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POLLUTION AND HUMAN HEALTH

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INTRODUCTION

Over the last three decades there has been increasing global concern over the public health impacts attributed to environmental pollution, in particular, the global burden of disease. The World Health Organization (WHO) estimates that about a quarter of the diseases facing mankind today occur due to prolonged exposure to environmental pollution. Most of these environment-related diseases are however not easily detected and may be acquired during childhood and manifested later in adulthood. Improper management of solid waste is one of the main causes of environmental pollution and degradation in many cities, especially in developing countries. Many of these cities lack solid waste regulations and proper disposal facilities, including for harmful waste. Such waste may be infectious, toxic or radioactive. Municipal waste dumping sites are designated places set aside for waste disposal. Depending on a city's level of waste management, such waste may be dumped in an uncontrolled manner, segregated for recycling purposes, or simply burnt. Poor waste management poses a great challenge to the well-being of city residents, particularly those living adjacent the dumpsites due to the potential of the waste to pollute water, food sources, land, air and vegetation. The poor disposal and handling of waste thus leads to environmental degradation, destruction of the ecosystem and poses great risks to public health.
These toxicants can be found in air, water and soil and could find their way into the human body through:

- Industrial Waste e.g., falloff or unused chemicals and raw materials, expired products and substandard goods
- Agricultural Waste e.g., pesticides (herbicides and fungicides)
- Hospital Waste e.g., packaging materials and containers, used syringes and sharps, biological waste and pharmaceuticals
- Heavy Metals e.g., lead, mercury, cadmium, arsenic, chromium, zinc, nickel and copper
- Persistent Organic Pollutants e.g., aldrin, dieldrin, dichlorodiphenyl-trichloroethane (DDT), endrin, heptachlor, toxaphene, chlordane, hexachlorobenzene, mirex (organochlorines, organophosphates, carbamates) and polychlorinated biphenyls (PCBs) PUBLIC HEALTH EFFECTS

A medical camp was set up next to the dumpsite. A total of 328 children and adolescents living and schooling adjacent the dumpsite were examined and treated for various ailments. Of these, 40 were referred for further laboratory tests that entailed blood and urine sampling to assess the impact of exposure to environmental pollutants from the dumpsite on human health. The major public health effects were:

- Skin Disorders – Fungal infection, allergic dermatitis, pruritis and skin cancer

- Respiratory Abnormalities – bacterial upper respiratory tract infections (pharyngitis, laryngitis and rhinitis), chronic bronchitis and asthma
- Abdominal and Intestinal Problems – bacterial enteritis, helminthiasis, amoebiasis, liver cancer, kidney and renal failure
- Dental Disorders – dental carries and dental pain
- Ear Infections – otitis media and bacterial infections
- Skeletal Muscular Systems – back pain
- Central Nervous System – impairment of neurological development, peripheral nerve damage and headaches
- Eye Infections – allergic conjunctivitis, bacterial eye infections
- Blood Disorders – Iron deficiency anaemia
- Others – malaria, chicken pox, septic wounds and congenital abnormalities, cardiovascular diseases and lung cancer ROUTES OF EXPOSURE
- Inhalation – movement of air from the external environment through the airways during breathing
- Ingestion – the consumption of a substance by an organism either man or animals
- Absorption – the movement and uptake of substances into cells or across tissues such as skin by way of diffusion or osmosis

Toxic heavy metals with established health effects

Heavy Metal	Sources of Environmental exposure	Minimum Risk level	Chronic exposure toxicity effects
Lead	Industrial, vehicular emissions, paints and burning of plastics, papers, etc.	Blood lead levels below 10 µg/dl of blood	Impairment of neurological development, suppression of the haematological system and kidney failure
Mercury	Electronics, plastic waste, pesticides, pharmaceutical and dental waste	Below 10 µg/dl of blood Oral exposure of 4mg/kg/day	Gastro-intestinal disorders, respiratory tract irritation, renal failure and neurotoxicity
Cadmium	Electronics, plastics, batteries and contaminated water	Below 1 µg/dl of blood	Irritation of the lungs and gastrointestinal tract, kidney damage, abnormalities of the skeletal system and cancer of the lungs and prostrate

Persistent organic pollutants are long-lasting non-biodegradable organic compounds that accumulate in the food chain, especially fish and livestock, and pose serious health risks to humans. They dissolve poorly in water and are readily stored in fatty tissue hence may be passed to infants through breast milk. These chemicals include: aldrin, dieldrin, dichlorodiphenyl-trichloroethane (DDT), endrin, heptachlor, toxaphene, chlordane, hexachlorobenzene, mirex, pesticides and polychlorinated biphenyls (PCBs) all of which are to be phased out and/or eliminated under the international environmental agreements.

RESULTS

Environmental Evaluation

The concentration of lead (Pb) in the soil samples ranged from 50-590 ppm. 42% of the samples had levels above 400 ppm and only one sample had Pb levels at 50 ppm with the rest above 60 ppm. Samples from within the waste dump manifested a value of 13,500 ppm and this is a clear indication that the dumpsite is the major source of high lead levels found in the surrounding environment. For mercury (Hg), samples collected from the waste dump exhibited a value of 46.7 ppm while those collected along the river bank registered a value of 18.6 ppm. Both of these values greatly exceeded the WHO acceptable exposure level of 2 ppm. The rest of the samples were inconclusive due to the fact that the analytical method used was only capable of detecting high levels of mercury (15 ppm and above). Mean chromium (Cr) concentrations were slightly above the critical standard soil levels hence had no major negative impact on the environment. Zinc (Zn) concentrations from soils exceeded the recommended standard levels as well.

Copper concentrations in water samples were well below the prescribed WHO and Dutch standards. None of the polychlorinated biphenyls (PCBs) were detected in the samples as PCBs dissolve poorly in water and the river flow was rapid. However, their presence in the environment cannot be ruled out due to the manifestation of clinical abnormalities e.g., irritation of the nose and lungs, gastrointestinal discomfort, depression, fatigue and skin ailments among the children.

Impacts on Public Health

From the environmental evaluation conducted, it was determined that the dumpsite exposes the residents around it to unacceptable levels of environmental pollutants with adverse health impacts. A high number of children and adolescents living around the dumping site had illnesses related to the respiratory, gastrointestinal and dermatological systems such as upper respiratory tract infections, chronic bronchitis, asthma, fungal infections, allergic and unspecified dermatitis/pruritis – inflammation and itchiness of the skin. Table 3 below summarizes the health results of the 328 children aged 2-18 years examined.

The high levels of lead in the soil samples analyzed are negatively impacting on the communities living near the dumpsite which is evidenced as well by the fact that half of the children examined had blood lead levels equal to or exceeding the internationally accepted toxic levels (10 µg/dl of blood). This in turn led to clinical symptoms such as headaches, chest pains and muscular weakness being manifested in the children.

Blood samples collected from the children also indicated a significantly high level of certain enzymes that collectively with other parameters or individually result in cellular damage in the body or the presence of a disease process affecting the liver. High levels of creatinine (breakdown product of creatine phosphate in muscle usually produced at a fairly constant rate by the body depending on muscle mass) in some children examined indicated the need of closer follow-up in order to determine the onset of renal disfunction. Blood investigations confirmed that 50% of the children had low haemoglobin levels while 30% had size and staining abnormalities (microcytosis) of their red blood cells (iron deficiency anaemia – IDA), a condition brought about by heavy metal intoxication. Further, the blood film studies indicated that 52.5% of the children had marked eosinophilia (increase in the number of white blood cells mostly associated with allergic reactions) a condition that could lead to chronic rhinitis (irritation of the nasal cavity), asthma, allergic conjunctivitis and dermatitis.

CONCLUSION

This pilot study has linked environmental pollution to public health. Soil samples analyzed from locations adjacent and within the dumpsite show high levels of heavy metals emanating from the site in particular lead, mercury, cadmium, copper and chromium. At the same time, a medical evaluation of the children and adolescents living and schooling near the dumpsite indicates a high incidence of diseases that are associated with high exposure levels to these metal pollutants. For example, about 50% of children examined who live and school near the dumpsite had respiratory ailments and blood lead levels equal to or exceeding internationally accepted toxic levels (10 µg/dl of blood), while 30% had size and staining abnormalities of their red blood cells, confirming high exposure to heavy metal poisoning.

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