Chapter 6
Environmental Health

ABSTRACT

This chapter, titled "Environmental Health," expands the lens to global environmental health, analyzing how climate change, pollution, and ecological disruption exacerbate disease burdens in LMICs. It argues that interoperable EHR systems can support environmental health monitoring by linking clinical data with geospatial and exposure metrics. The chapter also discusses ethical considerations in data collection and use, particularly in marginalized communities disproportionately affected by environmental hazards.

INTRODUCTION

By 2030, the global population will increase from 8.4 billion to 10 billion (Carter, 2024). Globalization increases human mobility, links communities, cultures, and industries by sharing access to foreign markets, leverages the benefits of multinational human and natural resources, cultural exchanges, innovations and technologies, and helps organizations establish or increase an international presence (McCloskey, 2023). Technological advancements in integrated digitized processes and interoperable systems have made the world smaller, making conducting transactions between organizations thousands of miles apart as easy as making a few keystrokes (Winslett, 2023). However, one of the challenges of globalization and global population growth is its increased demand for food chains and the use of glyphosate.

Globalization increases the demand for farmers for agricultural products, more standardized farming processes, and integrated agricultural systems. Glyphosate is a globally used herbicide that promotes food quality, increases crop yields, and protects agriculture from pests and diseases (de Morais Valentim et al., 2024). Glyphosate is an herbicide, and although commonly used in developed and developing countries, there are concerns about its toxicity and potential health risks to humans. Toxicology is crucial to public health and safety, and understanding gly-

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phosate's Dose-Response Relationship (DRR) is essential to reducing the dangers and consequences of exposure. The DRR is an area of toxicology that promotes the understanding of the interaction of chemicals and living organisms and potential health impacts (WGU, 2020b).

DOSE-RESPONSE RELATIONSHIPS AND GLYPHOSATE

Glyphosate was introduced under the trade name Roundup in 1974 by the Monsanto organization as an herbicide designed to kill living pests and diseases while protecting food sources (Valavanidis, 2018). There is, however, debate in the literature on the product's safety, as some science suggests excessive exposure to glyphosate is potentially dangerous to humans. The United States Department of Health and Human Services (DHHS) Agency for Toxic Substances and Disease revealed in Tables 1(Human) and Table 2 (Animals) several health risks and potential DRR correlations (Pohl et al., 2019).

Table 1. US DHHS agency for toxic substances and disease registry (humans)

• **Gastrointestinal effects:** Clinical signs and/or pathological evidence of glyphosate-induced irritation were observed in several animal studies; the lowest dose level resulting in gastrointestinal effects was 175 mg/kg/day for diarrhea and few feces in pregnant rabbits administered glyphosate acid by gavage. Gastrointestinal disturbances are signs and/or symptoms following ingestion of substantial amounts of glyphosate-containing products.
• **Developmental effects:** Glyphosate treatment-related developmental effects were noted in a few studies at dose levels (≥1,234 mg/kg/day), resulting in maternal toxicity as well.
• **Body weight effects:** Depressed body weight and/or depressed body weight gain resulted from repeated dosing of glyphosate technical at dose levels ≥1,183 mg/kg/day.
• **Hepatic effects:** Increases in liver weight and serum ALT activity were observed in one repeated-dose study at a dose level of 1,678 mg/kg/day.
• **Ocular effects:** Lens abnormalities were observed in one repeated-dose study at a dose level of 940 mg/kg/day.
• **Renal effects:** Indicators of renal toxicity were noted in rats and mice administered glyphosate technical in the diet for 2 years at high doses (940 and 6,069 mg/kg/day, respectively).
• **Other effects:** Neurological, hematological, immunological, and reproductive endpoints have been evaluated but do not appear to be targets of glyphosate toxicity.
• **Cancer:** Upon evaluation of available carcinogenicity studies in laboratory rodents, multiple agencies or organizations have concluded that glyphosate technical does not appear to be an animal carcinogen. In contrast, IARC considered the animal data to provide "*sufficient evidence*" of glyphosate carcinogenicity.