

Student analyzes the effects of lead exposure in Chinese children

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Richard Liu and Jianghong Liu.

(Medical Xpress)—The exposure of its citizens to dangerous toxins continues to be a concern in China, a newly industrialized nation with a large population and little environmental regulation, but for University of Pennsylvania senior Richard Liu one health risk has been particularly deserving of attention: lead exposure in young children.

Seeking internships after his freshman year, the engineering student came across a post on Penn's Student Employment Web site detailing the childhood [lead exposure](#) project of Jianghong Liu, associate professor of nursing. (They are not related.)

The study is in Jintan, a city of more than 552,000 residents in the south of Jiangsu province. It focuses on early health risk factors and the impact

of [environmental exposure](#) on bio-[behavioral health](#) and neurocognitive development in children – or as, Richard Liu explains in layman's terms, "We look for the effects of lead on growth.

"I was instantly sold on the project," Richard Liu says. "I couldn't believe there was an opportunity to conduct research abroad."

Although the undergraduate had little experience in toxicology research, Jianghong Liu selected him for the cohort project.

"I want to promote an interdisciplinary nature to research," she says, hoping for further collaborations between the School of Engineering and Applied Science and the School of Nursing.

Jianghong Liu's background is in maternal child health nursing. She has also received training in psychology and public health.

"I'm very interested in how early health risk factors, whether social or environmental, for example, can influence childhood and adolescent development and behavior," she says.

Before traveling to China, Jianghong Liu sent Richard Liu to train in the labs of Adrian Raine, a Penn Integrates Knowledge Professor of [criminology](#), psychiatry and psychology, and Ruben Gur, professor of psychology, in order to prepare him for their work.

Once in Jintan, Richard Liu and his mentor set up a laboratory, a process that included training research assistants and establishing protocols for data collection.

In order to measure the long-term effects of exposure, the Jintan project was established as a longitudinal study, based on observations of several variables repeated over extended periods of time. The research is

currently supported by the National Institute of Health.

For this study, which began around eight years ago, participants were first measured for blood lead concentrations at 3-5 years of age.

The children were primarily recruited through local schools, Richard Liu explains. The researchers contacted teachers and principals of preschools to get them involved in the project. He says that the team has ensured a good demographic for the study, working with a range of schools from downtown Jintan to more rural districts.

Richard Liu, who hails from Los Angeles, explains that it's generally understood that young children are significantly impacted by toxic exposures, more so than adults. But he and his mentor want to understand the finer mechanisms of this relationship.

"We want to track later-stage development of children with higher blood lead levels. Would their psychophysiological outcomes be different than those who were at normal levels when first tested?" he says.

Richard Liu emphasizes that Jintan was selected because it has average levels of lead exposure, rather than the higher concentrations found in more populated urban centers.

"With Jintan's lower levels of lead exposure, we can observe the levels at which detrimental effects start to occur," he says. "From there, we can determine what the safe limit of lead exposure might be and compare that to the thresholds already established by the Centers for Disease Control and Prevention and the World Health Organization."

Richard Liu has also continued, remotely, to conduct analyses using the findings offered by the Jintan laboratory. A Class of 1971 Robert J. Holtz Endowed Fund for Undergraduate Research supports his work this

summer.

In particular, he hopes to understand the correlations between lead exposure and psycho-physiological outcomes. Psycho-physiology, he explains, looks to establish the effects of physiological bases on psychological processes and visa versa.

He concentrates on the key outcomes from the automatic nervous system and the central nervous system responses. In order to process and record these reactions, he uses multiple measures -- electroencephalography, electrocardiography and galvanic skin response -- in a series of stressor and rest experiments.

For instance, Richard Liu describes one stressor test in which participants count backwards from a large number in increments. The experiment uses an EEG, a machine that produces recordings of electrical activity along the scalp.

"The evoked stress [from counting backwards] is reflected in the brain waves recorded by the EEG," he says. "We can derive cognitive and emotional responses from spectral analyses of the frequency bands."

Findings from other studies have indicated that early childhood lead exposure impairs intelligence and cognitive functions. But Richard Liu says the data from the Jintan project could potentially establish novel relationships between psycho-physiological outcomes and early environmental exposure.

Examination of academic and behavioral examination records collected through other components of the Jintan study will help to advance his work, he notes.

"I've gained a better sense of how hands-on research can be and how it

can have an impact on people," he says. "To succeed, you need to learn how to not only think differently but also how to apply cross-discipline concepts and approach challenges with an open mind."

He also says that longitudinal studies can also be difficult. Since sample sizes are likely to decrease, it is important for researchers to track any geographic transitions of the cohort's subjects.

But there are also larger policy implications with this project, Jianghong Liu says.

"Intervention will have to be established earlier," she explains. "All kids need to be tested for lead exposure, and they and their parents need to be educated on how to avoid lead."

Richard Liu is leaning toward medical school after completing his master's curriculum in bioengineering. He will continue his research as well as his involvement with several clubs on campus, including the Wharton Supply Chain Organization and Weiss Tech House, which he refers to as a "hub for entrepreneurship."

Provided by University of Pennsylvania

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