries, with accidental injuries being the most common (71.0%), followed by muscle aches (32.6%) and eye irritation (7.9%). The majority of these scrap dealers sold e-waste to other scrap dealers (85.5%), while a small percentage disposed of it with general waste (11.6%), which was similar to a study by Akormedi et al., Mishra et al. and Herat et al.[20–22] Only one participant chose to deposit e-waste in e-waste collection centres which was similar to a study by Alake and Ighalo.[19] The majority did not use personal protective measures (76.8%), though a few used masks (16.6%) or glasses (10.1%) which was similar to a study done by Kumari et al. and Mishra et al.[11,21]

Awareness Levels of the Participants and Disposal Practices

Notably, 73.9% lacked awareness of the terms “e-waste” or “e-waste handling.” Concerning understanding the detrimental effects of e-waste, only 22.5% acknowledged them, which was lower than a study done by Kumari et al.[11] but similar to a study done by Mishra et al.[21] Additionally, a mere 8.7% were aware of available options for e-waste disposal, and only 5.8% of scrap dealers were familiar with e-waste legislation in the country, which was lower than a study done by Kumari et al.[11] In terms of beliefs, 17.4% agreed that e-waste has adverse effects on human health, while 10.9% perceived the increasing global demand for electronic devices as a significant problem, which was similar to a study done by Mishra et al.[21] Only a minority (28.3%) emphasised the importance of recycling e-waste before disposal, which was similar to a study done by Mishra et al.[21] These findings underscore diverse levels of awareness and perspectives on e-waste-related issues among the surveyed individuals.

The study explored the association between demographic factors and e-waste awareness. The results indicated a statistically significant association between education level and e-waste awareness, with higher education levels linked to increased awareness ($p < 0.05$), which was similar to a study done by Kumari et al. and Makkar et al.[11,23] Among scrap dealers, the study revealed that as age increases, awareness of e-waste also rises. Additionally, awareness tended to increase with the number of years engaged in scrap dealing, although not statistically significant, which was similar to a study done by Makkar et al.[23]

Conclusion and Recommendations

The majority of the scrap dealers had a lack of fundamental knowledge about e-waste, including its appropriate handling and management, as well as the associated hazards of its generation. Addressing this gap requires extensive adoption of Information, Education, and Communication (IEC) services. These services should focus on educating about health and environmental risks linked to e-waste, government regulations, e-waste recycling centres, the use of personal protective gear, and the correct protocols for handling and managing e-waste. This broad approach is crucial for alleviating the burden of e-waste. These discoveries serve as the groundwork for future research and targeted interventions aimed at cultivating a more knowledgeable and environmentally aware community in the realm of e-waste management.

Source of Funding: None

Conflict of Interest: None

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ISSN: 2349-7181
DOI: https://doi.org/10.24321/2349.7181.202309