

Extramural papers of the month

By Nancy Lamontagne

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Superfund Research Program
Research Brief. New issues
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Reduced air pollution during Beijing Olympics linked with higher birth weights

NIEHS grantees report that women who were in their eighth month of pregnancy during the 2008 Beijing Olympics, when the Chinese government implemented policies to reduce air pollution levels, gave birth to children with higher birth weights compared to women pregnant before or after the games.

The air pollution controls implemented during the Beijing Olympics lasted for 6 to 7 weeks and were then relaxed, creating a natural experiment in which to study air pollution effects. The controls resulted in a 60 percent reduction in sulfur dioxide, 48 percent reduction in carbon monoxide, 43 percent reduction in nitrogen dioxide, and a reduction in particulate matter less than 2.5 microns in diameter (PM_{2.5}).

The researchers examined birth records from 83,672 full-term babies born to mothers in four urban Beijing districts. They found that babies whose eighth month of pregnancy occurred during the Beijing Olympics were on average 23 grams larger than those with their eighth month of pregnancy falling in the same dates in 2007 and 2009. The researchers observed that interquartile range increases in concentrations of PM_{2.5} (19.8 micrograms per cubic meter), carbon monoxide (0.3 parts per million), sulfur dioxide (1.8 parts per billion), and nitrogen dioxide (13.6 ppb) during the eighth month of pregnancy were associated with 18g (95% CI: -32g, -3g), 17g (95% CI: -28g, -6g), 23g (95% CI: -36g, -10g), and 34g (95% CI: -70g, 3g) decreases in birth weight, respectively. No significant associations were seen for pregnancy months one through seven.

Citation: Rich DQ, Liu K, Zhang J, Thurston SW, Stevens TP, Pan Y, Kane C, Weinberger B, Ohman-Strickland P, Woodruff TJ, Duan X, Assibey-Mensah V, Zhang J. 2015. Differences in birth weight associated with the 2008 Beijing Olympic air pollution reduction: results from a natural experiment. *Environ Health Perspect*; doi:10.1289/ehp.1408795 [Online 28 April 2015].

Early exposure to arsenic decreases lung function in children

An NIEHS grantee and colleagues report that *in utero* and early life exposure to arsenic through drinking water was associated with decreased lung function in children. Although several studies have reported more respiratory symptoms and diseases in people highly exposed to arsenic through drinking water, this is one of the first studies to look at early life arsenic exposure and lung function in children.

The researchers assessed the urinary concentrations of inorganic arsenic in 358 healthy children exposed to average arsenic concentrations of 152.13 micrograms per liter from pregnancy until early childhood. The urinary arsenic level among the participants averaged 141.2 micrograms per liter, and only 16.7 percent of the children had a urinary concentration below the national concern level.

The children in the study showed a reduced forced vital capacity — the maximum amount of air a person can expel from the lungs after a maximum inhalation — that was negatively associated with the percentage of inorganic arsenic. More than 57 percent of the children in the study showed a restrictive spirometric pattern, which indicates how quickly and effectively the lungs can be emptied and filled. The urinary arsenic levels were higher in children with restrictive lung patterns compared to study participants with normal spirometric patterns.

Based on these results, the researchers say that controlling exposure to arsenic during critical early life lung development may be important for reducing deficits in lung function.

Citation: Recio-Vega R, Gonzalez-Cortes T, Olivas-Calderon E, Lantz RC, Gandolfi AJ, Alba CG. 2015. In utero and early childhood exposure to arsenic decreases lung function in children. *J Appl Toxicol* 35(4):358-366.

How alpha-synuclein causes Parkinson's-associated neural damage

New research, funded in part by NIEHS, has revealed key insights into how alpha-synuclein aggregates cause damage to neurons in diseases such as Parkinson's disease. The research also revealed a possible new therapeutic strategy that might prevent the progressive neuron loss of Parkinson's disease.

In Parkinson's disease, alpha-synuclein aggregates released from neurons activate immune cells known as microglia, leading to chronic neuroinflammation that damages neurons. Using cultured rat cells, the researchers conducted experiments to find out more about how alpha-synuclein affects microglial activity. They also studied why microglia migrate toward injured neurons and tend to accumulate with alpha-synuclein aggregates in the affected areas of Parkinson's disease brains, such as the substantia nigra.

The experiments showed that neuron-derived alpha-synuclein aggregates act as chemoattractants that direct microglial migration by acting on NADPH oxidase and several downstream proteins. Blocking the targets involved in alpha-synuclein-mediated microglial directional migration could protect against progressive neuronal loss, representing a potential therapeutic strategy for Parkinson's disease and other diseases involving alpha-synuclein aggregates.

Citation: Wang S, Chu CH, Stewart T, Ghingina C, Wang Y, Nie H, Guo M, Wilson B, Hong JS, Zhang J. 2015. Alpha-synuclein, a chemoattractant, directs microglial migration via H₂O₂-dependent Lyn phosphorylation. *Proc Natl Acad Sci U S A* 112(15):E1926- E1935.

BPA exposure shows transgenerational effects on reproductive health

A study, funded in part by NIEHS, found an association between low levels of BPA exposure during pregnancy and reproductive problems in the next

three generations of mice. The new findings suggest that some effects of *in utero* BPA exposure, including the ability to become pregnant and maintain pregnancy to term, may be transgenerational.

The researchers exposed pregnant mice to BPA levels equivalent to those considered safe in people from gestation day 11 until they gave birth. This exposure was associated with significant reproductive problems, including declines in fertility, sexual maturity, and pregnancy success, in three generations of female mouse offspring. The first generation of pups also experienced an abnormal estrous cycle and engaged less in typical mating behavior than mice not exposed in the womb. The third generation, which was not directly exposed to BPA either as a fetus or as an egg in a fetus in its mother's womb, experienced later sexual maturity, reduced fertility, and lower pregnancy success than mice whose ancestors were not exposed to BPA. In the third generation, the lowest dose of BPA (experienced by their great-grandmothers) interfered most with their fertility.

The researchers say that future studies should investigate the mechanism underlying the effects of BPA on female reproduction outcomes in the first to third generations of offspring.

Citation: Ziv-Gal A, Wang W, Zhou C, Flaws JA. 2015. The effects of in utero bisphenol A exposure on reproductive capacity in several generations of mice. Toxicol Appl Pharmacol 284(3):354-362.

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