Pilot Study of Biomarkers of Environmental Exposures in BCERC

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Introduction: Within the BCERC studies of determinants of puberty in girls, environmental exposures are a primary concern. We are focusing mainly on hormonally relevant agents that might affect the critical endocrine control of reproductive maturation, which may also represent a window of susceptibility for later disease, such as breast cancer. Because of the paucity of information on many of these chemicals, we conducted a pilot study to determine the degree of detectable concentrations and within- and across geographic site variability of various chemical families.

Methods: Girls 6-to-8 years old are being recruited for a 5-year study to follow onset and progression of breast and pubic hair development, as well as menarche, at three sites (New York, California and Ohio). Urine samples from 30 girls at each site, and serum samples from two sites (CA and OH), were assayed for bisphenol A (BPA) and other phenols, phthalates, phytoestrogens, metals, cotinine, non-persistent pesticides, perfluorinated chemicals (PFCs), polybrominated diphenyl ethers (PBDEs), and other organohalogenated chemicals.

Results: Of ten phthalate metabolites measured, nine were detected in ≥90% of samples (limits of detection (LODs): 0.1-1 ng/ml). Median urinary concentrations ranged from 5-155 ug/g creatinine, with monoethyl phthalate (MEP) detected at the highest levels. Whites had lower levels than others of MEP as well as another phthalate. BPA and two other phenols were frequently detected (≥90%; LODs ~0.1-0.5 ng/ml). Median BPA levels were consistent across the three sites at 2.5-3.1 ug/g creatinine, but other phenols showed more variation. The six phytoestrogens were highly detectable and levels varied by site. Five of seven PFCs were detected in >94% of samples (LODs: 0.05-0.2 ng/ml) and the median serum concentrations were highest for perfluorooctane sulfonate (PFOS), which was also highest among Blacks. Six of eleven PBDE congeners were detected among >80% of samples, with BDE47 having the highest median level. Hispanics tended to have the highest PBDE levels. In contrast, concentrations of PCBs and p,p-DDE were highest among Asians, based on somewhat small numbers.

Discussion: Our results show that many of these potentially hormonally active agents, some of which have been little studied previously in children, were detectable in a large proportion of young girls, some at relatively high levels. Concentrations of several varied by geographic location and other demographic factors. These results justify further measurement of most of these biomarkers for investigation of their relationship to pubertal development.