Chapter

Introductory Chapter: The Significance of Environmental Health Literacy – Children and BPA-free Plastics

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1. Introduction

Over the past century, there has been unparalleled technological development, unlike any other time in human history. While this is exceptional, it is not without underlying issues. The result of technological advancement has led to significant changes at various levels across the globe. Some of these changes are highly evident, such as deforestation, ecosystem alteration (or destruction), species extinction, and shifts in planetary temperature, while others are less apparent but of great importance to public health, such as the release of endocrine disruptors, exposure to pesticides, or the ingestion of microplastics. These are a few examples of the human impact on the planet.

Some authors have begun to use the term Anthropocene to define this new era in the planet's history, during which humans have become a global force that has pushed the planet beyond its natural boundaries [1]. For the first time in the last 24,000 years, there are temperature changes occurring, with an increase of 1.1°C above pre-industrial levels and a current rate of 0.2°C per decade [2]. The significant consequence of the Anthropocene is the exponential increase in potential risks to human health. Therefore, environmental health literacy (EHL) is a fundamental concept and a necessity for the modern era.

In simple terms, Environmental Health Literacy (EHL) can be defined as the understanding that environmental exposures can impact health [3]. Delving deeper into the concept, it is the ability to seek, comprehend, assess, and use environmental health information to make more informed decisions and reduce health risks [4]. EHL is a field of study that integrates components from various disciplines, including health literacy, risk communication, environmental health, communication research, and safety culture [5]. In 2016, the World Health Organization estimated that 24% of global deaths were caused by environmental factors such as water and air pollution, radiation, workplace hazards, noise, climate change, and issues related to water and agricultural practices. For children under the age of 5, the percentage of deaths related to environmental factors rises to 28% [6].

Children under the age of 5 represent a particularly sensitive population in modern society, as they are exposed to numerous xenobiotic elements even before birth. Elements as commonplace as tobacco smoke increase the risk of sudden infant death in the first year of life [7, 8]. It is important to note that two-thirds of deaths related to environmental factors occur in underdeveloped countries due to pathologies stemming from air and water pollution [9]. However, there are issues that occur across the globe, such as exposure to endocrine disruptors resulting from the use and consumption of plastic materials.

Within the range of monomers associated with the plastic industry, one of the most prominent in recent years is bisphenol A (BPA). BPA is a phenolic compound that is widely distributed due to its multiple uses as a monomer, additive, and plasticizer in plastic polymer production [10]. This compound can be found in a multitude of everyday items, such as food containers, toys, dental fillings, medical-surgical materials, or even clothing [11–16]. Its significance, apart from being influenced by its versatility and productivity, lies in its ability to modulate the action of estrogen receptors. BPA is known as one of the primary endocrine disruptors currently under scrutiny by the scientific community.

Due to the heterogeneous distribution of BPA, the potential magnitude and impact it can have on the population are a cause for concern. In recent years, a plastic recycling system has been developed that categorizes plastics into seven categories. In most everyday plastic items, you can identify a triangle with a number from 1 to 7 inside. This coding system was created by the Plastics Industry Association [17] and was recently improved in collaboration with the American Society for Testing and Materials (ASTM), resulting in the current voluntary consensus standard ASTM D7611 [18]. This standard includes the following categories: (1) polyethylene terephthalate (PET); (2) high-density polyethylene (HDPE); (3) polyvinyl chloride (PVC); (4) low-density polyethylene (LDPE); (5) polypropylene (PP); (6) polystyrene (PS); (7) other (materials made from more than one resin from categories 1 to 6) [19].

It is common in academic literature to find texts that describe BPA as the primary monomer used in the production of polycarbonate, a plasticizer in the synthesis of epoxy resins, and an additive in the manufacturing of PVC (codes 3 and 7) [11, 20]. Even though it can be used as an additive in various types of plastics, the possibility of its presence in other materials is usually not considered. In fact, there are numerous online spaces where it is claimed that certain polymers are harmful, while others are considered to pose no potential health risks. These sources often reinforce these axioms with information from the media. Consequently, it is common to come across statements emphasizing the safety of plastics categorized in groups 1, 2, 4, and 5, while those in categories 3, 6, and 7 are considered dangerous to health [21–23]. However, there is evidence in academic literature that BPA is present in all elements of the plastic classification system [24–29]. Given all that has been discussed, environmental health literacy is crucial so that the population can understand the magnitude of the problem and can take measures to reduce exposure to these types of monomers, with special attention to the most vulnerable population groups: newborns and children.

In recent years, there has also been a growing trend of producing items for children with the "BPA-free" label in response to the evidence indicating the potential hazards of BPA, especially in these vulnerable population groups [30]. However, the removal of BPA from plastic synthesis may not necessarily lead to an improvement in health if the substitute molecules exert the same deleterious effects as BPA itself. When conducting a quick internet search for images of "BPA-free" labels, one can

find various designs with different fonts, but most of them feature one or more plant leaves, which conveys a sense of "natural" to the buyer. In other cases, terms like "non-toxic," "all-natural," "safe," "clean," or "healthy" may be seen. However, are these claims supported by scientific evidence?

In academic literature, it has been described that in "BPA-free" products, BPA has been replaced with molecules that could have similar physiological effects, such as bisphenol S or F (BPS or BPF, respectively) [31]. These molecules have not been extensively studied, but there are already concerning pieces of evidence about their potential effects on children. To provide some examples, a positive association has been observed between BPF and the risk of obesity in children and adolescents [32], as well as associations between BPS and BPF with asthma and/or fever [33]. There have also been descriptions that both substitute molecules could have a similar endocrine-disrupting capacity to BPA, as shown in a study conducted on children and adolescents [34].

Furthermore, there are alarming indications of the possible impact of BPA substitute molecules on cognitive and neurological development. For instance, Bornehag et al. [35] found a significant association between prenatal exposure to BPF and the cognitive function of 7-year-old children. Jiang et al. [36] provided evidence that prenatal exposure to BPA and BPS could affect neurological development in children. Kim et al. [37] even determined an association between BPS and BPF with attention-deficit/hyperactivity disorder in 6-year-old children. Therefore, it is of utmost importance to increase efforts in EHL simultaneously with the implementation of governmental measures to minimize exposure to these compounds.

2. Conclusions

Today, environmental health literacy is becoming increasingly important for public health because we are living in a new era with a growing number of potential environmental hazards. The population should have reliable and scientifically validated information about the potential environmental hazards they may face. Furthermore, in the case of children under 5 years of age, a group with a particular susceptibility to endocrine disruptors, obtaining information and implementing regulations should be a priority.

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Conflict of interest

The author declares no conflict of interest.

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