Polycyclic aromatic hydrocarbons, polymorphisms of genes encoding their metabolic enzymes, and risk of neural tube defects in rural China

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Project Background
• Neural tube defects (NTDs) are severe birth defects defined as malformations of the neural system. Infants with NTDs are stillborn or usually die within a few hours or days after birth while survivors often suffer from life long disabilities and are at risk for psychosocial maladjustment, leading to tremendous emotional as well as financial burden to the family.
• Polycyclic aromatic hydrocarbons (PAHs) are potent atmospheric pollutants that has been associated with elevated risk of NTDs. PAHs require metabolic activation and subsequent binding to DNA (forming PAH-DNA adducts) to exert their biological effects. Functional polymorphism of PHA metabolic enzymes may affect fetus susceptibility to NTDs.
• China has one of the highest NTD prevalence of the world. Shanxi province of China, especially some rural counties, suffer from both drastically elevated NTD risk and severe PAH contamination.
• This is a prospective cohort study. The study cohort has been established since November 2011 with a significant portion of individuals lacking outcome data.

Project Timeframe
- February–March 2012: Connect with in-country project partners to determine project outline and establish training goals.
- May–July 2012: (1) Training at in-country partner institution; (2) Field data collection with local collaborators in rural China; (3) Conducting laboratory research on genetic analysis and PAH-DNA adducts level measurement; (4) Completing preliminary data report to in-country partner.
- August–September 2012: Completing final project report.

Project Goal
The primary objective of the research project is to determine the relationship between maternal blood level of PAHs, fetal blood level of PAH-DNA adducts, polymorphisms of PAH metabolic enzymes and the risk of infant NTDs. The secondary objective of the research project is: to elucidate the relationship between polymorphisms of maternal PAH metabolic enzymes and maternal PAH level/fetal PAH-DNA adducts level.

Specific Aims
• To collect missing pregnancy outcome data for the study cohort.
• To provide fundamental epidemiologic training to local medical care providers.
• To examine the quality of local epidemiology practice and collected data.
• To determine disease-related genotype for a subset of the study cohort through laboratory assay.
• To determine the level of PAH-DNA adducts level in placenta specimens by 32P post-labeling assay.

Progress to Date
• Collected pregnancy outcome data of over 200 individuals from various sources: in-village visits and hospital medical records etc.
• Conducted training sessions with county medical representatives overseeing maternal and child health
• Performed genetic assay and determined disease-related genotype in over 100 individuals
• Measured PAH-DNA adducts level in placenta specimens from ~50 individuals
• Conducted preliminary data analysis
• Completed draft report and presented to project partner.

Populations Served
Rural populations with low SES and high level of exposure to environmental PAH contaminations in rural counties of Shanxi, China

Next Steps
• Distribute final project report to project partners
• Continue collaboration with IRCH to explore potential research opportunity

Project Partners
• Faculty supervisor: Cheng Huang, Ph.D. Hubert Department of Global Health, Emory University
• Field supervisors: Aiguo Ren, M.D., Ph.D; Zhiwen Li, Ph.D. Institute of Reproductive and Child Health, Peking University Health Science Center
• Support from faculty members and graduate students at Institute of Reproductive and Child Health, Peking University Health Science Center
• Support from local collaborators at Pingding County Maternal and Child Health Hospital and village clinics.
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