

Researching Lead Exposure Effects on Substance Use Disorders:

My Passions in Environmental Health Equity

Chloe Thach

Upon arriving to Miami University, I was ecstatic to study everything I was passionate about. After nights of manically calculating course credits, I declared four majors: biology, individualized studies with a concentration in health equity, neuroscience, and public health with a concentration in human disease and epidemiology. Although I am proud of this, it takes a lot of motivation within myself to defend this decision.

Whenever I introduce myself with my name and major, I am usually met with raised eyebrows. “Four majors? How are you doing that?” they say. I respond with, “There’s a lot of overlap between the majors!” or, “I had a lot of transfer credits from high school,” downplaying these achievements with bashfulness.

Most times, I am very comfortable with this decision. Sometimes, I have impostor syndrome, where I convince myself that I am not smart, motivated, or dedicated enough to complete these majors. “Four majors? How am I doing that?”

One day, I was filling drinking bottles for an experiment in the Reward and Addictive Disorders (RAD) Lab, a tedious task where I have time to introspect. My thoughts were getting to me as I racked my brain for ways to make sense of what I was doing. “Is this all a waste? Why am I complicating this with so many studies? How do I make this all worthwhile?”

Then, I had my best idea in my college career: a research project that combines my interests in health equity and neuroscience. With my thoughts already racing, I began brainstorming critical public health issues that I could possibly study in the RAD Lab, which is a behavioral neuroscience lab that uses mice models to study the motivational brain circuits that

relate to addiction. I related my current lessons in global health of water insecurity to the water crisis of Flint, Michigan, a tragic case of environmental racism that resulted in chronic lead poisoning of a community of racial minorities.

Then, I had the next best idea in my college career: because lead is a neurotoxin, prolonged exposure results in many learning disabilities, such as ADHD, which I knew was tied to the development of substance use disorders (SUDs). With underlying neurological effects of lead on learning and neuron firing, which is seen in consequential developments of learning disabilities, could the comorbidity of ADHD and SUDs be determined, in part, by Pb exposure? After a long afternoon of self-doubt, I concluded the perfect research project to tie in all my majors. I wanted to study, “The Effects of Lead Exposure During Early Development on Fentanyl Addictive Behavior in Mice.”

From my individualized studies major, I developed the knowledge of environmental racism case studies, history of redlining, critical race theory, social justice, and health systems that fuel my passion for the project. As I explain this project, I see a picture of a mother from Flint, Michigan holding bottles of orange water from her sink, after she was gaslit by health officials that her water was safe for her children. I see the overlapping of redlining maps and childhood elevated blood lead levels maps, which clearly show the matrix of race within this issue. I see the list of adverse childhood experiences and social determinants of health, all of which are out of an individual’s immediate control, that result in substance use disorders. I see the cases upon cases of Black, Indigenous, and people of color (BIPOC) who are met with brutality when involved with drug usage. I remember these stories, and I am motivated to complete my project with the utmost rigor so I could serve justice through empirical evidence and research.

From my public health major, I can interpret population data that allowed me to understand the comorbidity between learning disabilities and substance use disorders, maps that show redlining and blood lead levels, and the burden of the opioid epidemic. I have also developed the skills to communicate these relationships to diverse audiences and through my writing. I am very proud to say that I have been successful in earning over \$3900 in research grants for this project from the Undergraduate Research Award and Honors Grant through my developed grant writing skills.

From my biology major and neuroscience co-major, I understand the underlying neural mechanisms that could explain the potential causal relationship between lead exposure and SUDs, as well as the paradigms to study addictive behaviors. With mentorship from Dr. Anna Radke, I was able to design the project to supplement current literature found in the Miami University Library databases. I chose to use an animal model to determine causation with empirical evidence, whereas most epidemiological studies with human populations are limited to observational or correlational data. Additionally, I have identified shortcomings in current literature that I address in my own study, such as choosing a paradigm that does not require many learning processes from the subject that might have learning deficiencies from lead exposure.

My previous research experience under mentorship of Dr. Radke from the RAD Lab and Dr. Jacqueline Daugherty from the Western Center for Social Impact and Innovation have also supported me in my development of my independent research study. Because my project was novel to the psychology department, Dr. Radke and I worked closely with the Laboratory of Animal Resources staff and Environmental Health and Safety staff to ensure safety while working with lead. This process gave me experience with collaborating with professional

researchers across the university. Through the Western Center, I had experience with conducting research for underserved communities, where I investigated the effects of gentrification in Over-the-Rhine, Cincinnati and conducted oral history interviews of marginalized alumni to expand the resources of the Miami University Library Archives. These opportunities gave me the confidence in conducting research that had underlying themes of social justice.

As of March 13th, I am currently in the process of conducting the fentanyl consumption tasks with the mice that have undergone a long process of developmental lead exposure. I do not have data yet, but I will have results to present at the Undergraduate Research Forum. I have since been inspired to relate all my class projects back to themes of environmental health equity.