HEALTH IMPACT OF PHARMACEUTICAL POLLUTION: THE INDIAN SCENARIO

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Abstract

Part A: Human Health Risk Assessment

Water is often regarded as the elixir of life and is particularly important in sustaining ecosystems and human societies. However, the growing world population has placed enormous stress on the limited and unevenly distributed water resources with climate change exacerbating this water stress. In such a scenario, wastewater recycling and reuse has emerged as a viable solution and consequently water pollution has become a focal point of discussions. While industrial discharges, agricultural runoff, and microplastics garner all the attention, the infiltration of pharmaceuticals in drinking water supplies is often overlooked. Pharmaceutical pollution is an unintended consequence of the remarkable progress of modern medicine. Active Pharmaceutical Ingredients (APIs) are bioactive compounds, designed to interact with living tissue, and remain unaffected by present-day wastewater treatment plants, posing a significant health threat to humans as well as aquatic species by disrupting endocrine functions, increasing cancer risk, and causing Antimicrobial Resistance (AMR). This paper employs a specific form of the dose-response function, known as the Human Health Risk Assessment, developed by the US EPA to construct a risk index for 10 of the most frequently occurring APIs in Hyderabad and Delhi, the hubs of pharmaceutical production in India. While the present environmental concentrations of APIs do not pose an immediate threat to human health, Metformin and Caffeine could soon exceed the threshold limit and hence require constant monitoring to prevent any threat to human health.

Keywords: pharmaceutical pollution, active pharmaceutical ingredients, risk assessment

JEL Codes: I18, Q53, Q58

Abstract

Part B: Antimicrobial Resistance: Case Studies

The discovery of antibiotics (Penicillin) by Alexander Fleming is regarded as the most important discovery in modern medicine. Antibiotics are life-saving drugs that have been the cornerstone of modern medicine's contribution in increasing life expectancy and decreasing human suffering. However, its large-scale use and improper disposal has resulted in antibiotic pollution of the world's water resources. A menacing consequence of antibiotic pollution is Antimicrobial Resistance. Antimicrobial resistance (AMR) happens when bacteria (also viruses, fungi, and parasites) change over time and stop responding to medicines, such as antibiotics, that were previously effective in treating them. This resistance can make infections harder to treat and increase the risk of complications or even death. This section of the paper presents the extent of AMR in India through case studies covering several cities (Bengaluru, Mysuru, Delhi, Chandigarh, and Pondicherry), pathogens (E. coli, MRSA, S. uberis) and diseases affecting both humans as well as bovines in the dairy sector. The case studies help make a case for a more bottom-up approach to antibiotic stewardship rather than the presently followed top-down approach practiced by the Indian Council of Medical Research as AMR is a highly hyper-local and context specific socio-environmental issue.

Keywords: antibiotics, antimicrobial resistance, antibiotic stewardship

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