



ORIGINAL RESEARCH PAPER

Community Medicine

STUDY TO ASSESS THE AWARENESS ABOUT E-WASTE AND ITS MANAGEMENT AMONG COLLEGE STUDENTS IN INDIA

KEY WORDS: students; awareness; e-waste

Dr Pranjal P Bobade*

Designation is "Preventive and Social Medicine Specialist in AMC India"
*Corresponding Author

Dr (Air Cmde) Kevin Fernandez

VSM is Prof & HOD, Dept of Community Medicine AIMST University, Malaysia

Dr Ritesh Kundap

is a Preventive and Social Medicine Specialist

ABSTRACT

India has emerged as fifth largest electronic waste producer in the world. Computer devices account for nearly 70% of e-waste, with the contribution of telecom sector being 12%, medical equipment being 8%, and electric equipments being 7% of the annual e-waste production. The Government, public sector companies, and private sector companies generate nearly 75% of electronic waste; with the contribution of individual household being only 16%. The problem of E-waste in near future will be gigantic and will adversely affect the environment. This will have serious effects not only on the human beings but also on each and every other living organisms on earth. The study was aimed to find out the awareness about the e-waste and its management amongst the young population of digital India.

INTRODUCTION:

Man has conquered each and every field that he is aware of. Advances in the field of science and technology brought about industrial revolution in the 18th Century which marked a new era in human civilization. In the 20th Century, the information and communication revolution has brought enormous changes in our lives, our economies, industries and institutions. The creation of innovative and new technologies and the globalization of the economy have made a whole range of products available and affordable to the people changing their lifestyles significantly. These spectacular developments in modern times are undoubtedly important, at the same time, these have led to manifold problems including the problem of massive amount of hazardous waste and other wastes generated from electric products. These hazardous and other wastes pose a great threat to the human health and environment. It constitutes a serious challenge to the modern societies of today's era.

According to the Basel Convention, wastes are substances or objects, which are disposed of or are intended to be disposed of, or are required to be disposed of by the provisions of national laws.¹ Like hazardous waste, the problem of Electronic Waste (E-waste) has become an immediate and long term concern as its unregulated accumulation and recycling can lead to major environmental problems endangering human health.

The countries of the European Union and other developed countries to an extent have addressed the issue of E-waste by taking policy initiatives and by adopting scientific methods of recycling and disposal of such waste. The European Union defines this new waste stream as 'Waste Electrical and Electronic Equipment' (WEEE). As per its directive, the main features of the WEEE include definition of 'EEE', its classification into 10 categories and its extent as per voltage rating of 1000 volts for alternating current and 1500 volts for direct current.²

E-waste generation in India

In 2006, the International Association of Electronics Recyclers (IAER) projected that 3 billion electronic and electrical appliances would become WEEE or e-waste by 2010.

That would tantamount to an average e-waste generation rate of 400 million units a year till 2010.

Globally, about 20-50 MT (million tons) of e-wastes are disposed off each year, which accounts for 5% of all municipal solid waste.³

According to the Comptroller and Auditor- General's (CAG)

report, over 7.2 MT of industrial hazardous waste, 4 lakh tons of electronic waste, 1.5 MT of plastic waste, 1.7 MT of medical waste, 48 MT of municipal waste are generated in the country annually.

Central Pollution Control Board (CPCB) estimated India's e-waste at 1.47 lakh tons or 0.573 MT per day.⁴

A report of the United Nations predicted that by 2020, e-waste from old computers would jump by 400 per cent on 2007 levels in China and by 500 per cent in India. Additionally, e-waste from discarded mobile phones would be about seven times higher than 2007 levels and, in India, 18 times higher by 2020.⁵

India, in the last couple of decades, has also been vastly influenced by the culture of consumerism. The application of electronics related technology has been very wide spread in all sectors. Particularly the students of today's era belonging to any branch are so much used to the various electronic equipment particularly mobile phones, laptops, personal computers, tablets etc.

Added to the burden of the management of hazardous municipal waste, the management of huge and growing quantities of electronic waste is emerging as one of the most important environmental problems of developing countries, especially India. The problems associated with electronic waste are now being recognized. E-waste is highly complex to handle due to its composition.

E-waste typically contains complex combinations of materials and components down to microscopic levels. The wastes are broken down in not just for recycling but for the recoverable materials such as plastic, iron, aluminum, copper and gold. However, since e-waste also contains significant concentration of substances that are hazardous to human health and the environment, even a small amount of e-waste entering the residual waste will introduce relatively high amount of heavy metals and halogenated substances. Such harmful substances leach into the surrounding soil, water and air during waste treatment or when they are dumped in landfills or left to lie around near it. Sooner or later they would adversely affect human health and ecology.

Aims:

1. To assess the awareness about E-waste and its management amongst the young college students who uses the electronic gadgets daily & more frequently.
2. Give suitable recommendations based on the study findings.

Settings and Design: Community based cross-sectional study

Methods and Material:

A community based Cross-sectional study was undertaken in the field practice area of a medical college in Pune. The field practice area has various colleges of professional courses like Engineering, Management, Commerce, Science, Pharmacy etc. The sampling frame was formed by the students of these various courses. The sample size was difficult to calculate as there is dearth of literature available on this subject with professional students as the study subjects. So for feasibility purpose we resorted to convenient sampling method with a predefined quota of 200 study subjects. The inclusion criteria for the study was 18 years and above and studying in any of the colleges in the field practice area. The basis of selection of study subjects in this study was the fact that the students going to colleges form the population group who is fond of electronic gadgets usage and have tendency to purchase newer versions more frequently. This could be the result of likings for newer versions of gadgets, more updated and faster software, more space for storage of information, peer pressure etc. besides this few of the professional courses also demand uses of Laptops, PC, and Internet. So this population group is more in need of E-gadgets for academic purpose also. The college students were approached in their campus and study purpose was explained to them in detail and an appeal was made them to participate in the study. After the discussion, written informed consent was taken from the study subjects and they were interviewed face to face with the study proforma. The study tool had 2 parts –

- Part 1 contains Sociodemographic Information of Study Subjects
- Part 2 had Questions about the awareness of E-waste and its management.

Total 200 students belonging to Engineering, Management, Commerce, Science, Pharmacy etc. were interviewed. Students who haven't given the informed consent were excluded from the study. The operational definitions that included in the present study are –

- 1) Electronic equipment – Any equipment using electric current for its functioning.
- 2) Electronic waste – Waste Electrical and Electronic Equipment including all components, subassemblies and their fractions.
- 3) Awareness about E-waste – In this study, the study subjects were considered aware about E-waste if they answered the question 'what is E-waste.'
- 4) Awareness about Health risk associated with E-waste – In this study, the study subjects were considered aware about the health risk associated with E-waste if they told any 2 health risks associated with E-waste.
- 5) Awareness about the Environment risk associated with E-waste – In this study, the study subjects were considered aware about the environment risk associated with E-waste if they told any 2 environment risks associated with E-waste.
- 6) Awareness about the E-waste management – In this study, the study subjects were considered aware about the E-waste management if they know that the consumer have to ensure that e-waste is deposited with the dealers or authorized collection center for the management of E-waste.
- 7) Awareness about Recycling of E-waste – In this study, the study subjects were considered aware about the recycling of E-waste, if they know that the 'E-waste can be recycled' and 'any 2 methods of recycling of the E-waste.'

The study was completed in 6 months which was from Jan to June 2016. Data entry was done in excel sheet simultaneously as data collection was going on.

Statistical analysis used:

Statistical analysis was done using EPI-INFO 7. Descriptive

statistics was used. Percentages were calculated and chi-square was used to test the association. P-value of < 0.05 was considered as significant.

Results:

• **Gender wise distribution of study population**

Table number 1 shows the gender wise distribution of the study population. In the present study, 130 (65%) were males and 70 (35%) were females. The male to female ratio was 1.85:1.

• **Stream wise distribution of study population**

In the present study as shown in table number 1, 110 (55%) students belonged to Engineering branch, 22 (11%) belonged to MBA, 21 (10.5%) each to Pharmacy and B.Com, 15 (7.5%) belonged to Hotel management while 11 (5.5%) belonged to B.Sc. broadly this distribution can be categorized to Engineering students which comprises of 55% of the study population and Non engineering students (MBA, Pharmacy, B.Com., Hotel Management and B.Sc.) which comprises of 45%.

• **Usage of Personal electronic gadgets among study subjects**

The table no. 1 shows that in the present study the usage of personal electronic gadgets were also estimated. In the study we have specifically assessed the personal gadgets like Mobiles, Laptops, I-pod, Tablet, Personal Computers etc. used by the students. We have excluded the routine electronic gadgets like iron, music systems, trimmers, hair dryer etc. This has been specifically done because the students have tendency to change and upgrade their personal gadgets like mobiles, laptops etc. more frequently as compared to the routine electronic gadgets. In this study the study subjects were categorized into – those who were using less than 3 electronic gadgets and those who were using more than 3 electronic gadgets. The study subjects who were using less than 3 personal electronic gadgets were 70 (35%) and 130 (65%) were using more than 3 electronic gadgets.

Table 1. Baseline data of the study population (n=200)

Variable	Frequency (percentage)
1. Gender	
Male	130 (65%)
Female	70 (35%)
2. Stream of the study subjects	
Engineering	110 (55%)
MBA	22 (11%)
Pharmacy	21 (10.5%)
B.Com	21 (10.5%)
Hotel Management	15 (5.5%)
B.Sc.	11 (5.5%)
3. Personal gadgets used per study subjects	
Less than 3	70 (35%)
More than 3	130 (65%)

• **Awareness about E-waste in the study population**

When assessed the awareness about E-waste amongst the study population, it was found that amongst 200 study subjects, 152 (76%) were aware about 'what is E-waste'.

As seen in table no. 2, amongst this 152 study subjects, 101 (66%) were males and 51 (34%) were females. This association of Gender and awareness about E-waste was not found to be statistically significant. (Chi-square value = 0.348; P value = 0.555) Amongst this 152 study subjects who were aware about E-waste, 89 (59%) were students belonging to Engineering stream and 63 (41%) were students belonging to faculty other than engineering streams. The association of streams to which students belong and awareness about E-waste is not found to be statistically significant. (Chi-square value = 2.659; P value = 0.103).

• Awareness about Health risk associated with E-waste

In the present study, we also assessed the awareness about health risk associated with E-waste amongst the study population.

As seen in table no. 2, it was found that, amongst 152 study subjects who were aware about E-waste, only 51 (34%) study subjects were aware about the health risk associated with E-waste. Of this 51 study subjects, 30 (59%) were males and 21 (41%) were females. The association of Gender and awareness about Health risk associated with E-waste was not found to be statistically significant. (Chi-square value = 1.519; P value = 0.218)

Of the 51 study subjects who were aware about the health risk associated with E-waste, 36 (71%) were Engineering streams and 15 (29%) were of Non-engineering streams. The association of Stream of the student and awareness about E-waste was found to be statistically significant. (Chi square value = 3.865; P value = 0.049).

• Awareness about the Environment risk associated with E-waste

It was found in the present study that amongst 152 study subjects who were aware about E-waste, 101 (66%) study subjects were aware about the environment risk associated with E-waste.

Of this 101 study subjects, 76 (75%) were males and 25 (25%) were females. The association of Gender and awareness about the environmental risk associated with E-waste was found to be statistically significant. (Chi-square value = 3.588; P value = 0.058). Of the 101 study subjects who were aware about environment risk associated with E-waste, 69 (68%) were students belonging to Engineering streams and 32 (32%) were students belonging to Non-Engineering streams. The association of stream of the student and awareness about the environment risk associated with E-waste was found to be statistically significant. (Chi-square value = 10.657; P value = 0.001) as shown in table no. 2.

• Awareness about the E-waste management

In the present study it was found that out of the 152 study subjects who were aware about the E-waste, only 79 (52%) subjects were aware about the management of E-waste.

Of this 79 subjects, 46 (58%) were males and 33 (42%) were females. The association of gender and awareness about E-waste was found to be statistically significant. (Chi-square value = 4.247; P value = 0.039)

Of the 79 subjects, 53 (67%) were students belonging to engineering stream while 26 (33%) were students belonging to non-engineering streams. The association of stream of the students and the awareness about E-waste management was found to be statistically significant. (Chi-square value = 4.233; P value = 0.04), as shown in table no. 2

• Awareness about Recycling of E-waste

As shown in table no. 2, in the present study it was found that out of the 152 study subjects who were aware about the E-waste, 135 (89%) subjects were aware about the recycling of E-waste.

Of this 135 subjects, 90 (67%) were males and 45 (37%) were females. The association of gender and awareness about the recycling of E-waste was not found to be statistically significant. (Chi-square value = 0.012; P value = 0.911)

Of this 135 subjects, 83 (61%) were Engineering students and 52 (39%) students were belonging to non-engineering streams. The association of stream of the students and awareness about recycling of E-waste was not found to be statistically significant. (Chi-square value = 3.256; P value = 0.071)

Table 2. Association table

Gender	Awareness about E-waste		Chi-square value	P value	Interpretation
	Present	Absent			
Male	101	29	0.348	0.555	Not significant

Female	51	19			
Stream of the student	Awareness about E-waste				
	Present	Absent			
Engineering	89	21	2.659	0.103	Not significant
Non-engineering	63	27			
Gender	Awareness about health risk associated with E-waste				
	Present	Absent	1.519	0.218	Not significant
Male	30	71			
Female	21	30			
Stream of the student	Awareness about health risk associated with E-waste				
	Present	Absent			
Engineering	36	53			
Non-engineering	15	48	3.865	0.049	Significant
Gender	Awareness about the Environment risk associated with E-waste				
	Present	Absent			
Male	76	30	3.588	0.058	Significant
Female	25	21			
Stream of the student	Awareness about E-waste management				
	Present	Absent			
Engineering	69	20			
Non engineering	32	31	10.657	0.001	Significant
Gender	Awareness about E-waste management				
	Present	Absent			
Male	46	55	4.247	0.039	Significant
Female	33	18			
Stream of the students	Awareness about E-waste management				
	Present	Absent			
Engineering	53	36	4.233	0.04	Significant
Non-engineering	26	37			

Gender	Awareness about recycling of E-waste				
	Present	Absent			
Male	90	11	0.012	0.911	Not significant
Stream of the students	Awareness about recycling of E-waste				
	Present	Absent			
Engineering	83	6	3.256	0.071	Not significant
Non-engineering	52	11			

Conclusions:

From the study it was concluded that -

1. Electronic gadgets are being used by students belonging to technical as well as non-technical fields more or less equally.
2. Moreover, the students are not aware about the increasing burden of electronic waste and its hazards.
3. In the given study it was also found that there is no significant difference in the knowledge of E-waste amongst males and females but there was significant difference between the knowledge of E-waste management, Health risk associated with E-waste and Environment risk associated with E-waste amongst Males and Females.
4. Many students are responsible for this increasing burden as they buy gadgets according to their whim and do not even care to think whether they really need them or not.
5. Habits like buying new gadgets even if the same old gadget is working and just throwing away the gadget that is not useful is the reason for piling up of E-waste in present time.

RECOMMENDATIONS

Based on the study findings following recommendations are made -

1. Responsibility of government
 - Necessity of having laws concerned with management of E-waste in India.
 - Collection system and logistics for management of E-waste.
 - The government should make people aware about the problem of E-waste.
2. Responsibility of industries
 - Electronic industries should make collection centers for the collection of E-waste.
 - Industries should also mention the helpline numbers for the collection of the E-wastes in the advertisement of their product.
3. Responsibilities of citizens
 - E-waste should never be disposed with garbage or other household wastes.
 - To the extent possible the old electronic equipment should be reused and if not, then to be given to the needy for use.

Key Messages:

India happens to be the 5th largest producer of e-waste in the world, not even 30% of the population is aware of the need for and the right methods of E-Waste management! Ewaste contains potentially hazardous substances which when exposed to the environment causes harm to the environment. Awareness about

the problem of e-waste and its proper management is the need of the present time to save our Earth. Protection of environment is everyone’s duty and every effort matters while creating a change.

REFERENCES:

1. Text of the Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and Their Disposal, UNEP, Geneva, Switzerland, p.6, <http://www.basel.int/text/>
2. Amit Jain, 'Global e-waste growth' in Rakesh Johri, E-waste: Implications, regulations and management in India and current global best practices, TERI, New Delhi, 2008, p.4
3. (UNEP Press Release, 'Basel Conference addresses Electronic Wastes Challenge', 27 November 2006 <http://www.unep.org/>)
4. (Lok Sabha Unstarred Question no.650, DT 28.07.2010.)
5. (Tom Young, 'E-waste a growing problem for China and India', 22 February 2010, <http://www.computing.co.uk>)