E-POLLUTION AND ITS COPING

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ABSTRACT

E-pollution (electronic pollution or e-waste) refers to the toxic environmental contamination caused by discarded electronic devices like smartphones, computers, and appliances.

Key Dangers of E-Pollution

- Toxic Leaching: Heavy metals like lead, mercury, cadmium, and arsenic seep into soil and groundwater.
- Air Pollution: Burning e-waste to recover precious metals releases dioxins and harmful particulate matter.
- Data Insecurity: Improperly discarded devices can expose personal data if not wiped securely.

KEYWORDS-E-pollution, coping, e-waste, devices, toxins, environment

INTRODUCTION

E-waste is one of the fastest growing solid waste streams in the world (1).
In 2022, an estimated 62 million tonnes of e-waste were produced globally. Only 22.3% was documented as formally collected and recycled (2).
Lead is a common substance released into the environment when e-waste is recycled, stored or dumped using informal activities, including open burning, (3).
Informal e-waste recycling activities may have several adverse health effects. Children and pregnant women are particularly vulnerable.
ILO and WHO estimate that millions of women and child labourers working in the informal recycling sector globally may be at risk of hazardous e-waste exposures (4,5).
Every year millions of electrical and electronic devices are discarded as products break or become obsolete and are thrown away. These discarded devices are considered e-waste and can become a threat to health and the environment if they are not disposed of and recycled appropriately.

Common items in e-waste streams include computers, mobile phones, large household appliances, and medical equipment. Millions of tonnes of e-waste are recycled using unsound activities, as well as being stored in homes and warehouses, dumped, and illegally exported. When e-waste is recycling using unsound activities, it can release up to 1000 different chemical substances into the environment, including known neurotoxicants such as lead (3). Pregnant women and children are particularly vulnerable due to their pathways of exposure and

developmental status. The International Labour Organization (ILO) estimates that 16.5 million children were working in the industrial sector in 2020, of which waste processing is a subsector Electronic waste (e-waste) is one of the fastest growing solid waste streams in the world (1). Less than a quarter of e-waste produced globally in 2022 was known to be formally recycled; however, e-waste streams contain valuable and finite resources that can be reused if they are recycled appropriately. E-waste has therefore become an important income stream for individuals and some communities. People living in low- and middle-income (LMICs), particularly children, face the most significant risks from e-waste due to lack of appropriate regulations and enforcement, recycling infrastructure and training. Despite international regulations targeting the control of the transport of e-waste from one country to another, its transboundary movement to LMICs continues, frequently illegally. E-waste is considered hazardous waste as it contains toxic materials and can produce toxic chemicals when recycled inappropriately. Many of these toxic materials are known or suspected to cause harm to human health, and several are included in the 10 chemicals of public health concern, including dioxins, lead and mercury. Inferior recycling of e-waste is a threat to public health and safety.

Exposure to e-waste

Electrical and electronic items contain many different toxic substances. Users are unlikely to have contact with these substances while the items are functional. When they become waste, these toxicants can be released into the environment if the devices are managed using environmentally-unsound practices and activities. Many unsound practices have been observed at e-waste sites including: [1,2,3]

scavenging
dumping on land or in water bodies
landfilling along with regular waste
opening burning or heating
acid baths or acid leaching
stripping and shredding plastic coatings
manual disassembly of equipment.

These activities are considered hazardous to the environment and health as they release toxic pollutants, contaminating the air, soil, dust, and water at recycling sites and in neighbouring communities. Open burning and heating are considered the most hazardous activities due to the toxic fumes created. Once in the environment, these toxic pollutants can travel significant distances from the point of pollution, exposing people in faraway areas to hazardous substances.

Children are the most vulnerable

Epidemiological research has posed several adverse health outcomes linked to informal and unsound e-waste recycling activities.

Children and pregnant women are especially vulnerable to the effects of hazardous pollutants from informal e-waste recycling activities. Children are often involved in waste picking and scavenging, burning discarded e-waste and the manual dismantlement of items into component parts. In some countries, children may serve as a source of cheap labour and their small hands give them an advantage in taking apart the smallest items. These activities directly expose children to injury and high levels of hazardous substances. Working as a waste picker is

hazardous labour and is considered one of the worst forms of child labour by the ILO. In 2020, the ILO estimated that as many as 16.5 million children globally were working in the industrial sector, of which waste processing is a subsector (4). It is unknown how many child labourers participate in informal e-waste recycling.

E-waste exposure may be linked to the following health effects during pregnancy and in infants and children:

adverse neonatal outcomes, including increased rates of stillbirth and premature birth;
neurodevelopment, learning and behaviour outcomes, especially associated with lead released through informal e-waste recycling activities;
reduced lung and respiratory function and increased asthma incidence, which may be linked to high levels of contaminated air pollution that characterize many e-waste recycling sites.
Children and pregnant women are at high risk to hazardous substances released through informal e-waste recycling activities due to their unique vulnerabilities. Children have different exposures to e-waste recycling activities than adults. E-waste recycling activities release toxic chemicals that can cross the placenta and may contaminate breastmilk, for example mercury. Fetuses and young children are highly sensitive to many pollutants released through e-waste recycling due to their rapidly developing bodies, including their respiratory, immune and central nervous systems. E-waste contains several known neurotoxicants, including lead and mercury, that may disrupt the development of the central nervous system during pregnancy, infancy, childhood and adolescence. Some harmful toxicants from e-waste may also impact the structural development and function of the lungs. Changes to children's developing systems may cause irreparable harm and affect them for the rest of their lives.[4,5,6]

Prevention and management
National and international actions are essential to protect communities from unsound e-waste recycling activities. Actions that can be taken include:

adopting and enforcing high-level international agreements;
developing and implementing national e-waste management legislation that protects public health;
incorporating health protection measures into national legislation;
monitoring e-waste sites and surrounding communities;
implementing and monitoring interventions that improve informal e-waste recycling activities, protect public health and ensure vital sources of community revenue;
educating health workers across all levels on e-waste-related child health issues;
eliminating child labour.
International agreements
The Basel Convention controls the transboundary movement of hazardous wastes and their disposal. It is a comprehensive environmental agreement that aims to tackle issues surrounding hazardous wastes, including e-waste and its management. In 2019, the Ban Amendment to the Basel Convention entered into force. It prohibits the movement of hazardous wastes, including e-waste, from countries of the Organisation for Economic Co-operation and Development (OECD), the European Commission countries and Liechtenstein to other states that are party to the Convention. The Basel Convention runs programmes and workshops to develop and deliver

guidance on environmentally sound management of e-waste. It also provides states with guidelines to distinguish between waste and non-waste and the transboundary movement of e-waste. Regional conventions also exist, including the Bamako Convention and the Waigani Convention. Both regional conventions arose in response to the Basel Convention and aim to further restrict the movement of hazardous wastes, including e-waste, in African and South Pacific countries, respectively.

DISCUSSION

WHO response

World Health Organization's (WHO) Initiative on E-waste and Child Health is contributing to a number of international e-waste programmes and pilot projects in countries in Latin America and Africa. These projects are developing frameworks to protect children's health from e-waste exposures that can be adapted and replicated in other countries and settings. The Initiative aims to: increase access to evidence, knowledge and awareness of the health effects of e-waste
improve health sector capacity to manage and prevent risks
facilitate monitoring and evaluation of e-waste exposures and interventions that protect health.
In 2021, WHO released its first global report on e-waste and child health, which called for greater effective and binding action to protect children from the growing threat. WHO has developed training tools for the health sector, including a training package for health care providers, including a specific training module on e-waste and child health. Additionally, WHO contributes to multi-agency capacity training tools, including a MOOC, a joint course with PAHO and the UNICEF-WHO Introduction to Children's Environmental Health.
E-waste, electronic waste, e-scrap and end-of-life electronics are terms often used to describe used electronics that are nearing the end of their useful life, and are discarded, donated or given to a recycler. The UN defines e-waste as any discarded products with a battery or plug, and features toxic and hazardous substances such as mercury, that can pose severe risk to human and environmental health.[7,8,9]

According to the UN, in 2021 each person on the planet will produce on average 7.6 kg of e-waste, meaning that a massive 57.4 million tons will be generated worldwide. Only 17.4% of this electronic waste, containing a mixture of harmful substances and precious materials, will be recorded as being properly collected, treated and recycled. Many initiatives are undertaken to tackle this growing concern, but none of them can be fully effective without the active role and correct education of consumers.

The International Telecommunication Union (ITU) also indicates that e-waste is one of the largest and most complex waste streams in the world. According to the Global E-waste Monitor 2020, the world generated 53.6 Mt of e-waste in 2019, only 9.3 Mt (17%) of which was recorded as being collected and recycled. The fourth version of the Global E-waste Monitor 2024 shows an increasing trend in the generation of e-waste as by 2022, the world generated 62 billion kg of e-waste, (7.8 kg per capita). Only 22.3 percent (13.8 billion kg) of the e-waste generated was documented as properly collected and recycled.

E-waste contains valuable materials, as well as hazardous toxins, which make the efficient material recovery and safe recycling of e-waste extremely important for economic value as well as environmental and human health. The discrepancy in the amount of e-waste produced and the

amount of e-waste that is properly recycled reflects an urgent need for all stakeholders including the youth to address this issue.

Tne United Nations Environment Programme (UNEP) also estimated in a 2015 report "Waste Crimes, Waste Risks: Gaps and Challenges in the Waste Sector" that 60-90 per cent of the world's electronic waste, worth nearly USD 19 billion, is illegally traded or dumped each year.

RESULTS

E-waste can be toxic, is not biodegradable and accumulates in the environment, in the soil, air, water and living things. For example, open-air burning and acid baths being used to recover valuable materials from electronic components release toxic materials leaching into the environment. These practices can also expose workers to high levels of contaminants such as lead, mercury, beryllium, thallium, cadmium and arsenic, and also brominated flame retardants (BFRs) and polychlorinated biphenyls, which can lead to irreversible health effects, including cancers, miscarriages, neurological damage and diminished IQs.

A 2019 joint report "A New Circular Vision for Electronics – Time for a Global Reboot" calls for a new vision for e-waste based on the circular economy concept, whereby a regenerative system can minimize waste and energy leakage. The report supports the work of the E-waste Coalition, which includes the ILO, ITU, UNEP, UNIDO, UNITAR, UNU and Secretariats of the Basel and Stockholm Conventions.[10,11,12]

According to the report, the improper handling of e-waste is resulting in a significant loss of scarce and valuable raw materials, including such precious metals as neodymium (vital for magnets in motors), indium (used in flat panel TVs) and cobalt (for batteries). Almost no rare earth minerals are extracted from informal recycling; these are polluting to mine. Yet metals in e-waste are difficult to extract; for example, total recovery rates for cobalt are only 30% (despite technology existing that could recycle 95%). The metal is, however, in great demand for laptop, smartphone and electric car batteries. Recycled metals are also two to 10 times more energy efficient than metals smelted from virgin ore. Furthermore, mining discarded electronics produces 80% less emissions of carbon dioxide per unit of gold compared with mining it from the ground.

In 2015, the extraction of raw materials accounted for 7% of the world's energy consumption. This means that moving towards the use of more secondary raw materials in electronic goods could help considerably in reaching the targets set out in the Paris Agreement on climate change.

Climate Change

It is also worth considering the effects electronic goods have on climate change. Every device ever produced has a carbon footprint and is contributing to human-made global warming. Manufacture a tonne of laptops and potentially 10 tonnes of CO_2 are emitted. When the carbon dioxide released over a device's lifetime is considered, it predominantly occurs during production, before consumers buy a product. This makes lower carbon processes and inputs at the manufacturing stage (such as use recycled raw materials) and product lifetime key determinants of overall environmental impact.

Lack of Recycling

Recycling rates globally are low. Even in the EU, which leads the world in e-waste recycling, just 35% of e-waste is officially reported as properly collected and recycled. Globally, the average is 20%; the remaining 80% is undocumented, with much ending up buried under the ground for centuries as landfill. E-waste is not biodegradable. The lack of recycling weighs heavily on the global electronic industry and as devices become more numerous, smaller and more complex, the issue escalates. Currently, recycling some types of e-waste and recovering materials and metals is an expensive process. The remaining mass of e-waste – mainly plastics laced with metals and chemicals – poses a more intractable problem.[13,14,15]

CONCLUSIONS

A new vision for the production and consumption of electronic and electrical goods is needed. It is easy for e-waste to be framed as a post-consumer problem, but the issue encompasses the lifecycle of the devices everyone uses. Designers, manufacturers, investors, traders, miners, raw material producers, consumers, policy-makers and others have a crucial role to play in reducing waste, retaining value within the system, extending the economic and physical life of an item, as well as its ability to be repaired, recycled and reused.[16,17,18]

Changes in technology such as cloud computing and the internet of things (IoT) could hold the potential to "dematerialize" the electronics industry. The rise of service business models and better product tracking and takeback could lead to global circular value chains. Material efficiency, recycling infrastructure and scaling up the volume and quality of recycled materials to meet the needs of electronics supply chains will all be essential. If the sector is supported with the right policy mix and managed in the right way, it could also lead to the creation of millions of decent jobs worldwide.[19,20]

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