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Occupational Exposure to Endocrine Disrupting Chemicals: A Need for Practical Solutions and Recommendations

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Endocrinedisruptingchemicals(EDCs)aredefinedasaheterogeneousgroupofexogenous agents thatinterfere with endocrine functions or pathways. Possiblemechanisms of EDCs include mimicking of hormoneeffects, antagonization of hormone receptors,disturbance of hormonal synthesis pathways, binding to transport proteins, or otherinterferences with hormonal function[1,2].

Furthermore, EDCs may interfere with the normal endocrinesystem by changing the normal hormone levelsthrough stimulation or inhibition of the production of hormones[3]. These chemicals are often found in: pesticides, fungicides, disinfectants, adhesives, lubricants, chemical solvents, cleaning agents, dyes, paints, oils, tubing, wiring, plastics, plasticizers, coal or coal combustion and heavy metals [4-8]. Exposure to EDCs has become pervasive globally, and there is evidence that they influence biological pathways which may increase cancer risk [9-11].

Potential EDCs have been described as human-made substances that alter hormone regulation in humans or wildlife. The endocrine system regulates many essential body functions such as growth, behavior, and reproduction through the controlled release of hormones. EDCs include many synthetic and natural chemicals such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, phthalates, organic solvents, phenols such as bisphenol A, alkylphenolic compounds, brominated flame retardants, some metals, and parabens[12].

Moreover, there is a particular concern for people who work within an occupation or industry where even greater EDCs exposure may occur, potentially explaining differential rates of cancer within certain occupations [13,14]. It has been hypothesized that part of the increase in the incidence of hormone related cancers, such as breast cancer, could be the result of the increased presence of EDCs in the environment due to westernization and industrialization [15]. Yet previous epidemiological studies examining the association between exposure to substances that may have hormonal activity and risk for breast cancer have been inconsistent [16-20].

Human exposure to EDCs has been associated with a wide range of health outcomes such as breast, prostate, and testis cancer, diabetes, obesity, and decreased fertility [21]. Although policy regarding the use of EDCs has evolved over the years, EDCs remain present in some foods and consumer products and in the workplace [12,21]. During pregnancy, periods of fetal vulnerability occur during growth and development of organs and systems, leaving the fetus particularly sensitive to environmental factors [22]. This is cause for concern, given that EDCs are potentially damaging during the embryonic and fetal periods because they resemble or interfere with the hormones, neurotransmitters, growth factors, and other signaling substances that normally regulate fetal development [21]. Previous studies have evaluated the impact of maternal EDC exposure in the general population on fetal growth and found exposure associated with impaired growth [23,24]. However, studies of maternal occupational exposure to EDCs and fetal growth outcomes are few and limited in size, providing insufficient sample size to evaluate infrequent occupational exposures [25].

Several epidemiological studies suggest that arange of EDCs may actually cause preterm birth and/or lowbirth weight [26]. Many of these studies are concernedwith specific substances, such as phthalates [27], some pesticides[28] and PCBs[23]. Forexample, exposure to PCBs is believed, with increasing evidence,to inhibit fetal growth [23].Due to methodologicalrestrictions, the complexity of these chemical substances, and due to preventive measures, the effects are often limited and the results inconsistent [29,30]. Therefore, it is difficult to determine whether associations between EDCs and preterm birth and/or low birth weight are causal [31].

Research groups attempted to classify occupationalexposure to several EDCs in job-exposure matrices(JEM) for community or industry-based settings [32]. However, there is a need for further research in this field and to set minimum standards for prevention and management of health effects caused by occupational exposure to EDCs.

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