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Posted Date: 11 May 2026

doi: 10.20944/preprints202605.0658.v1

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Article

Knowledge, Attitude, and Practice Towards E-Waste Management in an Urban Slum of Delhi: A Community-Based Cross-Sectional Study

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Abstract

Background: E-waste is one of the fastest-growing waste streams globally, with India emerging as a major contributor. Despite existing regulatory frameworks, safe e-waste management remains suboptimal, particularly in vulnerable urban populations. This study aimed to assess knowledge, attitude, and practices (KAP) related to e-waste management and to examine the knowledge–practice gap in an urban slum of Delhi. **Methods:** A community-based cross-sectional study was conducted among 425 adults in an urban slum of Delhi using a stratified random sampling technique. Data were collected using a pretested, and semi-structured questionnaire assessing KAP domains. Multivariable linear regression, Spearman correlation, and mediation analyses were performed to identify determinants and pathways influencing practice. **Results:** Only 20.24% of participants demonstrated adequate knowledge, 43.29% had a positive attitude, and 11.29% reported good practices. Higher education was associated with better knowledge ($p = 0.002$), more positive attitudes ($p = 0.001$), and better practice scores ($p = 0.013$). In hierarchical regression analysis, Knowledge emerged as a strong independent predictor of practice ($\beta = 0.48$, $p < 0.001$) and remained significant after further adjustment for attitude ($\beta = 0.45$, $p < 0.001$). Correlation analysis demonstrated significant positive associations between knowledge and attitude ($\varrho = 0.52$), knowledge and practice ($\varrho = 0.38$), and attitude and practice ($\varrho = 0.33$) (all $p < 0.001$). Mediation analysis revealed that knowledge had both direct and indirect effects on practice through attitude, indicating partial mediation. **Conclusion:** The present study found that the levels of knowledge, attitude, and practices related to e-waste management remained low among residents of an urban slum in Delhi. While knowledge plays a central role in influencing behavior, the absence of accessible disposal systems and limited dissemination of policy information hinder translation into safe practices. Strengthening community-based awareness programs alongside improving and is essential for effective e-waste management.

Keywords: electronic waste (e-waste); knowledge; attitude and practice (KAP); environmental health; urban slum populations; waste disposal practices; informal recycling sector; community-based cross-sectional study; India

Introduction

Rapid urbanization, accelerating technological innovation, and an increasing dependence on electronic devices coupled with their increased obsolescence have led to a dramatic rise in electronic waste (e-waste), making it one of the fastest-growing streams of municipal solid waste worldwide. Electronic waste, also known as e-waste or Waste Electrical and Electronic Equipment (WEEE), refers to discarded, surplus, obsolete, or broken electrical and electronic devices.[1]

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According to the Global E-waste Monitor 2024, approximately 62 million metric tonnes (Mt) of e-waste were generated globally in 2022.[2] India is the on the largest producer of e-waste globally, ranking third after the US and China[2] A report by Central Pollution Control Board (CPCB) estimated that around 1.3 million tonnes of e-waste were generated in India in 2024–2025, which experts believe will grow exponentially in the coming years.[3] Delhi ranks among the largest generators of e-waste in the country. Although formal collection and recycling systems have improved over time, they have not kept pace with the increasing volume of e-waste generated.[4]

Almost 95% of e-waste is collected, handled, and managed by informal providers who are routinely exposed to harmful elements such as lead, mercury, cadmium, arsenic, selenium, and glass, thereby predisposing them to dermal, neurological, respiratory, and reproductive hazards.[5] Improper disposal techniques such as burning, informal recycling, or dumping into landfills adversely affects health, the informal handlers being the most acutely affected groups, Already coming from marginalised communities with poor health-seeking behaviour, the risk to their health gets accentuated by insufficient knowledge, lack of proper training, absence of protective gear, limited recycling facilities and inadequate recycling infrastructure.[6] A report by the Associated Chambers of Commerce and Industry of India (ASSOCHAM) revealed that almost 80% of the workforce engaged in e-waste collection experiences respiratory conditions of some kind.6 Even populations living near dumping sites are more exposed to gases, fumes, and radioactive substances, which can have deleterious long-term impacts including teratogenicity, weakened immunity, and impairment of renal and brain function.[7–10]. Studies linking the incidence of adverse pregnancy outcomes associated with ecological exposure of WEEE are increasing.[11]

Improper disposal of e-waste releases toxic substances that contaminate environment. Recent literature implicates e-waste in contributing to soil degradation, air pollution, water pollution and global warming. Heavy metals present in e-waste can leach into the soil, percolate into groundwater, and disperse through air as particulate matter. These contaminants do not remain confined to ecological compartments; instead, they move through food chains and water systems, bioaccumulating in plants, animals, and ultimately humans.

Concurrently, e-waste represents a paradoxical resource reservoir within urban settings. Often termed “urban mining,” the recovery of precious and rare earth metals from discarded electronics offers an opportunity to reduce dependence on virgin mining, conserve natural resources, and mitigate environmental harm.[13] However, when such recovery is inefficient or informal, not only are valuable materials lost, but hazardous extraction practices may further intensify environmental contamination and human exposure

While the Government of India notified the E-waste (Management) Rules, 2022, amending the 2018 rules, the impact of such policy initiatives depends largely on the knowledge, attitudes, and practices (KAP) of individuals within the community.[14] Therefore, the present study was conducted to assess the knowledge, attitudes, and practices related to e-waste management among residents of an urban slum in Gokalpuri.

Materials and Methods

Study Setting

A community-based cross-sectional study was conducted in the field practice area of the Urban Health Center (UHC), Department of Community Medicine, Maulana Azad Medical College, Delhi, India, located at Ganga Vihar in the northeast district of Delhi. The study site was chosen as, besides being the field practice area of the medical college, it is also an updated demographic, developmental, and environmental surveillance site.[15] The total study area consisted of Gangavihar, Gokalpuri, and Gokalpuri village, consisting of 9597 households with a total population of 54,614 people.

Study Population

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Participants were eligible for inclusion if they were aged 18 years or older, resided in Gokalpuri for at least 6 months at the time of study and expressed willingness to participate. Individuals unable to comprehend or respond to the interview questions because of severe cognitive impairment, speech/hearing disability, or terminal illness were excluded from the study. The study was conducted for a period of 2 months starting from February 2026 to March 2026. Assuming a prevalence of adequate disposal practices of 47.5% from Bandyopadhyay A et al., with 95% confidence (Z=1.96) and 5% absolute precision (d=0.05), the calculated sample size ($n = Z^2pq/d^2$) is 382.8, which after adding 10% for non-response is rounded to 425 participants.

A stratified random sampling method was used. A line-listing of households was obtained from the Accredited Social Health Activist (ASHA) and Auxiliary Nurse Midwife (ANM) records. First random selection of wards was done. Later, the ransom selection of participants was done. Only one member from each household was chosen, usually the head of the household. If they were unavailable or unwilling to participate, any other willing member was selected.

Any household found locked even after three visits was replaced by the immediately next household in the sequence.

Data Collection

The data collection was carried out through face-to-face interviews conducted by the investigators at participants' homes. Prior to the interviews, researchers introduced themselves, explained the study's objectives and procedures in simple and understandable language, and obtained written informed consent. For participants who were illiterate, the consent form was read aloud in the presence of a witness, and verbal consent was obtained and documented with a fingerprint in place of a signature.

Study Tools:

Due to the lack of a validated questionnaire for Indian settings, a self-designed, semi-structured tool was developed based on an extensive literature review and expert consensus. The study instrument comprised a structured questionnaire with sections on socio-demographic characteristics and knowledge, attitude, and practices (KAP) related to e-waste management. Socio-demographic variables included age, gender, religion, marital status, education, occupation, type of family, nature of residence, and socioeconomic status[17], along with details on the presence and number of discarded, replaced, or non-functional electronic items in the household. Additional information was collected on the frequency and speed of replacement of electronic devices, reasons for replacement (such as malfunction, technological obsolescence, or consumer preference), and sources of information regarding e-waste and its management.

Knowledge was assessed using 14 dichotomous items (yes/no), covering multiple domains including awareness of the concept of e-waste, identification of electronic waste sources, recognition of official symbols, and understanding of its health and environmental impacts. The items also explored awareness of hazardous components such as heavy metals, risks associated with unsafe disposal practices, and knowledge of appropriate disposal pathways including recycling and segregation. In addition, the tool assessed awareness of systemic and policy-level aspects such as informal e-waste handling, availability of authorized collection or recycling centres, and regulatory frameworks including Extended Producer Responsibility (EPR).

Attitude towards e-waste management was assessed using 12 items measured on a combination of Likert and binary scales, capturing perceptions of responsibility, risk, and willingness to engage in appropriate management practices. The items explored beliefs regarding segregation of e-waste, appropriateness of storage, and perceived responsibility across stakeholders including government, manufacturers, retailers, scrap dealers, and individuals. They also assessed willingness to participate in e-waste management initiatives, recycling programs, and community-based awareness activities.

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Practices were assessed using 4 dichotomous items evaluating actual behaviors related to e-waste disposal, segregation, use of protective measures, and adoption of appropriate recycling methods.

The questionnaire was prestested in RHTC Barwala, Rural Health Training Centre, Barwala, in 10 % participants before field deployment.

Ethics Approval

Institutional Ethics Committee permission was obtained before the start of the study (Institute name/IEC/2021/388 dated February 06, 2026). Our study was conducted according to the Declaration of Helsinki. Written informed consent was obtained from all participants prior to data collection. Participation was voluntary, and respondents were informed of their right to withdraw at any time without consequences. Confidentiality and privacy were strictly maintained; no personal identifiers were collected, and data were anonymized and stored securely with access restricted to the research team. Participants with unmet needs were referred to UHTC Gokalpuri for further management.

Data Management and Statistical Analysis

Data were entered into KoboCollect (KoBoToolbox, Harvard Humanitarian Initiative, USA). and analysed using STATA version 19 (StataCorp LLC, College Station, TX, USA). All 425 data collected were included in the analysis. Normality of continuous variables was assessed using graphical methods (histograms and Q–Q plots) and statistical tests like Shapiro-Wilk test.

The percentage of correct responses was calculated by dividing the total number of correct answers by the total number of questions and multiplying the result by 100 for each domain (knowledge, attitude, and practice). A cut-off at the 50th percentile was used to categorize participants, with scores above the cut-off considered adequate and those below considered inadequate. Descriptive statistics, including frequencies, percentages, means and standard deviations were used as appropriate.

Bivariate associations were initially explored using univariate linear regression analysis. Variables with $p < 0.20$ in univariate analysis and those considered epidemiologically relevant were included in multivariable linear regression models to identify independent predictors of the outcome variables. Multicollinearity was assessed using variance inflation factor (VIF). Model fit was evaluated using F-test, R^2 and adjusted R^2.

Correlation between key variables was assessed using Spearman's rank correlation coefficient.

Mediation analysis was conducted to examine the potential mediating effect of selected variables in the relationship between independent and dependent variables, estimating direct, indirect, and total effects.

All statistical tests were two-tailed, and a p value <0.05 was considered statistically significant.

Results

Table 1 represents the socio-demographic status of the respondents. A total of 425 participants were included in the analysis. The mean age was 42.07 years (SD = 13.30; range 18–75). The majority of the participants were females (62.59%), married (78.35%), and belonged to Hindu religion (96.00%). Graduates constituted the largest group (27.06%), and over half of respondents were homemakers (52.24%). Most participants resided in nuclear family (61.88%), owned a house (87.53%), and belonged to upper middle socioeconomic status under BG Prasad socioeconomic status (64.71%).

Table 1. Sociodemographic status of residents (N=425).

Characteristics	n (%)
Age (in completed years)	
18-29	88 (20.71)
30-39	106 (24.94)

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40-49	96 (22.59)
50-59	79 (18.59)
60-69	48 (11.29)
70 and above	8 (1.88)
Gender	
Female	266 (62.59)
Male	157 (36.94)
Other	2 (0.47)
Religion	
Hindu	408 (96.00)
Muslim	11 (2.59)
Others	6 (1.41)
Marital Status	
Single	72 (16.94)
Married	333 (78.35)
Divorced/Separated/Widowed	20 (4.71)
Education Level	
Illiterate	51 (12.00)
Primary School	63 (14.82)
Middle School	54 (12.71)
High School	53 (12.47)
Higher Secondary School	76 (17.88)
Graduate	115 (27.06)
Professional/Postgraduate	13 (3.06)
Occupation	
Unemployed	47 (11.06)
Homemaker	222 (52.24)
Self-employed	17 (4.00)
Government Job	9 (2.12)
Private Job	97 (22.82)
Student	33 (7.76)
Type of Family	
Nuclear	263 (61.88)
Three Generation	124 (29.18)
Joint	38 (8.94)
Nature of Residence	
Own House	372 (87.53)
Rented House	53 (12.47)
Socioeconomic Status	
Upper Class	66 (15.53)
Upper Middle Class	275 (64.71)
Middle Class	79 (18.59)
Lower Middle Class	3 (0.71)
Lower Class	2 (0.47)

N=425.

Table 2 presents the distribution of household digital access, mobile usage patterns, and information sources regarding e-waste among study participants. The majority of households possessed a moderate to high number of electronic gadgets, with nearly half (47.06%) reporting 7–9 devices, while 36.24% had 4–6 devices. Only a small proportion (3.29%) had three or fewer gadgets. A large majority of households (94.12%) reported no unused or non-working electronics at home.

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Most households (86.35%) had not replaced any electronic devices in the past year, while only 10.12% replaced one device.

Table 2. Distribution of Household Digital Access, Mobile Usage Patterns, and Information Sources among Study Participants (N = 425).

Characteristics	n (%)
Variable	**n (%)**
Number of gadgets in household	
1–3	14 (3.29)
4–6	154 (36.24)
7–9	200 (47.06)
≥10	57 (13.41)
Unused electronics at home	
No	400 (94.12)
Yes	25 (5.88)
Devices replaced last year	
0	367 (86.35)
1	43 (10.12)
≥2	15 (3.53)
Number of mobile phones	
0–1	16 (3.76)
2–3	209 (49.18)
4–5	170 (40.00)
≥6	30 (7.06)
Mobile phone replacement interval (months)	
≤24	69 (16.24)
25–48	154 (36.24)
49–72	177 (41.65)
>72	25 (5.88)
Reasons for replacement of last mobile*	
Device old	184 (43.29)
Battery issues	116 (27.29)
Repair not possible	80 (18.82)
Other reasons	74 (17.41)
New features	50 (11.76)
Got stolen	30 (7.06)
Sources of information of e-waste*	
No information	356 (83.76)
Internet/social media	42 (9.88)
School/colleges	32 (7.53)
Friends/relatives	13 (3.06)
User manuals	13 (3.06)
Mass media	11 (2.59)
Government campaigns	6 (1.41)
Newspaper	4 (0.94)
TV	3 (0.71)
Radio	2 (0.47)

N=425. *Multiple options correct.

The mean number of mobile phones per household was 3.41 ± 1.42. Most households had multiple devices, with 49.18% reporting 2–3 phones. Most participants replaced their mobile phones

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after 2–6 years, with 41.65% reporting replacement after 49–72 months and 36.24% after 25–48 months, while only 5.88% reported replacing their phones after more than 72 months. Among reasons for mobile replacement, the most common reason was the device becoming old (43.29%), followed by battery issues (27.29%) and repair not being possible (18.82%). Replacement due to new features (11.76%) or theft (7.06%) was less common.

Awareness regarding electronics-related information sources was notably low. A substantial proportion of participants (83.76%) reported no access to any information source. Among those with exposure, internet and social media were the most common sources (9.88%), followed by schools/colleges (7.53%). Traditional media such as television, radio, and newspapers contributed minimally.

Knowledge

Overall, 20.24% of participants demonstrated good knowledge. The mean knowledge score was 35.49 ± 17.40 (range: 12.5–100). The highest awareness was observed for unsafe disposal practices, with 100% of participants aware that e-waste should not be dumped in a landfill. In contrast, only 2.35% of participants aware of Extended Producer Responsibility (EPR) and authorized e-waste collection centres. **Figure 1 shows the distribution of knowledge levels by gender.**

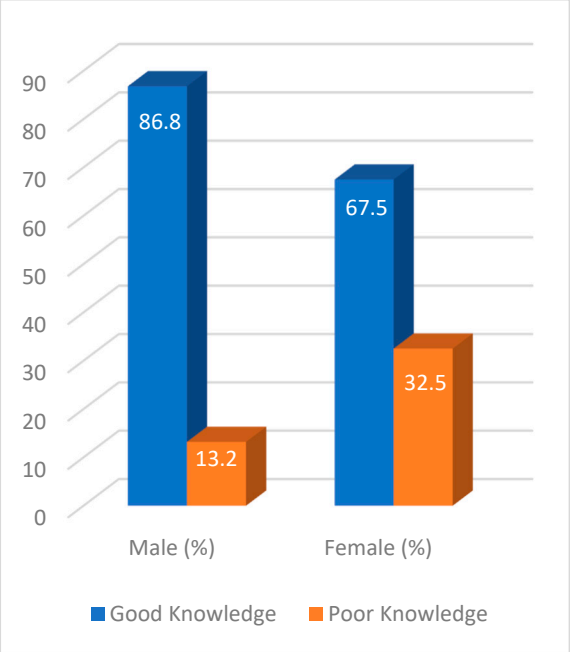

Figure 1. Distribution of Knowledge Levels by Gender.

On multivariable analysis, participants with higher education had higher knowledge scores compared to illiterate individuals (β = 1.40, p = 0.002), and those employed had higher scores compared to those not working (β = 1.39, p = 0.001), with students showing a borderline increase. Households with more than six electronic devices also had higher knowledge scores compared to those with fewer devices (β = 0.51, p = 0.038). In contrast, participants from the middle socioeconomic group had lower knowledge scores compared to the upper class (β = -1.05, p = 0.002), and those aged 40–59 years had lower scores compared to younger individuals (β = -0.67, p = 0.026). **(Supplementary File S1)**

Attitude

Overall, 43.29% of participants demonstrated a positive attitude, while 56.71% had an insufficient attitude. The mean attitude score was 49.47 ± 9.47 (range: 19.05–85.71). A large majority

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(99.06%) of participants felt that e-waste should not be stored at home, whereas only 8% expressed willingness to dispose of their e-waste through authorized collection centres. **Figure 2 shows the distribution of attitude levels by gender.**

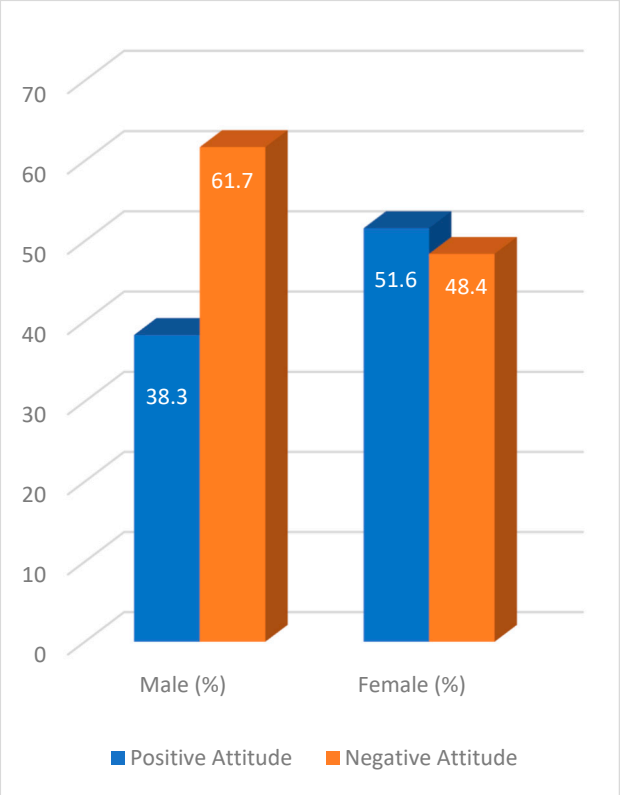

Figure 2. Distribution of Attitude Levels by Gender.

On multivariable analysis, participants with higher education as compared to illiterate individuals (β = 1.24, p = 0.001) while those belonging to the middle socioeconomic group had lower scores compared to the upper class (β = -0.58, 95% CI: -1.10 to -0.05; p = 0.031). **(Supplementary File S2)**

Practice

Overall, only 11.29% of participants demonstrated good practices, while a vast majority (88.71%) had poor practices. The mean practice score was 16.88 ± 17.31 (range: 0–100). **Figure 3 shows the distribution of practice levels by gender.**

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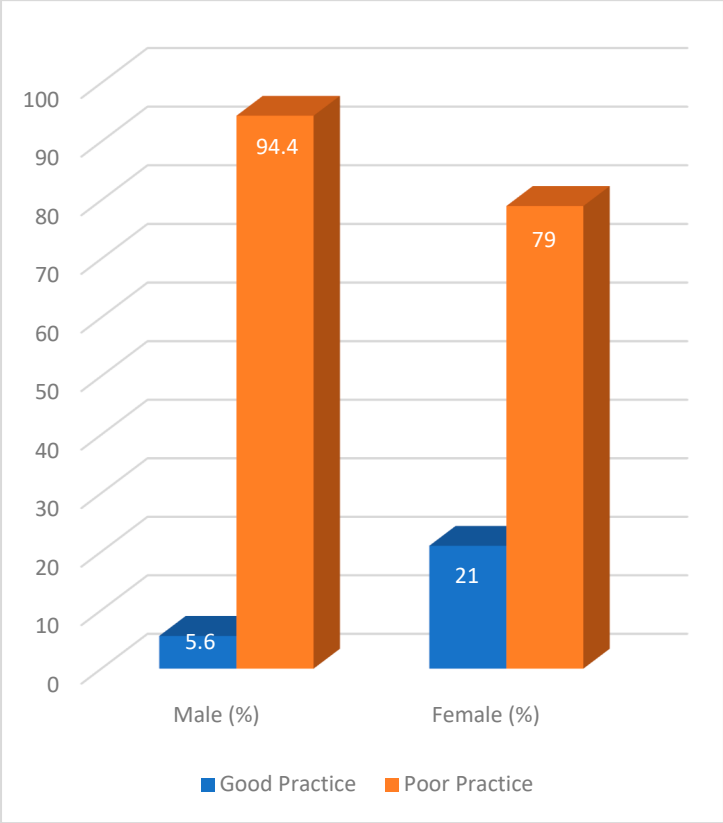

Figure 3. Distribution of Practice Levels by Gender.

At the item level, the highest reported practice was appropriate disposal of e-waste (0.47 ± 0.50), followed by segregation of e-waste from household waste (0.18 ± 0.39). In contrast, extremely low practices were observed for handing over e-waste to authorized collection or recycling facilities (0.01 ± 0.12) and the use of personal protective measures while handling e-waste (0.01 ± 0.08).

A hierarchical linear regression analysis was conducted to assess factors associated with practice scores.

In Model 1, which included only sociodemographic variables, participants aged ≥60 years had significantly lower practice scores compared to younger individuals (β = -0.43, p = 0.001), and those belonging to the middle socioeconomic group had lower scores compared to the upper class (β = -0.24, p = 0.007), while higher education was associated with increased practice scores (β = 0.31, p = 0.013).

In Model 2, after inclusion of knowledge score, knowledge was strongly associated with higher practice scores (β = 0.48, p < 0.001). The effect of higher education was attenuated and became borderline significant, while age ≥60 years and middle socioeconomic status remained significantly associated.

In Model 3, after further inclusion of attitude score, attitude was not significantly associated with practice (β = 0.09, p = 0.149). Knowledge remained a significant predictor, while age ≥60 years and middle socioeconomic status continued to show significant negative associations. (**Table 3)**

Table 3. Determinants of Practice Related to E-waste.

Variable	Model 1: Sociodemographic β (95% CI)	p-value	Model 2: + Knowledge β (95% CI)	p-value	Model 3: + Attitude β (95% CI)	p-value
Age ≥60	-0.43 (-0.68, -0.18)	0.001**	-0.38 (-0.62, -0.14)	0.002**	-0.38 (-0.62, -0.14)	0.002**

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Middle SES	-0.24 (-0.42, -0.07)	0.007**	-0.21 (-0.38, -0.04)	0.018*	-0.20 (-0.37, -0.03)	0.018*
Graduate and above	0.31 (0.06, 0.56)	0.013*	0.24 (-0.00, 0.48)	0.050	0.22 (-0.02, 0.46)	0.076
Adequate Knowledge	—	—	0.48 (0.32, 0.65)	<0.001***	0.45 (0.28, 0.63)	<0.001***
Positive Attitude	—	—	—	—	0.09 (-0.03, 0.22)	0.149

N=425. Model 1: R^2 = 0.265; adjusted R^2 = 0.234. Model 2: R^2 = 0.319; adjusted R^2 = 0.289. Model 3 :R^2 = 0.322; adjusted R^2 = 0.290 *** p<0.001, ** p<0.01, * p<0.05.

Spearman Correlation

Spearman's rank correlation analysis demonstrated a statistically significant positive correlation between knowledge and attitude scores (ϱ = 0.5179, $p < 0.001$). A moderate positive correlation was also observed between knowledge and practice scores (ϱ = 0.3839, $p < 0.001$). Additionally, attitude showed a significant positive correlation with practice (ϱ = 0.3260, $p < 0.001$).

Mediation Analysis

Structural equation modeling demonstrated that knowledge had a strong positive effect on attitude ($\beta = 0.40$, $p < 0.001$). Both knowledge ($\beta = 0.09$, $p < 0.001$) and attitude ($\beta = 0.05$, $p = 0.003$) were significantly associated with practice. The indirect effect of knowledge on practice through attitude was small but significant ($\beta = 0.02$, $p = 0.004$), indicating partial mediation. Model fit indices suggested an excellent fit (CFI = 1.00, TLI = 1.00, RMSEA = 0.00, SRMR = 0.00). (**Figure 4**)

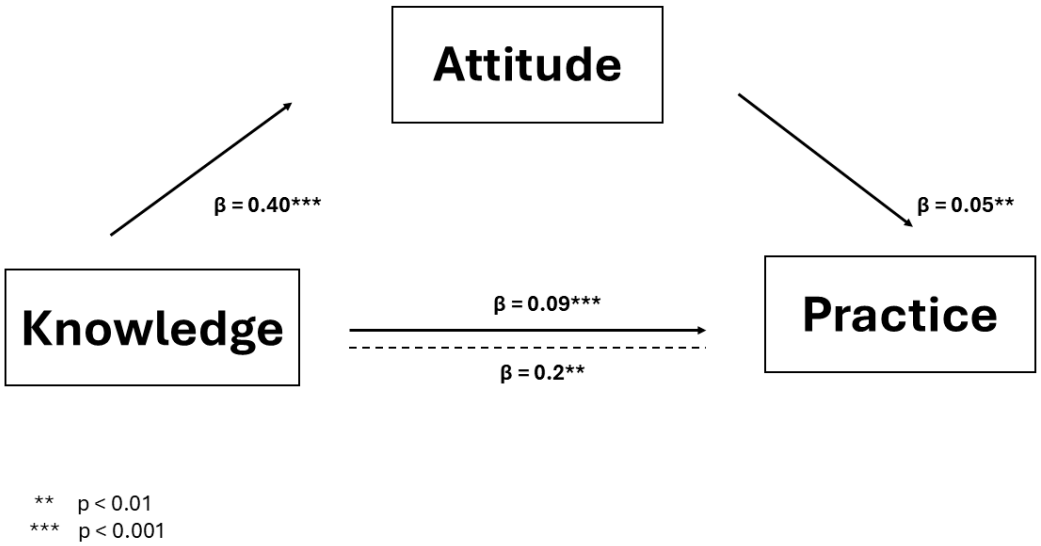

Figure 4. Structural Equating Modelling showing relationship between Knowledge, Attitude and Practices.

Barriers and Facilitators to Safe E-Waste Management

Multiple barriers to appropriate e-waste disposal were identified. The most frequently reported barrier was lack of awareness (79.76%). Nearly one-third of participants (29.88%) indicated the absence of nearby collection facilities as a constraint. Preference for scrap dealers was reported by 16.47%, reflecting reliance on informal disposal channels. Other barriers were less commonly cited,

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including lack of time (5.88%), absence of financial incentives (4.94%), and perceived inconvenience of the disposal process (4.00%).

Several facilitating factors were also identified. Awareness campaigns were the most widely endorsed strategy (76.94%), followed by door-to-door pickup services (39.29%) and the availability of convenient collection sites (20.94%). Financial incentives were supported by 9.65% of respondents, whereas legal enforcement through fines was endorsed by only 1.18%. The pattern of responses indicates stronger support for educational and service-based interventions compared to punitive regulatory approaches.

practices.

Discussion

The present study revealed substantial gaps across all domains of e-waste-related knowledge, attitude, and practices (KAP) among residents of an urban slum. While only 20.24% of participants demonstrated adequate knowledge, 43.29% exhibited a positive attitude, and merely 11.29% reported good practices, indicating a pronounced disconnect between awareness and actual behaviour. Similar patterns have been reported in low- and middle-income countries, where inadequate practices persist despite moderate awareness levels.[16,20,21]

The level of knowledge about e-waste among the community remained low. Our results are comparable to a study done by Neem RA et al. in Bangladesh, where all participants produced e-waste, but only 26.5% had proper knowledge about its disposal.[20] A study by Kariwala et al. in Lucknow city, India, found that only 37% of residents were aware of the health impacts of e-waste.[21] In contrast, Bandyopadhyay et al. reported that 93.4% of participants were aware of the harmful impacts of e-waste. The lower awareness observed in the present study could be due to differences in socio-demographic characteristics, literacy levels, and access to information among the study population.

However, even within the knowledge domain, levels of awareness varied substantially. While general awareness of e-waste, unsafe disposal practices, and their adverse health effects was relatively better, knowledge regarding policy-related aspects remained limited. In particular, awareness of authorized e-waste collection centres and Extended Producer Responsibility (EPR) was notably low. This is similar to studies by Singh M et al., where less than one-third of participants were aware of specific government legislation.[19]

Education emerged as consistent determinants across knowledge, attitude, and practice domains. Participants with higher educational attainment demonstrated significantly better knowledge, underscoring the critical role of education in shaping environmental awareness, risk perception, and informed decision-making regarding e-waste management.

Further, as shown by regression analysis, knowledge emerged as the strongest predictor of practice. The inclusion of knowledge significantly improved the explanatory power of the model, whereas attitude demonstrated only a borderline association. This suggests that knowledge may have a more direct influence on behaviour, while attitude alone is insufficient to drive practice in the absence of enabling conditions

The correlation and mediation analyses provided additional support for this pathway. Knowledge showed a moderate positive correlation with both attitude and practice, while attitude was also positively associated with practice. Mediation analysis demonstrated that knowledge had both direct and indirect effects on practice through attitude, indicating partial mediation. This aligns with established behavioural models of environmental action.

The most critical finding of the study was the extremely low level of practice. Despite some awareness and moderately positive attitudes, actual engagement in safe e-waste disposal remained minimal. This reflects a clear knowledge–practice gap, where individuals are aware of risks but are unable to translate that awareness into action. Structural and contextual barriers identified in the study, particularly lack of awareness (79.76%) and absence of nearby collection facilities (29.88%),

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appear to play a key role in this disconnect. In this light, these barriers need to be given due consideration while designing interventions to improve e-waste management practices

Importantly, structural and contextual factors appear to play a crucial role in limiting the translation of awareness into safe e-waste disposal practices. In the Indian context, e-waste management is largely dominated by the informal sector, where unsafe recycling practices are widespread, driven by economic incentives and the lack of accessible formal alternatives.[5] These challenges are further compounded by limited access to authorized collection systems, inadequate infrastructure for safe transportation, collection, and segregation, and weak enforcement of existing regulations.[23,24] Together, these systemic constraints likely underpin the observed gap between knowledge and behaviour in the present study.

Addressing these issues requires sustained political commitment, strengthened regulatory frameworks, and effective public–private partnerships, with active integration of both formal and informal sectors into a safer and more regulated system.[16,23] The government must prioritize the development of efficient and accessible mechanisms for e-waste collection, transportation, and segregation, alongside improved enforcement of existing policies.[23,24] At the same time, reducing e-waste generation at the source remains essential. Promoting practices such as repairing, upgrading, and upcycling electronic devices can help limit waste, while manufacturers should adopt environmentally sustainable policies and innovative technologies aimed at enhancing product durability and extending device lifespan.

In the present study, a substantial proportion of participants expressed willingness to attend community-based workshops on e-waste, highlighting a key opportunity for targeted interventions. This is particularly important given that a large proportion of participants reported not receiving any prior information on e-waste, underscoring the need for structured, community-oriented awareness programs. Despite the existence of e-waste management legislation in India since 2011, there remains a lack of comprehensive, nationwide educational initiatives. Limited dissemination of information through trusted sources such as government agencies and mass media further contributes to poor awareness of safe disposal practices. The absence of consistent and credible information channels may widen the gap between knowledge and actual practices.

It is important to recognize that individuals remain central to the e-waste management system. Without active public participation in segregating and channeling e-waste through authorized pathways, such waste often becomes mixed with general refuse, making safe recovery and recycling difficult. Bridging this gap will require coordinated efforts involving the government, private sector, and healthcare system to promote safe handling and disposal practices.

The present study provides useful insights into an emerging environmental and public health concern in India. However, its findings should be interpreted in light of certain limitations, including its relatively small sample size, focus on an urban population, and cross-sectional design. Despite these limitations, the study contributes to a relatively underexplored area and underscores the need for larger and more comprehensive investigations.

Conclusions

The present study found that the levels of knowledge, attitude, and practices related to e-waste management remained low among residents of an urban slum in Delhi. The most important finding was the presence of a marked knowledge–practice gap, with knowledge emerging as the strongest predictor of practice. Educational interventions therefore need to be strengthened through targeted, context-specific and culturally- appropriate campaigns that enhance awareness about e-waste, safe disposal practices and policy guidelines. This must be complemented with structural improvements in e-waste disposal practices including improved recycling infrastructure, efficient collection and disposal systems, and integration of the informal sector into formal e-waste management.

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