SHORT COMMUNICATION

A systematic review of prenatal exposure to potentially toxic metals and their effects on genetic material in offspring

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ABSTRACT

The background concentration of metals and other environmental contaminants has risen recently. Because of genetic or epigenetic changes, early-life exposure to pollutants may determine a person's susceptibility to chronic diseases as they mature. This review's goal was to find a connection between exposure to Potentially Toxic Metals (PTMs) during pregnancy and in the first few months after birth and harmful effects on the offspring's genetic make-up. Infertility and miscarriage, obstetric outcomes like preterm delivery and low birth weight, neurodevelopmental delay like autism and attention deficit hyperactivity disorder, and adult and children cancer are the main effects of toxic exposures connected to reproductive and developmental health. As, Cd, and Pb were the most frequently tested PTMs. Telomere length, gene or protein expression, mitochondrial DNA content, metabolomics, DNA damage, and epigenetic modifications were the main genetic changes in neonates related with prenatal PTM exposure. Numerous of these impacts were sex-specific and were more pronounced in boys. Exposures may typically be divided into the following categories, not withstanding the fact that there is much overlap in the kind of exposure and the related health outcomes: exposures to hazardous substances, air pollution, and climate change-related hazards. When a hazardous exposure is found, obstetric care doctors do not need to be experts in environmental health science to advise patients and, if necessary, send them to qualified specialists. Obstetrician-gynecologists and other obstetric care clinicians should learn about the toxic environmental exposures that are common in their particular geographic regions, such as local water safety warnings (for example, lead-contaminated water), regional air quality standards, and patients' proximity to power plants and fracking sites. Although all populations are exposed to hazardous environmental agents, many environmental conditions that are detrimental to reproductive health disproportionately impact underprivileged communities and are covered by environmental justice concerns. Clinical contacts provide a chance to screen and educate patients about ways to lower harmful environmental health exposures during the pre-pregnancy and prenatal periods, especially those who are disproportionately affected. This Committee Opinion has been updated to incorporate more recent research on lowering exposure to harmful environments during pregnancy and in utero.

Key Words: *Genetic material; Metals; Newborns; Prenatal exposure*

INTRODUCTION

More study is required to investigate various environmental exposures and provide suggestions for efficient therapeutic interventions, even if there is evidence linking some exposures to impacts on pregnancy and foetal health. While additional information is obtained about the clinical effectiveness of certain therapies and problems of causality, clinical counselling toward reduction of exposures that are known or thought to be potentially harmful can still be incorporated into care when it is feasible. Toxic environmental agents can range from population-based exposures like air pollution and water contamination to specific individual exposures like food packaging and personal care products [1]. Exposures may be the result of an urgent environmental crisis, like the lead-contaminated water in Flint, Michigan in 2014. The widespread mercury poisoning caused by methylmercury bioaccumulation in local fish and shellfish after decades of industrial wastewater being dumped in Minamata Bay, Japan, is one example of this [2]. It's important to note that this environmental crisis laid the groundwork for international regulation on mercury pollution and identified seafood as a potential source of heavy metal exposure. In contrast to medicines, the majority of environmental chemicals were introduced to the market without thorough and standardised data addressing their long-term toxicity or effects on reproduction [3]. Although all populations are exposed to hazardous environmental agents, many environmental conditions that are detrimental to reproductive health disproportionately impact underprivileged communities and are covered by environmental justice concerns. Injustice, racism, poverty, the standard of the neighbourhood and housing, psychological stress, and nutritional conditions can all enhance the consequences of environmental chemical exposure. Due to the risk of higher exposures at work, people who are exposed to toxic chemicals work are also more susceptible to poor outcomes for their reproductive health. In relation to exposure to toxic chemicals, immigrant populations engaged in low-wage labour work disproportionately in professions linked to dangerous workplace environments [4]. Consumer goods such as personal care items, food packaging, home items, as well as air and water, all contain toxic chemicals. Chemicals can pass through the placenta and, in rare situations, such as methylmercury, they can accumulate in the foetus, causing foetal quantities to be greater than mother amounts. Exposure to some hazardous environmental chemicals during pregnancy has been linked to a number of negative effects on newborn and childhood health, and exposure during any stage of gestation may have detrimental effects on reproductive and developmental outcomes. Agriculture (pesticides), manufacturing (organic solvents and heavy metals), dry cleaning (solvents), custodial and cleaning services (organic solvents), beauty salons (solvents and phthalates), and health care are among the occupations that pose a particular risk of potentially hazardous exposures during pregnancy (biologics and radiation). Among the professions that present a particular risk of potentially hazardous exposures during pregnancy are those in agriculture (pesticides), manufacturing (organic solvents and heavy metals), dry cleaning (solvents), custodial and health care, as well as cleaning services (organic solvents), hair salons (solvents and phthalates), and (biologics and radiation). The decrease of hazardous exposure can benefit from proper food preparation and storage. Even if it will be peeled or chopped, patients can be encouraged to properly wash raw food to lower bacterial contamination; nevertheless, it is uncertain if this will lower all hazardous chemical exposures (eg, perchlorate or pre and Polyfluoroalkyl Substances [PFAS]) [5]. Heating food in plastic containers, such as polystyrene, may increase exposure to plastic resins that may have endocrine-disrupting effects, however, there is no evidence to support this. Products for personal care and cosmetics may include poisons that are not well known. Environmental health research has been evaluated using systematic review methodologies based on best practices in clinical care (such as Cochrane and GRADE), and their usage should be broadened to strengthen the evidence-based foundation for decision-making. Analyzing and monitoring chemicals in people and the environment is essential for this endeavour in environmental health surveillance.

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CONCLUSION

More research is needed to validate and comprehend the connections between specific environmental health exposures and poor obstetric outcomes, as well as to offer treatment advice. Cochrane and GRADE are two systematic review approaches that have been used to analyse environmental health research; their use should be expanded to increase the evidence-based basis for decision-making. This effort in environmental health surveillance requires analysis and monitoring of substances in both the environment and individuals. Some restrictions apply to this study. The first is that by limiting study enrolment to healthy, term pregnancies, we may have limited the variation of the exposure variables and understated the effects of metals exposure. Additionally, we adjusted for a number of prospectively measured mother and newborn factors (such as smoking, depression, and birth weight) to further enhance our confounding control. Future studies should expand on our straightforward cumulative risk method to do more in-depth investigations of exposure to prenatal metal combinations, epigenetic control, and neurobehavioral consequences. Our knowledge of the developmental and epigenetic causes of neurodevelopmental risk will improve as a result.

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